LAND & WATER FORUM

Fourth Report of the

Land and Water Forum

November 2015

This report may be cited as:

Land and Water Forum, 2015. *The Fourth Report of the Land and Water Forum*

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Published in November 2015 by the Land and Water Trust

ISBN: 978-0-473-34360-6

This document is available on the Land and Water Forum website: www.landandwater.org.nz

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Foreword

The Land and Water Forum's third mandate provides its members with the opportunity to extend their recommendations on the reform of land and water management in New Zealand. The mandate was complex - it required us to consider how to maximise the economic benefit of fresh water, while managing within the quality and quantity limits set consistent with the National Policy Statement for Freshwater Management 2014 (NPS-FM), to consider the transition from the current management regime to a new one, and to consider the Crown's exploration of rights and interests with iwi in its work. At the same time we were to look at the regulatory requirements for stock exclusion from streams.

The time at our disposal has been short. From the time we were set up to the time we were asked to report to Ministers was almost exactly six months. We are grateful to Ministers for the additional month that they have allowed us to finish the work, including because the environment in which we have been working is now more complex. When we prepared our earlier reports, reform was still to come. This time, a limit-setting framework along the lines we recommended is in place and a number of councils are already setting objectives and limits pursuant to it, in some cases using collaborative processes derived, albeit often with significant modifications, from recommendations in our second report. We have increased our representation from councils, both regional and territorial, on that account.

Limit-setting is the fundamental basis of the reform, but it sat in our reports within a series of other measures - the bulk of our recommendations - intended to facilitate its implementation and ensure that that could be done effectively and efficiently. These remain to be implemented and in the end consensus will only hold if what is recommended is substantially put in place.

This is therefore not a blue sky report in the way its predecessors were. Much of it is somewhat technical, but it adds to and enhances our previous work. It gives it renewed currency and we hope - it is our first recommendation to the government - that the recommendations in earlier reports can now be implemented in full and without delay. Managing land and water better is, as recent environmental reporting shows, a matter of urgency.

There are three important points to make.

The first is that integrated catchment management systems are complex and the maximisation of the economic benefit of fresh water will come from no single action. Mitigation, infrastructure, land use planning, efficient systems of allocation and transfer can all help. We recommend approaches which will encourage and reward all the participants - on whose action change after all depends - to use water more efficiently and more productively, to allow them to innovate and invest with confidence, and to give access to new users and new uses of water. Robust limits are of course an essential part.

The second is that we have not sought to resolve the issue of iwi rights and interests - that task, as we all strongly agree, lies with the Treaty Partners. We know however how important the matter is to our economic future and to our society and have made a number of suggestions about tools that

might be used. Our proviso remains that the rights and interests of others in the resource should also be respected.

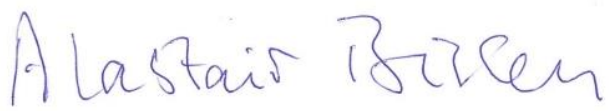
Finally, we have made a set of recommendations on stock exclusion from waterbodies and also on riparian management which break new ground, and address an important gap in our management system.

We are grateful to the government for its continuing trust and confidence in the Forum, and in particular to the two Ministers, Hon Nick Smith and Hon Nathan Guy, from whom our mandate came. We are grateful to the many people who carried out the task, meeting in the Plenary, in the various "flexigroups" that prepared the ground, in the Small Group where the consensus was forged. All this required work well beyond the call of duty over an extended period of time. I should specially acknowledge the chairs of the various flexigroups (Jeremy Stevenson-Wright, Paul le Miere, Jon Roygard, Jenni Vernon, Mike Scarsbrook, Billy Brough and Christina Robb) and the Secretariat, without whose skills this report could also not have happened.

At the end of our report we list all of the participants that support it. Strenuous efforts have been made to clear it within organisations in what was inevitably a very tight timeframe. In processes like this one, some resolutions don't come until the very end. We are also aware that some of our members are federal in structure, and a number have large memberships with whom they have not yet been able to discuss this report in detail. We regret that Fish and Game is no longer with us, but we are grateful for the contribution that they made from the beginning of our work until they withdrew on 22 October.

With this we have completed the first part of this mandate - the second, which relates to the review of the implementation of the NPS-FM and the further population of the National Objectives Framework to strengthen the limit-setting framework, is an essential companion piece and we look forward to beginning on it in the new year.

Finally, I would like, as I have done in our second and third reports, to remember Dean Stebbing whose contributions to this institution are still in our minds. I would also like to remember John Woods, whose death not long after our third report was finished robbed us of one of our most able collaborators.



Alastair Bisley

Chair, Land and Water Forum
6 November 2015

Executive Summary

Fresh water is one of New Zealand's most precious resources, but has come under increasing pressure in the last 20 years. To address this problem, the parties with major interests in it have worked together through the Land and Water Forum to reach consensus on a major reform of New Zealand's freshwater management system. This reform is outlined in a package of recommendations contained in the Forum's four reports. The government has put in place a National Policy Statement for Freshwater Management (NPS-FM) and a National Objectives Framework (NOF) along the lines that we recommended, with some substantive differences, but the great bulk of our recommendations are yet to be implemented and we urge them to do so at once.

Maximising the economic benefit of fresh water

Our mandate asks us how to maximise the economic benefit of fresh water while managing within quality and quantity limits. It is a fundamental assumption of this report that the limits on which the land and water management system that we have recommended depends will be robust. Our present recommendations primarily address the question of how these limits may be achieved, and in framing them we have, with growing the economy in mind, sought to encourage and empower land and water users and councils to increase the efficiency of their water use and discharges, and investigate ways to increase the amount of water and assimilative capacity available for use. The recommendations in the Forum's reports look to:

- allow flexibility – land and water users will be able to manage within their allocations as they see fit; increase or decrease their allocations through transfer; flexibly apply Good Management Practice (GMP); and change their land use
- facilitate the development of infrastructure and catchment-scale[1] mitigations – to increase the amount and reliability of water and assimilative capacity available for economic use
- improve certainty for decision-making and investment – through consistent national frameworks, better planning processes and firming up the rights of consent holders
- improve the information and science base – giving us better data, models and tools for setting and managing within limits
- reduce waste and inefficiency – through requiring technically efficient water use, GMP, the targeting of critical source areas, and a consistent national approach that prevents each council from having to 'reinvent the wheel'
- bring iwi more fully into the water economy
- protect and allow businesses to leverage off our clean green image.

Recognising and providing for iwi rights and interests in fresh water

We said in our third report that the resolution of iwi rights and interests in fresh water is essential to an enduring system of land and water management. We note that the responsibility for reaching agreement on how to do this rests with Crown and iwi, and we believe that the responsibility for giving effect to this agreement must also lie with the Crown. Our recommendations suggest the

[1] In this and subsequent text the term "catchment" means the catchment-based spatial unit of management, and can mean sub-catchment.

Crown should instruct and enable councils to implement the agreement, and canvass both guiding principles and a suite of mechanisms that might be considered. They stress that existing rights should not be compromised, and that costs should not be transferred to other parties.

Integrated catchment management

Integrated catchment management involves a range of limit-setting and management activities undertaken within a catchment. Its basis is high quality information, including data, modelling, research and mātauranga Māori. We have recommended establishing an integrated freshwater management information framework to identify and plug gaps in the data, models and research available for setting and managing within limits. Our recommendations also encourage interoperability and consistency in data, models and accounting systems and provide the transparency needed to allow parties involved in collaborative freshwater management processes to understand, test or question how these things work.

We recommend limit-setting and management activities should be prioritised both *within* and *between* catchments on the basis of environmental risks. Management/mitigation activities should be targeted to critical source areas and areas of significant ecological value in the first instance.

We recognise the contribution that infrastructure of all types can play in contributing towards both meeting limits and growing the water and assimilative capacity available for use. We recommend that options for public provision, funding and development of infrastructure and catchment-scale mitigations be considered during the catchment planning process.

To ensure transparency in the performance of communities in meeting limits we have recommended councils report every two years on progress. Central government should monitor and publicly report on the performance of regions in setting and managing within limits.

Water Quality

Our proposed system of regulation for water quality seeks to give water users flexibility to manage and innovate to minimise their costs.

Direct measurement of water quality impacts at an individual property level is not feasible at this stage. Instead, models must be used to estimate nutrient losses – the use of modelled numbers in regulation provides some additional challenges. We also lack data on spatial variability in the assimilative capacity of ground and surface water systems. Effective management requires gathering more data on this variation within catchments and improving our modelling and decision making.

The starting point for our system of regulating water quality is the requirement that land and water users comply with a set of nationally defined, industry specific, catchment-tailored GMPs that are regularly updated.

Over time, where feasible, we recommend councils implement a system of individual discharge allocations. These would be transferable if permitted by conditions in the catchment. Such a system is likely to be the most economically efficient as it allows dischargers flexibility in how they manage within their allocation and allows discharge allocations to move to their highest-value uses over time. In the near term, such an approach is feasible for nitrogen, and possibly also phosphorus, but a number of precursor steps must first be undertaken. Implementing a discharge allocation approach

will also require determining who gets allocated what during transition to the new regime. This has significant equity implications, and we have not been able to agree an approach at a national level, but we have suggested some guidance to working through the problem nationally and at a catchment level.

Urban catchments have an essential contribution to make. We have recommended a number of measures such as water sensitive urban design (WSUD), better integration of three waters infrastructure planning, reporting on wastewater overflows and a review of trade-waste bylaws.

Stock Exclusion

Government asked the Forum for advice on the form of a national regulation to exclude stock from waterways. We have recommended a framework that excludes dairy cattle, beef cattle, deer and pigs from waterways on the plains and in lowland hills over time, while allowing flexibility in the means by which this is done. Under this framework, councils will be able to require exclusion of stock from critical source areas and areas of ecological importance in terrain where the national stock exclusion regulation does not apply – such as hill country.

We have also made recommendations requiring the appropriate riparian setbacks and management strategies. We suggest that the appropriate setback width should vary at different points along the waterway according to the terrain, the contaminants being managed, and the effectiveness of alternative mitigations.

Water Quantity

To encourage efficient water use within limits, we recommend individual authorisations to take and use water are transferable so that where possible they can move to their highest-value uses. To facilitate transfer, we propose existing consents are translated into a new format. We have also recommended councils take measures, such as providing data on water use, to facilitate the transfer of water.

The reliability of water is a key determinant of its productive value. We have recommended that limits should define the reliability of water that is available for allocation and authorisations themselves should describe the circumstances under which the rate, volume and duration of abstraction will vary. Water storage and distribution infrastructure is a key method for improving the reliability of water. We have also made recommendations around the duration of consents, their treatment on expiry and lapse provisions aimed at providing more certainty for investors and decision-makers.

During transition to the new regime we have recommended councils apply a ‘reasonable technical efficiency test’ to remove paper over-allocation. Central government should work with industry, councils and other stakeholders to specify the methods used for defining technical efficiency. Small takes should also be accounted for at the catchment level, but do not need to be metered unless cumulatively they add up to a significant proportion of water use in the catchment.

In residential areas we recommend the rollout of water metering – at scales where it is appropriate - to identify areas of wastage. We have also suggested that municipal supply used for commercial or industrial uses be identified and treated on the same basis as commercial users outside the municipal supply – including the restrictions applied in times of shortage.

Reducing over-allocation

The timeframes for transitioning down from over-allocation should be defined by local communities and not cause unnecessary economic and social dislocation. All land and water users that impact on the over-allocation should bear some of the cost of transition by internalising their costs of production.

Our recommendations identify a range of mechanisms for reducing over-allocation of both allocated and unallocated contaminants and prioritise which to use on the basis of their effectiveness and how severely they restrict the activities of land and water users. They include: implementing GMP and requiring technically efficient water use; targeting critical source areas; developing additional infrastructure; administrative haircuts; and land-use controls.

Enabling transfer of allocated takes and discharges is important for minimising the costs of reducing over-allocation, as transfer will help to ensure that within the reduced overall cap, takes and discharges move to the best economic uses.

Central government should also ensure that its funding schemes enable it to contribute financially to efforts to bring highly over-allocated catchments back within limits.

Enabling change

The Forum's recommendations, and the expectations placed on councils, sectors and communities by the NPS-FM, comprise a significant body of work. The task of setting limits, making sure that they are met, and doing so in a way that maximises the economic benefit from fresh water will be a challenge for all groups.

To aid in meeting this challenge we recommend the establishment of a national information sharing platform (including a website and stakeholder workshops) accessible to all councils, iwi, CRIs, sector groups and communities to support effective and efficient fresh water management decisions.

We also recommend that central government rationalise and consolidate its existing funding for fresh water. We have provided criteria on which funds should be targeted. We have also identified high priority areas – environmental clean-up and headroom creation; science and information; and capacity building – where additional central government funding should be provided.

The future

This report is the first part of a three-part mandate given to the Forum by Ministers. The two further pieces of work are:

a. contributing to the further population of the National Objectives Framework (NOF), through the review of work carried out by the NOF Reference group and a commentary on the overall implementation of the NPS-FM
b. a review of the overall changes to water policy and its implementation, lessons learned, and the further work required to achieve the overall objective of improved water management in New Zealand.

Introduction

1. Through the Land and Water Forum the parties with major interests in fresh water - the primary sector, industry including hydro-generators, tourism, environmental and recreational organisations and iwi representing the Treaty Partner - have worked together to propose to the government a major reform of our systems and practices for managing land and water. We have written four reports and reached consensus on almost all of our recommendations. We have been materially assisted by representatives of central and local government, and by the science and economic communities.

2. We have recommended that this reform should occur over time to avoid disruption, but that we start at once. Implementation on the ground is urgent. Policy changes at national, regional and industry levels must be reflected in the actions of land and water users, and the most pressing problems must be given priority. The task cannot wait as, while we do not act, we continue to run down what is both a national treasure and a strategic asset for New Zealand.

3. Water is part of our heritage and identity and a means of pleasure and recreation. It supports our unique ecosystems and sustains our life. Managing it well is vital for both urban and rural areas.

4. Reliable supply of good water is a key economic advantage for New Zealand in an increasingly water-constrained world. It provides hydro electricity which is a main source of renewable energy. It underpins primary production - the combination of water availability, climate and geography helps our competitiveness internationally in agriculture, horticulture and forestry. It is an essential input to many of our processing and manufacturing industries.

5. Water is also part of our brand. It underpins our international and domestic tourism industry, and is associated with the way that we market our products overseas. We have become increasingly aware that our economic and our environmental welfare are linked.

6. Fresh water is however a resource that has come under increasing pressure over the last 20 years. In our first report, we noted that although it is still good overall and rates well internationally, both its quality and its availability have been declining, especially in lowland areas, as land use has intensified and our population has grown. We have made significant progress in dealing with point source discharges, but diffuse discharges remain an issue, and some urban and pastoral waterways remain highly polluted. Many catchments[2] are over-allocated with contaminants. Lags mean that impacts of present and past practices may not reveal themselves for some time, while. climate change will increase our difficulties. Poorer water quality adversely affects biodiversity, aquatic ecosystems, invasive species and in-stream uses,. impacting our health and our amenities.

[2] In this and subsequent text the term “catchment” means the catchment-based spatial unit of management, and can mean sub-catchment.

Building on what we have agreed

7. Against this background, between 2009 and 2012 we prepared our first three reports. In the course of two mandates, each lasting a little over a year, we reached consensus on 153 recommendations to government and a statement on iwi rights and interests.

8. At the core of our recommendations were measurable objectives for the state of our waterbodies to allow regional councils to set limits (including bottom lines) on both takes and discharges. We proposed that a National Policy Statement and a national objectives framework should permit these objectives to be set scientifically, respecting national bottom lines.

9. We made detailed recommendations on governance: consensus-based collaborative processes in regions, involving local communities and iwi, and assisted by hearing panels, would recommend the objectives and limits to regional councils. They would ensure that local values and knowledge were brought to bear and help to ensure local buy-in for the outcomes.

10. A large number of recommendations dealt with integrated catchment management. We proposed the deployment of improved management practices by all parties, supported by audited self-management and backed by regulation, to achieve water quality limits. We made recommendations on planning infrastructure development. We suggested the establishment of an accountable, efficient and fair water allocation regime which would both ensure that quantity limits would be observed, and allow best use of the quantum allocated for human and economic purposes. We said that fresh water was a common pool resource, and we proposed improved clarity about both the rights and the obligations of water users (including iwi), and explored the use of transfer to allow resources to move to their highest valued uses.

11. The Forum is a national-level body. The recommendations in this report, as with those in previous ones, apply equally to urban and rural water communities and environments. While the particular solutions for urban and rural water issues may be different, they are linked. Most of New Zealand's major cities are within or include catchments that are both urban and rural in nature – they can therefore affect each others' water quality, and influence each others' access to water. Both urban and rural water quality issues will take time to resolve. While different tools might be needed in different places, the need to comply with the NPS-FM applies in both urban and rural catchments and the need for completion of the NPS-FM appendices is pressing.

12. The government, which has indicated that its water reforms will be "based on and consistent with the Land and Water Forum's recommendations"[3], has already embarked on their implementation. Most importantly it put in place the NPS-FM in 2011 following our first report. In 2014, following our second, it revised this document and added a National Objectives Framework (NOF). It has also created and funded a clean-up fund, as we recommended, and its new system of environmental reporting is very much in keeping with our recommendations.

13. Our recommendations, however, are a package, and the great bulk of them remain unimplemented. Though the limit-setting process was at the heart of our proposals, it needs to

[3] Ministry for the Environment, 2013 *Freshwater reform 2013 and beyond*, page 8. http://www.mfe.govt.nz/publications/fresh-water/freshwater-reform-2013-and-beyond

be supported by the governance processes, the clarification of rights and obligations, and the dynamic integrated management systems all needed to help ensure that the economy and the environment and our social cohesion all make gains.

14. Much is already happening. In response to the NPS-FM, and also to our second report, a number of regional councils have already embarked on collaborative limit-setting processes and the institution of changes in water management. Industry and sector groups have set up and updated programmes to improve their performance over water. Many land users are improving their practices significantly. New priorities are being set for science and research, including through the National Statement of Science Investment, and through the National Science Challenge process. Other organisations, including both Local Government New Zealand and the government's Infrastructure Unit are reviewing the management and funding of the 'three waters' infrastructure.

15. None of that, however, makes the implementation of the rest of our recommendations less necessary. To take a single example, it is good that regional councils have instituted collaborative processes to put limits in place, but without the facilitating legislation, which we know is in preparation, councils must bear the double expense of Schedule 1 processes on top of the collaborative ones, and they are without the systems and guidance to make the collaborative approach work.

16. The new mandate which the government has given us has enabled us to reaffirm our consensus on our previous recommendations, and our first recommendation must be to implement them as a matter of urgency and in full.

Recommendation 1: The government should complete implementing the Forum's recommendations from its three previous reports as soon as possible. Unless otherwise explicitly stated in this report, those earlier recommendations remain unchanged.

Description of the Task

17. The Forum has produced three earlier reports: *Report of the Land and Water Forum: A Fresh Start for Freshwater* – 2010; *Second Report of the Land and Water Forum: Setting Limits for Water Quality and Quantity, and Freshwater Policy- and Plan-Making Through Collaboration* – 2012; *Third Report of the Land and Water Forum: Managing Water Quality and Allocating Water* – 2012. Appendix 1 contains a brief summary of their recommendations, which need to be read as a package.

18. Following these reports, the Government has now asked the Forum for further advice in a three part mandate. The first part of the Forum's new mandate asks for:

    - **Advice on managing within limits including maximising the economic benefit of fresh water while managing within water quality and quantity limits that are set consistent with the National Policy Statement for Freshwater Management 2014 (NPS-FM 2014). This work should take into account other measures to improve freshwater availability**

(quantity and quality) and engage with the experience of regional councils[4] in implementing the new water management regime, including through collaborative processes. Areas of focus could include how the resource is allocated, how water resources can better move between users to higher valued uses, and enabling new users to access the resource.

- **Regulatory requirements to fence streams to exclude dairy cattle, focusing on the policy design.**
- **Mechanisms to manage the transition from the current regime to effectively manage within limits. For example, ways to create headroom, other tools such as land retirements (in addition to freshwater clean-ups and other initiatives already underway) and timeframes to transition.**

19. The request by Ministers also stated that the Crown has agreed with iwi that iwi/hapu have rights and interests in fresh water, and that the exploration of those rights and interests and how they might be addressed is matter between the Crown and iwi. While the Forum does not need to address these rights and interests directly, its work on tools and approaches to managing within limits may assist the Crown and iwi/hapu in their engagement.

20. There are two key features of this mandate - first, it assumes that limits for both quantity and quality have been set, or are in the process of being set. Second, a key focus of this work is how to get economic gain from the 'water economy' in a resource constrained environment.

[4] In this and subsequent text, unless otherwise stated, the term "council":

- includes regional councils and unitary authorities
- refers to an entity comprising both elected and appointed members
- involves iwi, including co-governance arrangements
- recognises that some regions will have specific Treaty settlement obligations that will affect their water management policy and governance framework – for example, the arrangements for the Waikato River Authority.

Note that there is a presumption in our second report that regional councils will employ a collaborative process, involving the community and stakeholders, for the development of freshwater policy and plans, but that this approach may not be chosen in all cases.

Maximising the economic benefit of fresh water

21. A key task that the government has given us is to set out how to maximise the economic benefit of fresh water while managing within limits set through local collaborative processes and the NPS-FM. To do this, communities should consider whether it is possible to increase the amount of water and assimilative capacity available in catchments for economic use, and put in place a framework that allows land and water users to increase the efficiency and innovation with which water and assimilative capacity are used. The recommendations in the Forum's reports achieve this through:

    - allowing land and water users flexibility in how they manage within limits
    - facilitating the development of infrastructure and catchment-scale mitigations
    - improving certainty for investment and decision-making
    - improving the information and science base
    - reducing waste and inefficiency
    - allowing iwi to contribute economically
    - allowing businesses to leverage our clean green image.

Allowing flexibility

22. Improvements in the efficiency of water use and the management of discharges will be driven primarily by the decisions of individual businesses and water users. They will need to decide how best to use their resources (including the limits on water use and discharges) to enhance productivity, increase production, and manage their land and water use in the most efficient way. That is why it is important to give them the flexibility necessary to innovate and manage as effectively as they can within limits. The recommendations in the Forum's reports allow flexibility through:

    - providing individual allocations of water and moving toward individual discharge allocations where feasible – allowing individual businesses and water users the flexibility to innovate and manage within their allocation as they see fit
    - freeing up the transfer of consents to take water, and (in future) discharge contaminants, to allow businesses to increase or reduce their water use and discharges and allow resources to move more easily to their highest valued use over time
    - allowing land use to change over time in response to changes in all of the inputs that land and water users have to consider – markets, economic trends, climate, soil quality, as well as water availability and environmental limits
    - the systemisation and continuous improvement of sector good management practices (GMPs) and their flexible application based on conditions at the property-level.

Facilitating the development of infrastructure and catchment-scale mitigations

23. 'Hard' infrastructure, such as water storage and reticulation, can be used to increase the amount and reliability of water available for economic use. 'Soft' infrastructure, such as constructed wetlands, swales, and riparian buffers, can be used to increase the assimilative capacity of catchments. Infrastructure and catchment-scale mitigations are prone to under-

provision if left up to private individuals due to the presence of positive externalities, public good attributes and coordination failures. We have recommended that their development be considered during the catchment planning process and options for public provision and funding be considered then.

24. We also recognise that using infrastructure and catchment-scale mitigations will not always be possible – other ways of managing within limits may be better or more efficient, or the type of catchment, or particular type of water management issue, may not lend itself to an infrastructure solution. In some cases, individual land and water users might find ways to improve productivity through deintensification, or a move to precision agriculture. The Forum's reports make a number of recommendations that provide land and water users with the flexibility needed to make these decisions.

Improving certainty for investment and decision-making

25. Increased certainty in water management lets people and businesses make better timed and more certain investments, and better land use decisions. The recommendations in the Forum's reports achieve this through:

    a. national frameworks that generate consistency and efficiency between regions
    b. setting clear policies through the planning process, which provides greater certainty than making policy on a consent by consent basis
    c. the use of infrastructure to improve the reliability and certainty of water
    d. changing the water consenting regime to firm up consents, bring all takes into the management regime, and increasing investment and operating certainty for owners of long-lived infrastructure
    e. defining a transition path to a new water management regime that prioritises actions and avoids shocks and reversals. Communities and land and water users are able to set timeframes that let them adjust to the limits that have been set. The recommendations recognise that there is the potential for disruption, and prioritise science to reduce this, build in adaptive management concepts and agile planning and policy settings, and suggest the best way to transition through the uncertainty generated by changing science and modelling outcomes.

Information and Science

26. The Forum's reports make recommendations that underpin the new water management system, and make economic gains possible. We have suggested a framework for fresh water management information, and priorities for science and research, and for government action. Better science and information will allow communities and land and water users to identify and implement the optimal suite of mitigations over time.

Reducing waste and inefficiency

27. Through the use of reasonable technical efficiency tests, paper over allocation of water takes will be reduced on transition to the new regime, ensuring all allocated water is being used productively. Similarly, the requirement for land and water users to implement GMP will reduce needless discharges and free up assimilative capacity over time for other productive uses.

28. Our recommendations also reduce the wastage involved with councils 'reinventing the wheel' in each catchment by providing: standardisation in information, data and models; a national information sharing platform; model plan provisions and consents to aid with transition to the new water management regime; and a framework for integrated catchment management.

Allowing iwi to contribute economically

29. Bringing iwi more fully into the water economy through the resolution of their rights and interests in water should not only strengthen our society, but also help maximise economic growth by allowing iwi to fulfil their economic potential. Resolving iwi rights and interests will also provide more certainty for land and water users and regulators.

Leveraging our clean green image

30. Finally, New Zealand has a reputation as a producer of high quality, safe, fresh food consistent with our clean green image. Our ability to live up to the 100% pure New Zealand brand is increasingly important in many high value markets, and to tourism. If our products originate from a transparent and well-regulated environmental system, and there is transparent reporting on environmental metrics to our overseas markets, the ability to market New Zealand's tourism and primary production will be enhanced. In turn this may help New Zealand producers to innovate to generate higher value products.

Recognising and providing for iwi rights and interests in fresh water

31. From the outset of the Land and Water Forum's work our mandate has made clear, in line with the views of all participants, that iwi rights and interests in fresh water could only be resolved between iwi and the Crown. At the same time, the Forum has known that this resolution is essential to an enduring system of land and water management, and in our previous three reports we have made a series of supportive recommendations.

32. In our first report, where we described the special relationship between iwi and fresh water and iwi aspirations in relation to fresh water. We noted that "the transition to any new system of water allocation should proceed hand in hand with Crown-iwi discussions on iwi rights and interests in water management."

33. In our second, we made detailed recommendations on how iwi should be enabled to participate throughout the freshwater objective- and limit-setting process both as Treaty Partner and as stakeholders. We also proposed that the NPS-FM should acknowledge tangata whenua relationships with fresh water, and connect these to the formal objectives of the NPS-FM set out in a National Objectives Framework.

34. In our third report, we recommended allocation processes which were sufficiently flexible to accommodate outcomes from negotiations between iwi and the Crown. In the accompanying Forum statement on iwi rights and interests in fresh water, we noted, "For a system which articulates general rights and interests to be stable and durable, however, iwi rights and interests also need to be resolved. We can see significant win-wins in this process, including the development of under-utilised land and resources, and the ability of iwi to partner with others in the growing of the water economy - including through the development of infrastructure." We added "We also recognise that others have established rights and interests in New Zealand's freshwater resource that must also be respected. Existing rights should not be compromised, and costs relating to Crown-iwi resolutions should not be transferred on to other parties." We suggested that the Treaty Partners should "seek solutions which provide win-win opportunities to develop New Zealand's freshwater resource and enhance all parties' interests in fresh water."

35. Our current mandate notes that the Crown agreed with iwi that iwi/hapū have rights and interests in fresh water. It says that while the Forum should not need to address these rights and interests directly, its work on tools and approaches to managing within limits may assist the Crown and iwi/hapū in their engagement, as well as the wider community.

36. We have concluded that there is a range of mechanisms that can be used to recognise iwi interests in fresh water. The most attractive pathways forward also enhance the value of existing rights, and include investment which may generate "headroom" either in respect of takes or of discharges.

37. The issue of mandatory re-allocation of water and assimilative capacity at the expiry of consents was discussed during our deliberations in a number of potential contexts including: re-allocation from existing consent holders as consents expire, re-allocation at a common

expiry in a catchment, and through mandatory acquisition processes where compensation would be debated relative to a consent holders' expiry date. There was no agreement to approaches of this kind.

38. We have also noted that regional councils, who hold delegated authority for managing New Zealand's freshwater resources, are likely to play an important role in giving effect to agreements iwi and the Crown reach. They can advise, for instance, in consultation with their communities, how to take advantage of unique catchment and regional circumstances and governance. We did agree that councils need greater flexibility and additional tools to help them give effect to any agreements between the Crown and iwi. They need, for instance, to be able to set aside unallocated water in under-allocated catchments that can be allocated to iwi once agreements have been reached. This is important to avoid water being allocated in the interim, complicating the Crown's task of recognising iwi rights and interests in water. Water that has been set aside for this purpose would be able to be transferred to other users in the interim, or allocated for short timeframes and on the proviso that the water needs to be available for iwi should it be required to give effect to any agreement between the Crown and iwi.

39. Forum participants note the importance of the Crown's role if community is not to be set against community. The Crown will also need to require and empower Councils if they are to play their roles successfully.

40. In short, we want the Treaty Partners to reflect on the Forum's Statement on iwi rights and interests in fresh water, ensure that the resolution of rights and interests advances *Te Mana o Te Wai* and strengthens limits, and ensure that any rights provided to iwi sit within the same management framework as the rights of other users.

Recommendation 2: The responsibility for reaching agreement on how to recognise iwi rights and interests in water rests with the Crown and iwi, including agreed allocable quantum and discharge allowances. The responsibility for giving effect to those agreements lies with the Crown. When reaching and giving effect to these agreements the Crown's approach should have regard to the Forum's previous statement on iwi rights and interests in fresh water.

Recommendation 3: To enable agreements between the Crown and iwi to be given effect to, central government should:

- **a. require councils to implement any agreements between the Crown and iwi to recognise iwi rights and interests in fresh water**
- **b. enable councils to allocate authorisations to iwi to deliver any agreements between the Crown and iwi, including by using their plans:**
  - **i. in anticipation of agreements being reached, to reserve for iwi unallocated portions of the allocable quantum and discharge allowances in under-allocated catchments**
  - **ii. after agreements have been reached, to provide for iwi over time access to the allocable quantum and discharge allowances in fully- or over-allocated catchments**
- **c. ensure existing holders of authorisations are fairly compensated should their rights be**

adversely affected by any agreements made between the Crown and iwi

d. support councils to make any necessary changes to their planning frameworks to accommodate any agreements made between the Crown and iwi.

Recommendation 4: A broad range of mechanisms should be considered for giving effect to agreements between the Crown and iwi. These could include but not be limited to:

a. giving iwi priority access to:
  - **i. unallocated water and discharge allowances in catchments that have not yet reached full allocation**
  - **ii. allocable quantum that is created through application of the "reasonable technical efficiency test" on transition to the new freshwater management regime**
  - **iii. discharge allowances or load for unallocated contaminants that are created through the application of good management practice requirements on transition to the new freshwater management regime**
  - **iv. water, discharge allowances or additional contaminant load created through government investment in infrastructure to generate 'new water' or 'headroom' in quality limits**
  - **v. water or discharge allowances that are voluntarily surrendered**

b. facilitating commercial partnerships and joint ventures between iwi and incumbent holders of authorisations to take water and discharge contaminants

c. acquiring a portion of the allocable quantum, total available discharge allowance or total contaminant load through:
  - **i. commercial agreements between the Crown and other users to transfer authorisations to iwi**
  - **ii. running a voluntary reverse auction as a means to find the most efficient way for the Crown to access authorisations to transfer to iwi.**

Integrated Catchment Management

41. The Forum's third report (in particular paragraphs 38-71 and recommendations two to five) described at a high level the need to carry out integrated catchment management, to prioritise catchments for planning on the basis of the risks posed by areas of resource use pressure, and to set limits at the same time as considering strategies, methods and timelines for achieving the limits.

42. The approach that this report recommends builds on those recommendations. Its aim is to maximise the economic benefits of fresh water within a framework that will ensure that limits are met within agreed deadlines. The outcome will be that resources like effluent, nutrients, soil and water are retained within land-use systems for their maximum value; that urban discharges are managed efficiently; that natural capital is enhanced not destroyed; that interventions are effective and cost effective and that there is scope for innovation in the way that they are developed and applied; that human health is increased, and that our brand and the reputation of our environment are enhanced.

43. Integrated catchment management will involve a range of actions undertaken by individuals and companies, sectors, communities, and central and local government at property, catchment and national levels. Actions by land and water users are essential – it is their actions and decisions that will in the end improve water management and make the framework set by industry, local and national government operate well. It will involve measures taken in urban catchments. It will include catchment-wide steps such as construction of wetlands, infrastructure and soil management plans. It could, and in many instances will, include the allocation of takes and discharges to individuals and/or groups.

44. The results of these various steps will be modelled and subsequently monitored. Catchments will then be managed adaptively, so that actions can be adjusted in the light of their results and that further steps including land use changes can be taken where limits are not being met.

45. Integrated catchment management considers a range of broader factors when setting limits and managing a planning system. These include changing land and water use, growth and development patterns, and community and iwi values and aspirations. It includes thinking about the best way to meet limits so that economic benefits can be maximised. It also includes ensuring the impact of land uses and land development on the coastal receiving environment is explicitly and transparently addressed when designing freshwater objectives and limits.

46. At a technical level, integrated catchment management involves:

- accounting for all takes and sources of contaminants, and understanding the relationship between water flows and quality
- assessing and evaluating management options (including accounting for their effectiveness and assessing their costs and benefits)
- setting priorities for management
- implementation (including the contribution of industry good management practice and other mitigation tools, and policy and plan implementation)

- monitoring, reviewing and reporting on the state of the freshwater objectives that are being managed for
- adaptive management to improve the use of tools to achieve water management objectives.

47. This is not always simple – ecosystems and many of the tools for managing them are complex (for resource users and regulators); management responses need to consider ecosystem health, habitat and biodiversity as well as the numeric attribute states in the NOF; and spatial complexity (e.g. critical source areas) and management responses need to be integrated with communities' economic objectives and across a range of public and private institutions.

48. Integrated catchment management must also do two things at the same time. First, it needs to recognise the relationship between water quality and water quantity issues in the catchment. Second, it also needs to recognise the differences between them and the implications that this has for water management. These differences include the different planning and consenting systems that have operated for quality and quantity, the range and difference in nature of contaminants, and the ability to directly measure and attribute water takes in comparison to the modelling required for contaminant management. Paragraphs 54-57 of our third report summarise these differences, which are reflected in the nature of the recommendations that we have made in this report and previous ones.

49. All of this takes place when, in many catchments, water resources and assimilative capacity are under pressure. There is a need to manage quality pressures that occur before limits are set, and prevent a 'gold rush' that will make the limit harder to achieve in the future. This places an emphasis on the quality of the management tools, and the decisions made by councils, iwi, communities and sectors. This also requires integration within a complex world of co-governance arrangements and collaborative planning with iwi and communities.

Information framework and priorities

50. The basis for integrated catchment management is high quality information that supports councils and communities to adaptively manage fresh water within quality and quantity limits. This information includes data, modelling, research and mātauranga Māori. The NPS-FM recognises the need for robust information by requiring councils to account for water takes and sources of relevant contaminants.

51. While decisions must be informed by good high quality information, we can't wait to have perfect information to make decisions – uncertainties must be identified and acknowledged and monitoring, evaluation, review and adaptation are important. To enable adaptive management, a more agile planning system will be needed as recommended in the Forum's second report. Sometimes decisions will need to be made on less than optimal information and knowing that management approaches might need to change once better information comes to hand.

52. Much of the information needed to make decisions is in place. There are examples of good use of modelling in freshwater management, for example, SedNetNZ used by Horizons, and CLUES in combination with dynamic lake models used by Environment Canterbury. The benefit of using

the same models (such as OVERSEER) as much as practical across regions is not only one of efficiency, but as more data is entered, models are refined and validated for different environmental contexts. Inconsistency in the use of models creates risks and costs for land and water users, councils and the environment. At the same time, consistency needs to be balanced with allowing innovation which may lead to new, improved modelling systems.

53. Collating, developing and maintaining the information base for managing within limits will require significant efforts and investments by central and regional government, CRIs and sectors. A framework to coordinate and integrate this work will prioritise research programmes, and develop efficiency in information identification, gathering and presentation.

54. Information is so central to the effective implementation of the freshwater management framework that there is value in clarifying and standardising expectations, making sure that the right information is collected, and giving those involved in collaborative planning confidence about its collection and use. There are some key needs:

    a. clarifying and standardising expectations for the suite of information needed, including data standards
    b. integrating and prioritising the national, regional and sectoral information needed to set and manage within limits, including prioritising information gaps
    c. making the identification, collection and availability of this information as efficient as possible, for example, through the use of common frameworks and methods
    d. making the development and use of information transparent and accessible, especially to those most affected by its use (including, iwi, councils, communities, sector groups and NGOs) and ensuring that the information they have contributed is interpreted and used appropriately
    e. as much as possible, making the interaction between sector groups, land and water users and councils as efficient as possible.

55. Our discussions have focussed on the following important areas where additional information will be needed:

    a. robust information on the relationship between surface and groundwater flows, the nature and source of contaminants and ecosystem health responses, and how these relate to freshwater objectives and limits
    b. linkages between fresh water and coastal receiving waters (e.g. estuaries)
    c. data and/or modelling on the assimilative capacity of different land and receiving environments (e.g. quantification of surface and groundwater denitrification activity and potential within catchments)
    d. ability to test variations to policy and catchment scenarios, demonstrating the ability of management decisions to achieve objectives, including the costs and effectiveness of:
        - various contaminant mitigation or good management practices for various permutations of land use and terrain
        - water sensitive urban design
        - various types of infrastructure and catchment-scale interventions

- tools for the restoration or remediation of urban and rural streams that are highly degraded, significantly modified (e.g. for the purposes of flood protection) and have low levels of ecological health

e. modelling for co-benefits of mitigations (e.g. water quality, biodiversity improvements and economic impact).

56. The Forum wants to build on the work underway. The Environmental Reporting Act was passed into law in September 2015, and central government is working on data improvement "to ensure consistent and representative data is available for future environmental reporting"[5]. Following the New Zealand Geospatial Information Strategy 2007, LINZ is supporting the development of national standards and related infrastructure for sharing national spatial information.

57. Land Air Water Aotearoa (LAWA), a collaboration between New Zealand's regional councils, the Ministry for the Environment (MfE), the Cawthron Institute and Massey University has seen regional councils and NIWA share and align methods and reporting of water monitoring data. The National Environmental Monitoring Standards (NEMS) that are being developed by local government, MFE, NIWA and the energy industries are also a significant step for improving the way that water quality data is collected and reported on.

58. In some catchments, there is not enough data to establish a baseline of the current state of water quality and quantity. In other areas, data is currently unable to show trends over time or are not comparable due to different data collection methods. Standards will support the collection of data to be used for multiple purposes and that can show trends over time.

59. Farm data standards[6] are currently being developed for some farming systems. While these standards are generally for data used in the operation of farms, they may also support the data and modelling used by councils in plan rules and decisions on interventions for managing within limits.

60. While there is significant work being undertaken in science and information relating to freshwater management, the development of data standards for freshwater management is an iterative and ongoing process as science evolves to meet policy needs. The development and use of data standards must continue with urgency to ensure a robust national data set for assessing state and trends, for quantifying the size of the issue and to inform limit-setting.

61. The implementation of data standards should be done in a way that is appropriate for the local context (e.g. prioritised in over-allocated catchments), and allows for councils to continue monitoring long-term trends from data sets that may not align directly to the data standards.

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[5] Ministry for the Environment, 2015, "Improving environmental reporting data" http://www.mfe.govt.nz/more/environmental-reporting/about-environmental-reporting-nz/our-environmental-reporting-programm-0

[6] The Farm data standards development has involved DairyNZ, CRV Ambreed, Fonterra, LIC, Red Meat Profit Partnership, FarmIQ Systems, Fertiliser Association of NZ, Federated Farmers of NZ and Te Tumu Paeroa. See http://www.farmdatastandards.org.nz

62. Recommendations 62 and 63 of the Forum's third report proposed a review of the FRST Water Research and Development Strategy, implementation of this strategy, and continued investment in the development of models for water management. In the subsequent report *Freshwater reform 2013 and beyond*, central government proposed to review the research and information system for freshwater management to improve "the availability of the wider information needed for decision making including land use and economic data; improve coordination across research providers; and improve how information, efficient techniques and research findings are communicated to end users"[7]. Central government has since begun work on a Water Information Strategy which needs to be progressed with urgency. The following recommendation builds on these proposals.

Recommendation 5: Central government should work closely with regional councils and territorial authorities, iwi, sector groups, Crown research institutes, Crown entities, NGOs and universities to establish an integrated freshwater management information framework that:

- **a. presents a high level stock take and gaps assessment of the data and modelling available that is suited for the purposes of setting and managing within limits**
- **b. contains criteria for prioritising gaps, and a process to direct filling those gaps, including prioritising relevant research programmes and aligning work to achieve the NPS-FM**
- **c. includes mātauranga-derived knowledge to feed into decision-making.**

Additionally, to encourage interoperability and consistency, the information framework should:

- **d. identify opportunities for multi-purpose data and models in order to reduce costs and maximise the benefits of knowledge (e.g. data and models that can be used in multiple catchments and regions, and accounting systems and monitoring networks to be used for both setting and managing within limits)**
- **e. define nationally agreed data standards to:**
  - **i. provide for scaleability and ability to aggregate data to improve decision-making, monitoring and reporting at a national and regional level**
  - **ii. lead to a robust national data set for quantifying water quality and quantity state and trends that is resilient and flexible for future water management needs.**

The framework should be started immediately and established no later than 2017, and be maintained and updated regularly.

63. Councils' freshwater accounting systems (as required by the NPS-FM) will be a critical part of managing within limits and monitoring the efficacy of interventions, and the accountability of those responsible for them. The guidance that central government has developed on freshwater accounting systems is relevant for setting limits, but not necessarily for managing within limits or monitoring outcomes. Although some councils are establishing their freshwater

[7] Ministry for the Environment, 2013 "Freshwater reform 2013 and beyond", page 48. http://www.mfe.govt.nz/publications/fresh-water/freshwater-reform-2013-and-beyond

accounting systems to be functional for both setting and managing within limits, this is not universal.

Recommendation 6: Councils' freshwater accounting systems (as required under the NPS-FM) and central government's guidance on freshwater accounting, should be relevant for ongoing phases of water reform, integrated catchment management, and both setting and managing within limits.

64. Councils, iwi, sector groups, NGOs and communities need to have confidence that freshwater management decisions will result in achieving water quality and quantity outcomes, and are certain and fair. The NPS-FM requires "reasonable steps to ensure that information gathered … is available to the public, regularly and in a suitable form". Confidence in freshwater management decisions can be strengthened through involving communities, iwi, land and water users, sector groups, NGOs, Crown research institutes, Crown entities and universities in the ways models are used in the decision-making processes for managing water within quality and quantity limits.

65. Transparency in the use of data and modelling allows stakeholders to understand, test or question the scope of the modelling and the assumptions within it. Transparency needs to be provided, while also recognising and appropriately managing the privacy and commercial sensitivity of data, particularly from consent holders and landowners. In recommendation 65 of our third report, we recommended that there be guidelines and protocols for using and accessing data sourced from landowners and consent holders.

Recommendation 7: Councils should work collaboratively with relevant groups when commissioning and developing the data and models that are used for decisions on managing within limits in their regions and use co-design where appropriate. Councils' accounting systems, data and modelling should be transparent and accessible for all stakeholders to test and analyse water management decisions.

Priority setting

66. Recommendation 2 of our third report said that

Regional councils should prioritise catchments for planning on the basis of the state of the waterbody relative to the National Objectives Framework, and the risks posed by areas of resource use pressure (quality and quantity).

67. Good integrated catchment management means that priorities *within* catchments must also be addressed – there are two aspects to this. First, there is increasing evidence of the importance of targeting critical source areas and areas of significant ecological value. Second, this needs to be done in an integrated way that recognises the contribution that infrastructure of all types can play in both creating headroom for economic benefit, and in contributing towards meeting limits.

68. A critical source area is an area that accounts for a disproportionate share of contaminant loss or water quality problem within a catchment or sub-catchment.

69. Identifying critical source areas and areas of significant ecological value will be useful for informing collaborative planning processes, and could be provided in the form of a map. Key steps are:

    a. Identify the water quality issues of concern.
    b. Identify critical source areas relevant to water quality issues of concern and that may be targeted to prevent contaminant loss. This would include identifying catchment trends and areas that are potentially vulnerable.
    c. Identify ecologically significant areas within each catchment that may require targeted management to protect their values (and spatial areas within the catchment that may impact on those values). This could include permanently and intermittently flowing waterways, wetlands, headwater seeps, lakes and coastal and estuarine areas.
    d. Identify trends that might give rise to future resource pressures in the catchment.
    e. Identify and classify the terrain in catchments. This information on terrain and geological structure would be used to assist effective and informed decision making for a variety of land management purposes, including identifying erosion susceptibility, and classifying slope (which is required for implementing a national stock exclusion regulation – see the stock exclusion section).
    f. Refine this information over time as information improves.

70. As part of considering freshwater management solutions, councils and communities might identify that there are risks associated with activity changes that occur before limits are set in plans. The Forum's first report noted that moratoria may be able to be used in rare circumstances, with Ministerial approval, in order to provide time for collaborative planning to occur that would lead to improved outcomes. The conditions under which moratoria could be used include being temporary, the certainty of delivering the outcomes in the time period of the moratorium, and having a clear exit strategy.

Recommendation 8: As part of limit setting and managing within limits, councils in collaboration with iwi, communities, NGOs and sector groups, should identify and classify within their catchments:

a. areas that have particular ecological, social or cultural value
b. current and potential critical source areas for various contaminants
c. terrain information needed for land and water management purposes, including that required to implement the national stock exclusion regulation.

This information should be used to target areas where initial interventions will have the greatest effect.

Infrastructure and catchment-scale mitigations

71. Infrastructure and catchment-scale mitigations provide significant opportunities for "win-win" outcomes – they can assist in meeting environmental limits, provide headroom for further economic growth and also provide a number of other economic, environmental, social and cultural benefits. An important aspect of integrated catchment management is to establish the role they can play in managing within limits.

72. Infrastructure can be 'hard' or 'soft'. Hard infrastructure includes things like water storage and reticulation. Soft infrastructure encompasses constructed wetlands, swales, and riparian buffers. This section deals primarily with infrastructure implemented at the catchment-scale, but smaller-scale infrastructure can also be implemented at a property-level.

73. Although the upfront costs may be high, these projects can sometimes have a better benefit/cost ratio than alternative methods of meeting limits, such as requiring enhanced GMP (e.g. best practice requirements) across the catchment, haircuts to allocated takes/discharges, or enhanced land use controls. Infrastructure and catchment-scale mitigations have greater potential to increase the amount of water and/or assimilative capacity within a catchment - i.e. grow the pie, rather than just reducing the portion sizes - enabling greater economic benefit to the community while still managing within the limit. These benefits can be for both new and existing users.

74. These solutions will not be applicable in all catchments – in some it will not be possible due to the nature of the catchment, its hydrology, land use and the contaminant of concern. In some cases they will not be as efficient as other methods. In most cases, the assessment of their costs and benefits will need to include how they are maintained over time to maintain their effectiveness.

75. Examples of infrastructure and catchment-scale mitigations include:

    - water storage and distribution networks
    - managed aquifer recharge
    - wetland restoration and creation
    - sediment traps
    - soil erosion schemes
    - riparian buffers
    - the use of swales and green areas in urban environments.

76. In some places, the upgrading of wastewater treatment plants may be the most cost-effective way of meeting a limit and/or creating headroom for other uses.

77. More detail on these types of infrastructure and catchment-scale mitigations is provided below, although this is not an exhaustive list.

Water storage and distribution infrastructure

78. One way to increase the economic value generated from water while maintaining minimum flows is to invest in water storage and distribution infrastructure.

79. Water storage and distribution infrastructure allows excess water to be captured and used in periods of shortage, thereby smoothing variations in water availability, increasing the amount available (i.e. the allocable quantum) and improving the reliability of water use within a catchment. Storage also helps mitigate the impact of droughts and climate change and can aid in improving water quality by helping to maintain minimum flows (or replacing groundwater or surface water takes) and/or by using flushing flows to reduce algal growth. If so designed, water storage can also provide wider services such as electricity generation and recreational opportunities.

80. However, there are also difficulties associated with storage, including effects on the functioning and health of river ecosystems, the possible spread of algae, effects on the mauri of water where waters are mixed, and the ability to manage the environmental effects of the associated land use intensification. The latter may require the development of additional 'soft' infrastructure or other water quality management measures.

Managed aquifer recharge

81. Managed aquifer recharge involves building infrastructure or modifying the landscape to intentionally provide additional recharge water into the groundwater system. There are many ways of achieving this, including collecting and spreading water to allow infiltration, pumping water into the aquifer via a well or shaft and modifications to river channels to improve recharge rates.

82. Managed aquifer recharge has several potential uses, including:

- storing water for future use
- reducing vulnerability to hydrological variability
- recovery or stabilisation of groundwater levels in over-exploited aquifers
- reducing losses from evaporation
- managing saline intrusion
- enabling reuse of waste and storm water.

Wetlands

83. Wetlands have been called "the kidneys of the environment" because of their ability to absorb and filter out nutrients – both nitrogen (N) and phosphorus (P) – to allow sediment to settle out and to provide a buffer from large releases of E.coli (e.g. through a discharge from an effluent pond). Wetlands are naturally occurring, but artificial wetlands can also be constructed.

84. The protection and restoration of natural wetlands, and the construction of artificial wetlands, can increase the assimilative capacity of a catchment allowing the land/water system to sustain more intensive land uses. Wetlands also provide other benefits, such as improved habitat and enhanced hunting and fishing opportunities.

85. The construction or restoration of large wetlands should be considered as a potential catchment-scale mitigation, and the protection, restoration and construction of smaller wetlands on farms could potentially be part of GMP requirements.

Sediment traps

86. Sediment traps are formed by excavating an area or by placing an earthen embankment across a low area. They are usually installed in the path of drainage or discharge, but runoff can also be diverted into them. When used appropriately they allow sediment to settle out of runoff. By catching the sediment in the trap, the amount leaching into receiving streams, lakes, drainage systems, and the surrounding area can be reduced.

Soil erosion schemes

87. Some councils run catchment-wide soil erosion schemes to reduce erosion and sediment entering waterways. An example is Horizon's Sustainable Land Use Initiative (SLUI). Under this scheme additional resources, expertise and funding are provided by the council and central government to assist landowners in taking actions on farm to reduce erosion. SLUI involves:

    - a farm-scale resource assessment and works programme
    - identification of present and potential erosion and the risk of sediment entering waterways
    - promotion of appropriate land uses for land-type.

Riparian buffers

88. Paragraphs 220 to 232 provide a description of the functions of riparian buffers.

Swales

89. Swales are designed to manage water runoff, particularly in urban environments or beside roads. They slow and capture runoff by spreading it horizontally across the landscape (along an elevation contour line), facilitating its infiltration into the soil. As the water passes through vegetation and soil, it is cleaned by natural processes (filtration, absorption and biological uptake of nutrients into plants) before it enters the stream or stormwater system.

90. They can be created by digging a ditch on contour and piling the dirt on the downhill side to create a berm. Trees and shrubs along the swale can provide shade that decreases water evaporation. A common application is around parking lots, where substantial automotive pollution is collected by the paving and then flushed by rain. A swale can wrap around the parking lot and treat the runoff before releasing it to the watershed or stormwater system.

Difficulties with planning, funding and development

91. A limits-based regime means that communities will need to discuss the full costs and benefits of water use and discharges at a collective level. The costs and benefits of the provision of infrastructure and catchment-scale mitigations will need to be part of that discussion, including who should pay and who benefits.

92. A limits based regime provides a framework that will allow markets to develop, and provide signals about when to invest in infrastructure. It is possible that the costs and benefits faced directly by individual land and water users within these communities may not be sufficiently targeted to ensure the optimal level of provision. They may not always attract sufficient private funding because of one or a combination of features such as:

    - externalities (i.e. where costs or benefits to third-parties are not priced or regulated)

- public good features
- coordination failures.

Externalities

93. Catchment-scale mitigations and infrastructure often have positive externalities, such as:

    a. Water storage and conveyance infrastructure can allow water users to use stored water instead of ground and surface water, improving availability from these sources for users outside the scheme such as those in the lower reaches of the catchment.
    b. Wetlands and riparian planting on one property can absorb and filter contaminants from properties further upstream.

94. Catchment-scale mitigations and infrastructure can also incur negative externalities (such as the ecological impact of a new artificial lake for storage or hydro-generation) which are equally important to account for.

Public good features

95. Catchment-scale mitigations and infrastructure can be designed to deliver some services that are more public rather than private goods. These are services that are non-rival in consumption (so that one person benefitting from them does not prevent others from doing so) and/or non-excludable (so that it is difficult to prevent people gaining benefit or 'free-riding'). Examples include:

    a. Ecosystem services – storage infrastructure can provide greater and/or more reliable environmental flows and flushing flows to remove algae. Wetlands and riparian margins can provide habitat for fish and birds, and promote biodiversity.
    b. Recreational opportunities – swimming/boating in a hydro lake, or improved fishing and hunting opportunities due to restoration of natural wetlands and riparian buffers.

Coordination failures

96. Coordination failures arise when the costs or difficulty of getting individuals and groups to work together and contribute to decision-making prevent a project from going ahead. A coordination failure is more likely to occur when a project has diffuse benefits (i.e. it benefits a large number of different people, organisations and interests). Infrastructure projects, particularly community-driven ones, are subject to a number of these types of problems, such as:

    a. There can be high transaction costs associated with a large and diverse number of beneficiaries contributing funding to a project.
    b. Land and water users who have already obtained consents for water use and discharges are less willing to fund measures to increase the amount of water and assimilative capacity in the catchment as they do not need it.
    c. Often some of the benefits will accrue to future land and water users who will obtain land, water and discharge rights after more becomes available (i.e. if you build it, they will come). These potential beneficiaries cannot be included in decision-making processes or contribute funding to get the infrastructure built.

d. Large complex projects require additional expertise to be brought in and managed appropriately.
e. Large projects can be impeded by prolonged, expensive and litigious consent processes.
f. Objectors may try to prevent the infrastructure being constructed through the consent process, as they lack confidence that the environmental effects will be managed acceptably.
g. Uncertainty of consent outcomes can exacerbate the coordination failures of community schemes, as proposers must persuade land and water users to fund scheme development processes with no certainty of the project obtaining a consent.

97. As projects increase in scale, command area, complexity and cost, these problems compound.

The role of councils and collaborative processes

98. Often collective action is required for the delivery and/or optimal level of provision of goods and services subject to the failures described above. In our first report we recommended that collaborative processes should be used at an early stage in planning large infrastructure to ensure that problems could be recognised, addressed and resolved before the consenting stage. In our previous reports we also recommended the use of collaborative processes for catchment planning more generally – but they have particular importance for infrastructure and catchment-scale mitigations because they allow an integrated discussion on their relationship to limits; their relative costs and benefits compared to other management tools; community expectations; and how they might be funded. Council and collaborative processes should investigate whether funding is best provided: by private investors; publically, including through public-private partnerships; and whether a case can be made for central government to contribute.

99. Any public investment will require a robust business case. A cost-benefit analysis should be undertaken to help decide whether catchment-scale mitigations or infrastructure are more effective than alternative mitigation measures in meeting a limit, or creating headroom for further economic development and/or new users. Any cost-benefit analysis should consider the wider public good benefits that catchment-scale mitigations and infrastructure can provide, such as ecosystem services, building up natural capital, recreational, social and cultural benefits, greater resilience to extreme weather conditions, dealing with legacy issues, and any economic benefits from headroom creation. Any potential negative effects or risks should also be clearly identified – particularly those associated with any intensification in land use that infrastructure or catchment-scale mitigations may encourage, and any problems this may cause in managing within limits.

100. The benefits of these projects typically fall unevenly on different sections of the community. In some instances, the majority of the benefits may accrue to a relatively small number of groups. It is important that any public funding should be sourced equitably. Beneficiaries and/or those whose activities cause or add to the problem should be the primary contributors (e.g. through targeted rates), but a contribution from the community at large is also appropriate if there are wider public benefits from a project. Central government funding may also be justified in some circumstances. Recommendation 60a of this report asks central government to establish a fund

to assist local communities to manage within limits and we have suggested criteria by which funding could be provided in Appendix 2.

101. Resolving the above issues in a collaborative planning process, rather than consent-by-consent, will help identify and overcome any market failures and ensure catchment plans include the optimal suite of mitigations. This approach is consistent with how the provision of urban water and wastewater infrastructure is handled.

Recommendation 9: As part of catchment planning, councils should:

- **a. investigate the role that infrastructure and catchment-scale mitigations could play in:**
  - **i. meeting environmental limits**
  - **ii. creating headroom for economic growth through increasing the amount and reliability of water and/or assimilative capacity**
  - **iii. providing other economic, environmental, social or cultural benefits**
- **b. identify barriers to private investment in and deployment of infrastructure and catchment-scale mitigations**
- **c. identify what role they should play in the development and provision of infrastructure and catchment-scale mitigations.**

102. This section has focussed primarily on large-scale infrastructure developed at the catchment-level. But small-scale infrastructure (both hard and soft) can also be developed at the property-level and in fact it is often cheaper and more effective to mitigate closer to the source of contaminant loss. We expect small-scale infrastructure will play an important role in mitigating contaminant losses from critical source areas. However, the same problems – externalities, public good attributes and coordination failures – may be present. As a result, individual land and water users may not fund the level of mitigation that would be optimal for the catchment as a whole. Communities need to discuss co-funding arrangements in such circumstances. But communities should also ensure that mitigations are targeted to where the most benefit lies, rather than merely where a co-funder is available.

Monitoring and review

103. Iwi, communities, sector groups and NGOs will be involved all the way through this catchment management process – through setting limits, assessing information, and in discussions about addressing critical source areas and the way that infrastructure and catchment-scale mitigations might be part of a catchment solution.

104. Community involvement in setting limits also merits transparency in how those limits are being managed. Councils report to their communities in a variety of ways, and there is merit in having a transparent, easily understood and regular reporting arrangement between councils and their communities on the success they are having in meeting community expectations, and whether any additional steps are needed.

105. This reporting would be in addition to the discussion set out in our 2nd report about the ongoing role of collaborative groups in plan implementation.

Recommendation 10: Councils should be required to produce two-yearly a report card to iwi and their communities on:

a. progress that the combined interventions being used to manage water quality and quantity are making towards the achievement of objectives, limits and targets set under the NPS-FM

b. steps the council will take if the combined interventions are not sufficient.

106. There is real value in central government monitoring the performance of regions in setting and managing within limits. This monitoring could include:

a. the way that collaborative processes are working
b. the way that limits are being set under the NPS-FM, including how councils and communities are prioritising within and between catchments
c. whether councils have the tools required (for example, sufficient plan agility)
d. how adaptive management is used
e. the way that councils regulate, monitor and enforce limits
f. How councils and communities assess the impacts of setting and managing within limits.

107. In addition to the discussion contained in Appendix 4 of the Forum's third report, and recommendations 54, 55 and 58 of that report, the Forum believes that public reporting would be useful. This reporting should also include the approach that territorial authorities are taking towards phasing out of wastewater system overflows (see recommendation 21).

Recommendation 11: Central government should monitor and publicly report on the performance of regions in setting and managing within limits.

Water quality

Understanding the links between land use and water quality outcomes

108. A key issue when considering the tools for managing diffuse discharges is understanding the links between land use and water quality outcomes. Communities and land users need to be able to identify how they can most efficiently manage within limits. This means understanding with some degree of granularity the relationship between land use practices and discharges to the waterbody, including contaminant changes that occur along the transport pathway. This relationship is variable and complex. For example, the same amount of nitrogen applied to different pieces of land within a catchment or even within a farm does not necessarily result in the same amount of nitrogen being discharged into the waterbody in a given period of time.

109. Both natural characteristics (i.e. the *assimilative capacity* of the land/water system) and mitigations can affect the relationship between land use and practices and discharges to the waterbody. There are existing tools and science (e.g. models) to help communities and land users factor this into their decision making, but their continued development will be important to enabling management approaches to be improved over time to more efficiently achieve water quality outcomes and grow the water economy.

Assimilative capacity

110. Assimilative capacity is the ability of a land/water system to accept and tolerate contaminant discharges without exceeding limits. It has two main components: attenuation and the resilience of ecological communities.

111. Attenuation refers to changes that occur to contaminants along their transport pathway from their source to the waterbody where freshwater objectives are defined. These changes include physical, chemical and biological processes which change the nature of the contaminant as it travels. Ecological resilience refers to the ability of flora and fauna within the catchment to withstand increases in contaminants. Attenuation is a relevant factor for managing within limits, while ecological resilience is applicable to the National Objectives Framework and limit-setting within catchments.

112. Taken as a whole, assimilative capacity applies across multiple contaminants, including:

- Nitrogen (N)
- Phosphorus (P)
- sediment
- pathogens (e.g. E.coli)

…and has many components:

- the capacity of soils and waterbodies to absorb contaminants (e.g. P in soil, or sediment in a lake)
- biomass storage capacity (i.e. the amount of nutrients plants and animals in a catchment can take up)
- the capacity to remove nutrients through bacterial processes in groundwater and receiving waterbodies (e.g. denitrification)

- changes to the oxidation-reduction environment which changes the nature of contaminants, particularly in deeper groundwater and wetlands
- hydrological storage capacity (i.e. dilution effects and water and groundwater travel times)
- the hydrological regime in the catchment – particularly whether it has been altered through storage or other measures
- the resistance of ecological communities to increases in contaminants (ecological resilience).

113. A system with a high assimilative capacity will be less sensitive, and be able to absorb the impact of a stressor for longer than one with low assimilative capacity. However, the assimilative capacity of a system will eventually reach a threshold (saturation) level (e.g. tipping point) at which small changes in the stressor inputs cause a rapid change in system state.

114. While a catchment's innate assimilative capacity is a function of the natural landscape, this can and will be altered over time by the development of 'soft infrastructure' such as wetlands, swales and riparian buffers and other activities such as drainage, legacy nutrient effects and dredging.

115. Sustainable agricultural intensification is more achievable in catchments with a high assimilative capacity.

116. Our knowledge of the spatial variation in assimilative capacity is patchy, particularly data on groundwater flows and denitrification potential within catchments. Not all nitrates that leach off land reach surface waterways. Current estimates are that on average across New Zealand approximately 50% of nitrates leached from the root zone are attenuated before they reache surface water bodies. This average conceals significant spatial variation however, as rates of denitrification vary between and within catchments from as low as 10% to as high as 90%. There is often further denitrification from aquatic plants within the stream and vegetation on stream banks during downstream transport that provides additional attenuation.

117. Knowledge of variations in assimilative capacity between and within catchments is needed to target mitigation efforts and design regulatory or market instruments to deliver the maximum reductions in contaminant inflows for the minimum economic cost. Better information will mean that interventions can be targeted to where they will make the most difference to water quality. Without this information, the average effectiveness of mitigations will be lower; and the average costs land and water users and communities will have to bear (including direct costs, compliance costs, administration/monitoring costs and lost opportunities for economic growth) will have to be higher in order to meet the limit.

Recommendation 12: Improvements in catchment-by-catchment information on the spatial variability in assimilative capacity, particularly groundwater flows, lag times and denitrification potential, should be a high priority for government investment.

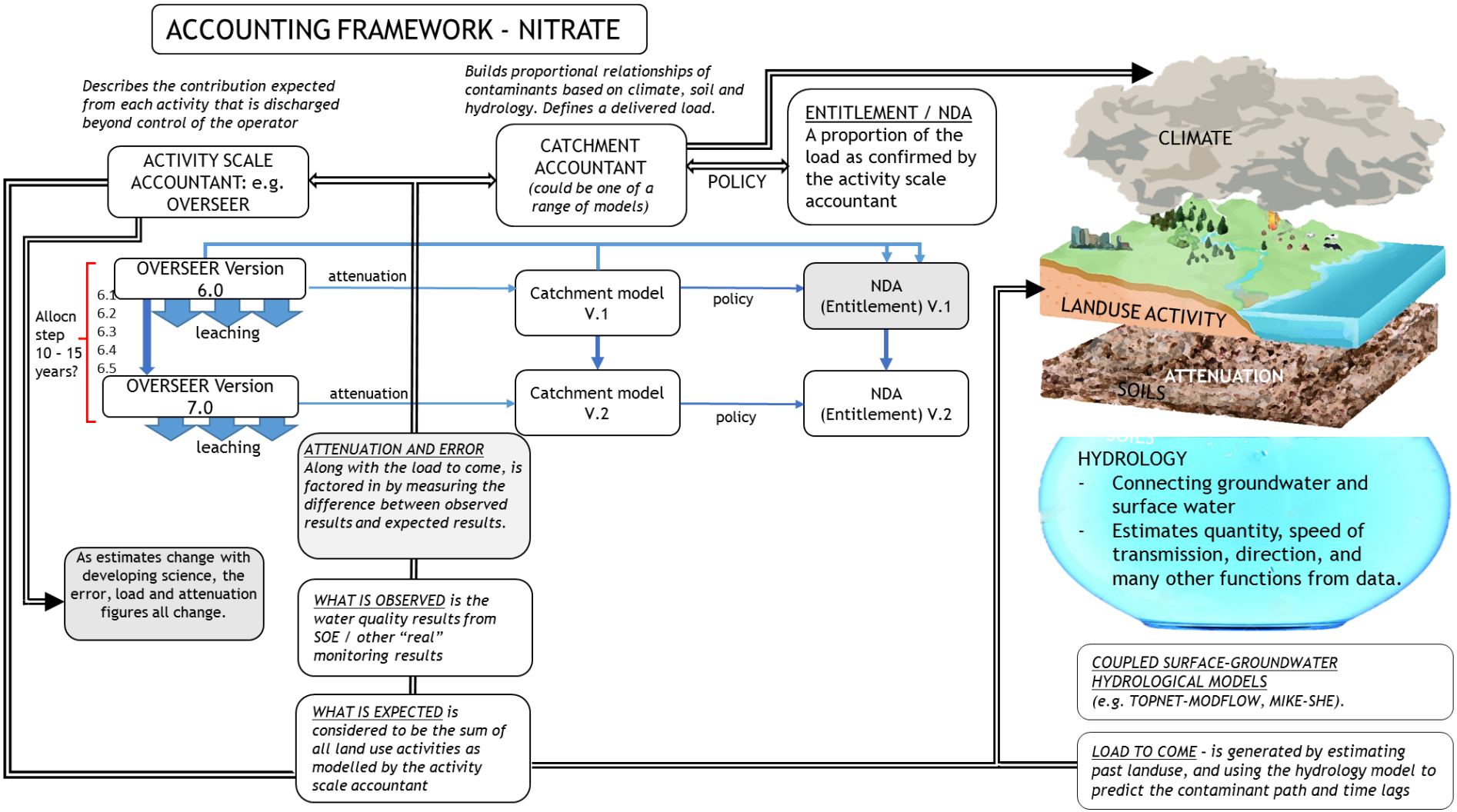
Modelling and accounting

118. A key difference between the regulation of water quantity and the regulation of water quality is that water metering allows water quantity (i.e. takes) to be more easily measured. Direct measurement of water takes allows them to be more easily managed through resource consents. By contrast, as we move toward managing water quality, we will need to rely more on models.

119. Modelled numbers are used frequently in regulation, but they do provide some additional challenges. Firstly, modelled data is usually less accurate than direct measurement, and models need to be properly ground-truthed. Secondly, the accuracy of modelled data depends on whether land and water users' practices accord with the assumptions of the model. The only way of verifying this is by monitoring the behaviour of land and water users. This can add administration costs for the councils responsible for monitoring and compliance costs for land and water users. If monitoring is lax, there will also be opportunities for 'gaming' the system – i.e. land and water users may say they will undertake a suite of mitigation practices, but then avoid doing them.

120. Water quality accounting requires the use of a range of models that work together to take into account the effects across: a range of contaminants; a range of land use types; and the various components of assimilative capacity. This will have to occur at an activity-scale and then be reconciled with catchment-scale modelling or measurement. A diagram illustrating this type of accounting is provided below.

Figure 1:Accounting Framework – Nitrates



(Diagram provided by Chris Keenan, Horticulture NZ)

121. Modelling should be based on the best available information and will inevitably include a range of assumptions. It will be improved iteratively over time as the underlying science and information base improves. The development of a national information framework as proposed in recommendation 5 of this report is important in this regard.

122. To help communities identify a robust package of tools and interventions for achieving their desired objectives, councils (with input from the primary sector and others) will need to model catchment discharges based on current and potentially achievable management practices. This information will help communities understand the impact of proposed objectives and limits, including helping identify appropriate timeframes (and targets) for meeting limits in catchments where desired objectives and limits are not currently being met. Monitoring is needed to check whether expected results are being achieved within desired timeframes and catchments will need to be managed adaptively.

Recommendation 13: For the purpose of managing within limits, councils should model and quantify the impact of the range of currently and potentially achievable management practices (including GMP) and mitigations for the contaminants of concern (e.g. nutrient losses) in each catchment.

Councils should adjust requirements on land and water users, including considering additional mitigations, if monitoring and modelling of the impact of the interventions used shows that the objectives, limits and targets set under the NPS-FM will not be met.

123. In order to reduce uncertainty for both land and water users and regulators, the model versions used in regulation should be 'locked in' for a period of time outlined in a plan and adjusted at regular intervals well signalled in advance. As new versions become available, land and water users and regulators will be able to use them to prepare and adjust for when the model version used in regulation is updated.

124. Changes to the model version used at the activity-scale should be synchronous with changes at the catchment-level and vice-versa to ensure 'apples versus oranges' comparisons are avoided. Ideally the old version of the model would remain available while it is still being used in a plan. Councils will also need to be able to use 'agile planning' tools that enable the model versions referenced in plans to be updated without going through a plan change process.

Recommendation 14: When using modelled numbers in regulation:

a. plans should clearly outline when new model versions will take effect in regulation
b. the model version used at the activity-scale and the catchment-scale should be updated simultaneously.

OVERSEER

125. OVERSEER is one important model used to estimate nutrient losses from land. OVERSEER generates information about the flow of nutrients on and off a farm. It allows land and water users and their advisers to predict the likely impacts of changes in their management practices or farm systems on nutrient discharges. OVERSEER estimates stop at the root zone. Other

models (e.g. CLUES) are needed to account for the nutrient reductions that occur in groundwater and in waterways.

126. OVERSEER has emerged as key tool for accounting for farm-level sources of nutrients and councils have also have also begun using OVERSEER as a tool to regulate land use decisions. In some places, OVERSEER is being used to allocate nutrient discharge allowances to individual properties (or groups of properties).

127. There are currently three main issues with using OVERSEER in a regulatory context:

    a. Its ability to accurately model discharges, particularly:
        i. it ignores nutrient reductions below the root zone
        ii. its accuracy varies between different land uses
        iii. it does not account for the full range of mitigation measures and it takes time before new approaches can be incorporated.
    b. Updating of OVERSEER versions that are in plans can create uncertainty for water users.
    c. Its accuracy depends on users being suitably skilled and not 'gaming' the model.

128. A joint project is underway between regional councils and central government, in coordination with OVERSEER owners, to enable appropriate and consistent use of OVERSEER by regional councils. This joint project will address some of the concerns identified above. In addition, work is underway to improve the use of OVERSEER for non-pastoral sectors.

Recommendation 15: Alongside improvements in catchment-scale models, the continued development of OVERSEER should be a priority.

Management of Discharges

129. The Forum's third report recognised the importance of good management practice (GMP) for setting and managing within limits. Recommendation 15 stated that GMP should be defined and adopted in all catchments and included recommendations to maximise the contribution from GMPs and to ensure their effectiveness as essential methods in achieving limits and freshwater objectives. The report defined GMPs as:

an evolving suite of tools or practical measures that are being put in place at a land user, sector and industry level to assist in achieving community agreed outcomes (in this case for water quality).

130. This reflects the responsibility to use the water and assimilative capacity available within the limit efficiently to free up resources for new uses within the catchment while still ensuring environmental outcomes are achieved.

131. Just moving everybody to reasonable water use and GMP may not be enough to meet limits in some catchments. Other tools will be needed to create a system that incentivises innovation and efficiency improvements to free up resources for other economic uses and to manage to limits. Management approaches will also need to consider:

a. including infrastructure development and catchment- scale mitigations
b. using discharge allocation approaches to manage contaminants where possible. These approaches may:
    i. set discharge caps that apply at the property scale (to individual properties or groups of properties)
    ii. create transferable discharge allowances that are allocated via individual or group consents and are able to be transferred
c. managing non-allocated contaminants by requiring better management practices and/or controlling inputs and/or land use.

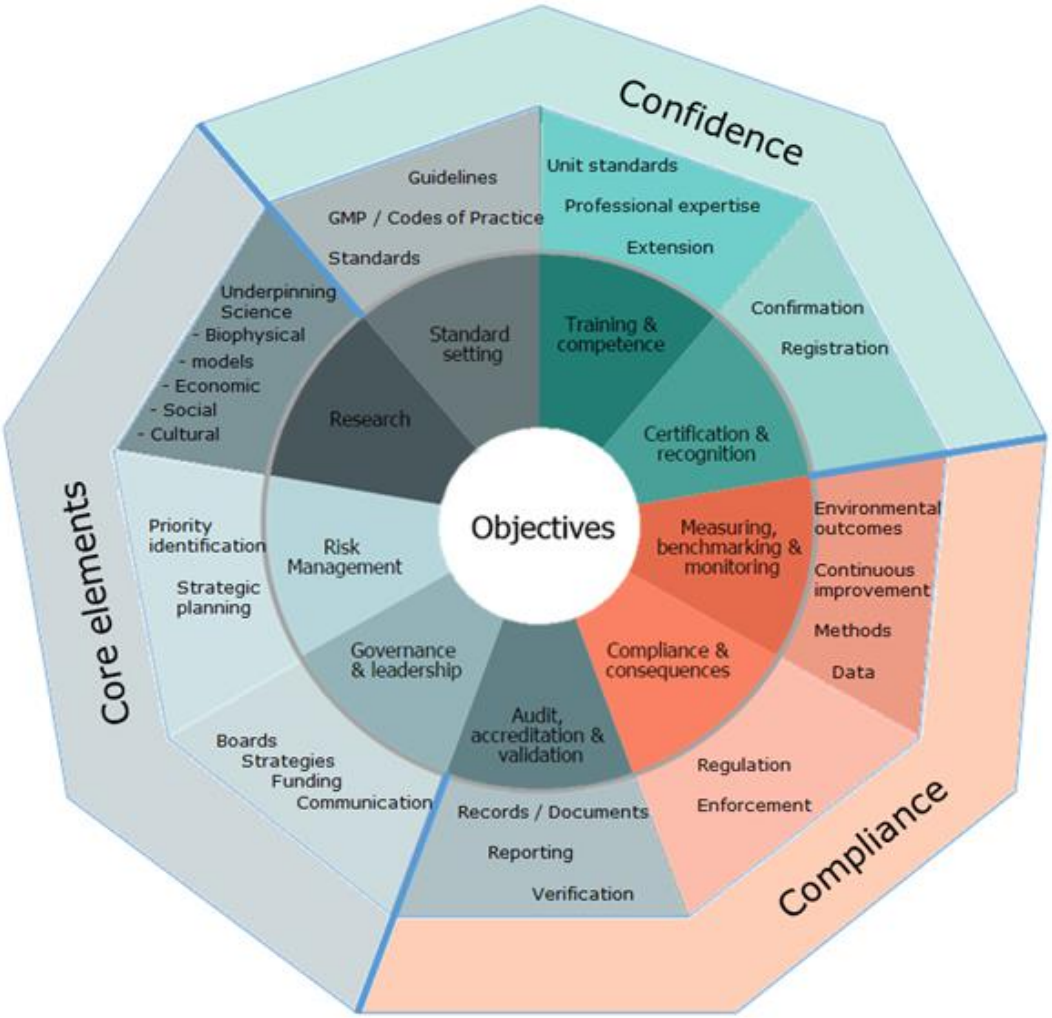
132. When deciding the specific tools and interventions to be used, the impact of the various steps should be modelled to check that they should result in the limit being managed within. Subsequent monitoring will check whether or not expected results are being achieved within desired timeframes. Catchments will then be managed adaptively, with actions adjusted in the light of their results. Further steps, including land use change, may be needed where limits are not being met.

133. The discussion below is focussed primarily on water quality in a rural context, with water quality in urban environments discussed in a later section. However, much of the material also applies in an urban context.

Regulating GMPs for primary production sector

134. GMP, including how it is recognised in regulation, needs to be considered in the context of the system within which GMP tools are created and improved over time, rather than just a list of practices. As set out in Figure 2 below, a wide range of matters need to be considered to ensure development and, equally importantly, the up-take and implementation of GMP is effective and efficient in achieving desired water quality outcomes.

Figure 2



135. GMP continually evolves with new technology and innovation. Therefore it is important that any regulation of GMP as far as possible allows for GMP to evolve, rather than locking it in as a static concept.

136. GMP is the minimum requirement for all industries, and is central in contributing to managing within limits. This means that increased attention is being given to understanding and documenting what GMP is, including for modelling and accounting purposes as reflected in recommendation 13. This focus needs to continue.

137. There is varying information and understanding across different regions and sectors on both what constitutes GMP and the level of GMP in place. Information is improving as limit setting processes are occurring. A notable example is the *Industry Agreed Good Management Practices related to Water Quality* document [http://ecan.govt.nz/get-involved/mgmproject/Pages/matrix-good-management.aspx]. This list of high-level industry-agreed GMPs has been developed by Environment Canterbury to estimate the "footprint" of nitrogen and phosphorus loss for the range of Canterbury farm systems, assuming operation at GMP. The practices have been developed in conjunction with some key national primary sector

groups to cover the dairy, sheep and beef, deer, horticulture, arable and pork sectors. It does not cover all primary sector groups (for example, forestry), and will need to be supplemented by other recognised sectoral GMPs.

138. While it will not be possible to make detailed national prescriptions for each element of GMP in a particular catchment, some degree of national understanding about a framework for thinking about agricultural GMP would be useful and prevent councils and communities from unnecessarily having to reinvent the wheel. As a starting point, councils and their communities should consider the *Industry Agreed Good Management Practices related to Water Quality* material when developing GMP-related policies for the primary sectors mentioned above. Similarly, other sectors have also developed good practice material (e.g. the *NZ Environmental Code of Practice for Plantation Forestry* developed by the Forestry Owners' Association) that will prove useful. It is important that industry GMP documents are regularly reviewed and updated.

139. In most cases determining exactly what GMP is will be context specific given the particular circumstances. The risks that need to be managed will vary with land uses and land and soil types, the myriad of activities and management decisions made on a daily basis and the particular water quality issue of concern in a catchment. Some councils are requiring farm plans as a way to identify tailored management actions that are appropriate for managing key risks to water quality associated with the enterprise. Farm plans set out the proposed and/or already implemented actions and commitments of the farmer that contribute to achieving desired catchment outcomes. The Farm Environment Plans National Collaborative Working Group has provided a useful platform for discussing how farm plans can be designed and implemented in a way that helps lift farmer capability and promotes sustainable and profitable farming within environmental limits. A number of councils are requiring farm plans as part of a consent requirement. Primary industry bodies are assisting their members by working with councils to explore using existing (or improved) industry programmes (e.g. Beef and Lamb's *Land and Environment Plan Toolkit*) where such plans are required.

140. Whether a land use activity is permitted or requires a discharge or land use consent will generally depend on the level of risk associated with the activity. Consent requirements are more likely where catchments are not meeting desired water quality outcomes, where properties contain hotspots or areas of ecological significance, or for unusual activities.

141. Determining where consents are required and the nature of permitted activity rules necessary for managing within limits will need to be part of a planning process at the regional or catchment level. The legitimacy of any permitted activity rule must be clearly demonstrated as these tests are not always robustly applied in practise when a permitted activity rule is set. Care must be taken when devising any permitted activity rule that it is consistent with the NPS-FM and the Resource Management Act (RMA). Clarity and certainty are important as uncertainty can lead to litigation, increase risks of failure to operate within limits, less effective management of activities, and unclear and unreliable distribution of costs and benefits. Permitted activity rules should therefore only be used if a council can demonstrate that the proposed rule (and its standards):

    a. is clear, capable of consistent interpretation and enforceable

b. is consistent with s69(3) of the RMA
c. will fulfil the specific requirements in s70 of the RMA.

142. The regional planning process will also consider requirements for other rural land uses (e.g. septic tanks on life style blocks), and management of urban land uses.

143. Permitted activity status may be adequate where risks are low and/or can be adequately managed (e.g. by being part of a Sustainable Land Use Initiative programme that is included as a method in a plan and accounted for and monitored, or through membership of a suitable industry scheme). Should the Forestry National Environmental Standard be implemented, it is intended that forestry activities complying with the Standard would be given permitted activity status in regional plans. Approaches such as discharge caps, where activities are permitted providing that the nutrient discharge cap (modelled on Overseer) is not exceeded, have also been given permitted activity status in some plans.

Recommendation 16: Good Management Practice is the minimum requirement for all industries. In developing GMP-related policies and methods, councils should consider in the first instance the national *Industry Agreed Good Management Practices related to Water Quality* framework and other recognised sector GMPs.

Recommendation 17: Discharges should be managed through the Resource Management Act by way of a consent requirement unless the council demonstrates using permitted activity rules will be sufficient for achieving the limits within the agreed timeframes. Whatever approach is used, there must be a transparent process to audit performance, either through an approved independently audited industry self-management scheme and/or a council compliance process that is documented and clear to both land and water users and the groups involved in the planning process.

Encouraging the development of approved Industry Schemes

144. More attention is being given by some primary industry organisations to developing comprehensive independently audited industry self-management schemes (industry schemes) that consider the elements in Figure 2 above. In a growing number of cases, the market is providing the impetus for industry schemes that prescribe environmentally responsible operating practices. This trend is expected to grow as both international and New Zealand customers require more transparency regarding the environmental credentials of products.

145. The Forum's third report contained a list of key principles of audited self-management schemes (Annex II) and defined audited self-management as:

A management programme (individual, industry, or land user collective) which allows for the credible and transparent demonstration (audit) that agreed actions have been implemented (in this instance for water quality).

146. Industry schemes have the potential to play a greater role in assisting in managing within limits. The requirement to manage within limits makes it increasingly likely that primary producers may need to obtain a discharge or land use consent (perhaps with a requirement to prepare a

farm plan). Industry schemes of sufficient quality could be recognised in a regulatory context. Schemes could substitute, in whole or part, for council management of a particular activity's (or group of activities') effect on water quality or some particular aspect of water quality. Members of approved industry schemes could be given permitted activity status or, more likely, be subject to a smaller number of consent conditions.

147. Industry groups should be encouraged to develop independently audited industry self-management schemes to assist in delivering desired water quality outcomes. It should not be compulsory for industry organisations to develop an industry scheme (or necessarily for an individual to join one), and the traditional council-managed approach (which may involve a consenting requirement) would still be available. However, the potential benefits of industry schemes, such as the ones below, means the concept is important to further develop:

    a. Scheme members would receive support from the Scheme rather than each individual having to bear the cost of going through a detailed consenting process that may otherwise be required.
    b. It has the potential to alleviate pressure on councils to exercise close oversight of the on-farm performance of (potentially) thousands of individual primary producers who pose an actual or potential risk to water quality.
    c. It can avoid potential duplication of effort between the risk assessment, extension, compliance and auditing work already being undertaken by an industry and that potentially required of the council in the absence of an Industry Scheme. Furthermore, it may enable best use of scarce skills where there are limited people with the skills and qualifications required (such as in the use of OVERSEER).
    d. It has the potential to be more effective than council control by making environmental performance part of everyday management practices observed on-farm as, for example, occurs already in respect of food safety. It establishes a much stronger connection between the ability to do business and the need to engage in appropriate environmental practices. In that way it may drive more rapid behavioural change.

148. A national approval process for industry schemes would provide a consistent approach and improve confidence that such schemes are robust. A national approval process also both helps avoid councils having to reinvent the wheel and industry bodies having to seek separate approval from multiple councils for common issues that could be dealt with once.

149. Duplication can be further reduced if there is a generic cross-sector approach that can be used across the country, with modification as needed for particular catchments and sectors. Many land and water users have mixed operations (e.g. sheep and beef and cropping) so a common approach across different schemes is desirable as far as possible.

150. Ideally a common approach would extend to cover a broader range of obligations than water quality (e.g. animal welfare, food safety) as part of one integrated business plan. Such a plan would be fit for a range of purposes, with the land and water user able to provide the relevant parts to the relevant regulatory authority (e.g. council) or other party (e.g. an international buyer interested in environmental credentials), rather than having to prepare multiple documents for different purposes.

151. The matters below should be required of industry schemes. At the same time, any approval system needs to avoid being overly stringent or bureaucratic relative to a standard council approach:

- 1 on 1 farm/property visits from appropriately skilled individuals to identify tailored actions
- mitigations are risk-based
- accredited third party auditing
- clear and measurable objectives
- confidence that mitigation actions put in place will translate to improved water quality outcomes
- benchmarking to help farmers and growers assess their performance
- opportunity for wider stakeholders (including NGOs, iwi and councils) to input into the development of the material
- regular and transparent review and up-dating of schemes, with opportunity for input from interested parties including NGOs
- ability to take timely remedial actions if a scheme is not delivering as expected.

152. Further work will be needed on the design options for industry schemes, including the legal and practical implications, the nature of a national approval process, and how such schemes are recognised in plans. In our second report we made recommendations about plan agility. Improving planning agility will be an important element of introducing and successfully implementing these schemes. Incorporating industry schemes to the right level of detail in regulation will be important so that it is done in a way which allows for on-going improvement of practices as new technologies develop rather than locking GMP in as a static concept. It is also important that practices can be adapted as monitoring information becomes available.

153. To build confidence and develop a robust approach, it is important that a range of stakeholders can contribute to these discussions. The Forum should be involved in further testing developments in this area, including learning from work underway in the Waikato region to explore the concept, and in reviewing the effectiveness of any national approval process after it is developed and implemented.

Recommendation 18: Central government, with input from sector groups, councils, iwi and NGOs, should develop a national process for approval of industry audited self-management schemes and have this process in place by 1 July 2017.

Water quality management in urban environments

154. Urban New Zealanders often have a very limited day-to-day experience of freshwater environments and, accordingly, they may not feature as a management priority. Cities in New Zealand are all in or include catchments that have both urban and rural uses. The requirements of the NPS-FM apply to all catchments, in both rural and urban environments. The changes required to manage within freshwater limits will, however, be quite different in urban environments.

155. Urban areas must contribute to achieving the requirements of the NPS-FM and should not be exempt from reducing contaminants and improving ecological health. It is particularly

important that urban water managers have flexibility to implement new and innovative approaches to improving water quality and habitat conditions that support ecological health. In some cases setting limits will need to take account of both habitat and water quality effects on intended ecological, recreational and amenity outcomes, including making use of realistic timeframes and interim targets to achieve community objectives. Urban water managers also need to be able to focus management efforts so they can build 'critical mass' and give themselves a chance to make real improvements in water quality in targeted areas.

156. The responsibility for managing water quality in urban environments largely falls to the owners and managers of transport, stormwater and wastewater networks, and the owners of commercial enterprises that result in trade waste and point source discharges of contaminants. It can be difficult to isolate the impacts of individual households' actions as stormwater and wastewater networks are designed to manage and treat contaminants at a collective level. In addition, allocating diffuse contaminants that enter stormwater to individual households would be challenging as the activities that generate contaminants and the associated adverse impacts are difficult to quantify or locate. These difficulties can complicate monitoring and compliance, and dilute the incentive of individuals to take responsibility for their actions. This is quite different to rural environments where the relationship between individuals' and farm-level actions and their effects on freshwater quality, in particular, are in most cases more obvious and direct.

157. Urban land developers tend to carry all or part of the capital cost of developing infrastructure and stormwater management networks, but the ongoing maintenance and renewal costs tend to fall to councils. Water sensitive approaches that rely on 'green infrastructure' such as swales and rain-gardens often require regular and ongoing maintenance that are different or additional to the current responsibilities of asset operators. This change in the profile of operational responsibilities can discourage councils from promoting new and more water sensitive approaches to water management.

158. The scale of urban environments tends to require specialisation in service delivery, meaning that multiple institutions or operations within one institution will be responsible for different aspects that impact on water quality (e.g. town planning, coastal planning, and the development and operation of roads, wastewater and stormwater networks). Each of these institutions or operations has their own objectives and obligations, and is required to comply with different planning processes, investment protocols and decision-making criteria. For example, public green spaces, parks and recreational grounds may be managed by one part of a council, with stormwater assets managed by another with the primary aim of flood management. If the planning of these two parts was aligned, such public green spaces could be used for stormwater management in high rainfall as part of a water sensitive approach, reducing environmental impacts on urban streams.

159. Many of New Zealand's urban environments are located on or near the coast, with rivers and streams in these environments flowing directly into harbours, estuaries and oceans. Urban New Zealanders are often more aware of coastal water quality than the quality of urban streams. The NPS-FM requires councils to have regard to the connections between fresh water and the coast, including the effects of land and water use. In urban areas, the alignment of plans will be

particularly important, as publicly recognised coastal water issues may provide the impetus for strengthened freshwater planning, asset management and land use controls.

160. Historical investment in network infrastructure can also limit appetite for new and innovative management approaches in urban environments. The National Infrastructure Unit has noted that conventional economic analyses will often conclude the marginal cost of incremental investment to extend existing networks is the cheapest option. The assumptions underpinning these analyses potentially discourage investment in alternative approaches to land and water management that could deliver better water quality or more resilient outcomes over longer timeframes. Renewal and replacement cycles for three waters infrastructure present an opportunity to improve water management in urban environments, either through the introduction of more efficient conveyance or treatment infrastructure, or the adoption of water sensitive design approaches.

161. The cost of maintaining and renewing water management infrastructure will be particularly challenging for some councils and communities, especially those with small urban centres, declining populations and rates bases. This may encourage conservative management responses or conversely discourage innovative approaches to delivering improved water management outcomes. The limit-setting process will need to consider these challenges when determining the timeframes to achieve community objectives for fresh water in these areas.

162. Current investment frameworks do not take full account of the environmental services from green infrastructure provided by water sensitive design (e.g. the amenity or biodiversity gains associated with reduced stormwater piping and increased raingardens). Local authorities may need to establish systems to create and maintain blue and green assets similar to ones to well-established local authority systems for creating and maintaining built assets.

Recommendation 19: Regional councils and territorial authorities should prioritise the alignment of the planning, investment and delivery of 'three waters' infrastructure, roads, residential development and land use controls to meet water quality objectives in regional plans for freshwater and coastal environments.

163. Traditional approaches to urban development, stormwater design and flood protection, have had a significant impact on the health of urban streams and their ability to sustain functioning natural ecosystems. The speed at which rain runs off impervious surfaces and into urban streams causes unnaturally fast flows during even 'normal' rainfall events and scours stream beds. At the same time impervious surfaces reduce infiltration and contribute to lower than natural base flows. This water runs over land picking up zinc, copper and other heavy metals and transporting them into aquatic environments that are particularly sensitive to these contaminants. It is very difficult to intercept and remove these contaminants from stormwater before they reach urban streams or the coastal environment. Water sensitive approaches to urban design and stormwater management can help address these issues, but dealing with diffuse urban contaminants as close as possible to their source is the most effective and cost-effective way to address the effect of many urban contaminants on water quality (e.g. using alternatives to galvanised iron for roofing can significantly reduce zinc contamination and using ceramic brake pads can reduce copper contamination).

164. Population growth can also create water management issues in urban areas. Brownfield intensification can put pressure on existing stormwater and wastewater networks potentially increasing the volume and velocity of water in streams during rainfall events, further reducing baseflows and increasing the number of controlled and uncontrolled wastewater overflow events. Traditional approaches to greenfield development tend to release significant amounts of sediment during development and rely on piping streams, draining wetlands and lowering flood plains to maximise returns from residential properties. It is significantly more expensive and difficult to remediate impacts on stream health and water quality in urban environments. Given that the requirement to maintain or improve water quality applies equally in urban and rural environments councils should avoid following approaches to development that create more legacy water management issues and defer the cost of meeting limits to future generations.

165. The need to develop and articulate good water management practices is equally important in urban and rural environments. These practices need to allow urban water managers to focus on 'hot spots', prioritise investment in the areas where most gains can be made, and take steps to prevent water quality getting worse as urban environments grow. New 'water sensitive' approaches to urban design and development should be adopted, especially in growth areas and where traditional approaches to land development and water management have been shown to degrade water quality. Water sensitive urban design minimises adverse impacts on urban streams by relying on natural hydrological systems in land use and infrastructure design before resorting to hard engineering approaches.

Recommendation 20: A "Water sensitive urban design" process must be adopted in the building and upgrading of stormwater and roading infrastructure and residential urban development (and redevelopment).

166. Some of New Zealand's urban environments are serviced by antiquated combined wastewater and stormwater systems. In these systems, constructed wastewater overflows routinely divert wastewater into stormwater networks or the coastal environment during high rainfall events. Even those wastewater systems designed with the latest technologies expect to overflow into stormwater or directly into coastal environments once or twice per year. While phasing out overflows entirely may not be practicable given current infrastructure and technology, wastewater managers should still aim to minimise these overflows to reasonable levels and work towards phasing out overflows over specified timeframes.

167. In areas where infrastructure and bylaws allow, trade waste may be discharged into municipal wastewater systems. This can place significant strain on municipal wastewater treatment plants. To increase the longevity of wastewater treatment plants, councils should review or revise trade waste by-laws and make use of similar tools to encourage sectors to pre-treat and recycle trade wastes before disposal into municipal wastewater systems. As part of this review, councils should consider the comparative efficiency of pre-treatment or recycling of particular contaminants against their discharge and management in municipal wastewater systems.

Recommendation 21: Where wastewater systems overflow into stormwater or directly into waterbodies, in either a controlled (designed) or uncontrolled manner, local authorities should be required to report publicly on:

a. the maximum acceptable frequencies that are set through consent conditions or plan rules, and the actual number of overflows
b. planning and progress towards phasing out overflows
c. how overflows will be managed to achieve objectives and limits.

Recommendation 22: Territorial authorities should review or revise trade waste by-laws to encourage or require the pre-treatment and recycling of trade waste before disposal into municipal wastewater systems.

168. Given urban New Zealanders' limited day-to-day experience of freshwater environments, in some situations the public may place more emphasis on the attractiveness of streams and adjoining parks, than on the recreational value of fresh water or the health and functioning of freshwater ecosystems. In these instances general litter and other 'gross pollutants' (e.g. shopping trolleys and plastic shopping bags) and the attractiveness of riparian planting may be key community concerns. Community stream clean-up and planting programmes can both increase urban residents' connection with and awareness of the issues facing urban streams. Increasing awareness of the individual and cumulative effect of urban activities on fresh water should continue to be an area of work for councils, including supporting community clean-ups and restoration of urban streams.

169. Urban catchments, or the urban portion of catchments, are generally hydrologically modified and often highly degraded. There are few examples, globally, where highly degraded rivers passing through urban areas have been able to be remediated to meet the level of quality or ecosystem expectations set by the NPS-FM. Research into cost-effective tools for the restoration and remediation of highly degraded urban streams is needed to give councils the tools they need to improve water quality in urban areas. Case studies and demonstration sites where urban streams have been successfully restored will be extremely useful. Research to this effect will need to be considered as part of the information framework (recommendation 5) and as a priority for central government funding (recommendation 60).

Setting discharge caps and allocating discharge allowances

170. When a limit is set, responsibility for meeting that limit is assigned and all sources of contaminants need to be accounted for in order to assess whether or not the limit is being met. A decision is needed about which sources of contaminants will be actively managed to ensure the total load is within the limit and a management regime must be designed that ensures the limit will be met (within agreed timeframes in over-allocated catchments) while maximising the economic benefits of water and land use activities.

171. Water quantity has a well-developed history of direct regulation, consents are required for most types of use, and metering required for all large users. In contrast, the shift towards the direct regulation of quality is still in process. While the majority of point source discharges are now subject to resource consents, it is relatively common for activities that result in diffuse

discharges to be managed through land use controls under section 9 of the RMA rather than as discharges under section 15.

172. Modelling developments now enable diffuse discharges of nitrogen and phosphorus from productive land to be modelled and accounted for at the property or entity level (as discharges from the root zone). The allocation of diffuse sources of nutrients to properties and/or entities (individually or as groups) is now becoming possible so long as the precursor steps to establish property-scale and catchment-scale accounting have been taken. Once these precursor steps have been taken it will be possible to move towards nutrient discharge allocation regimes which cover diffuse and point sources and enable discharges to be transferred. In the long term, this is likely to be the best management approach as it provides:

    - clarity on the relationship between land uses and water quality outcomes
    - clear accountability for achieving water quality outcomes
    - certainty to users about their entitlement
    - flexibility to users in how they manage their activities within their entitlement and incentives to develop innovative approaches
    - for diffuse and point source discharges to be managed in the same way
    - for discharges to be transferred within a catchment to where they are most valued and/or have a lower environmental impact.

173. These approaches are starting to be used in plans but we are learning as we go and most of the experience with allocation of diffuse source discharges sits within New Zealand. No approach has yet emerged as an exemplar, and where allocative approaches are being used the focus has been more on addressing over-allocation than on enabling economic efficiency gains over time.

174. The focus is currently on discharge allocation approaches for nitrogen and this should continue. Although OVERSEER can be used to account for and allocate phosphorus discharges at the property level, there are some additional complications in comparison with nitrogen. For phosphorus, there needs to be sufficient accuracy and granularity in the spatial data entered into OVERSEER to ensure accurate accounting of phosphorus entering the waterway. There are considerable challenges to be overcome before it would be practicable to allocate sediment discharges on a property level. There are other contaminants such as *E. coli* for which it may never be practical to allocate below the sub-catchment scale.

175. We do not yet suggest discharge allocation approaches that cover diffuse sources from productive land should be put in place everywhere now, particularly because it is undesirable to continue to design and debate discharge allocation regimes on a catchment-by-catchment basis. There will be some matters that need to reflect catchment circumstances but, as for water quantity, there will be many regime characteristics that should be approached in nationally consistent way.

176. Catchments that are already using or are in the process of developing a management regime that incorporates discharge allocation approaches for diffuse sources of nutrients should not stop as such approaches provide a critical mechanism for bringing the contaminant load down to limits by enabling the use of sinking caps that individuals or specified groups are responsible for meeting. It is important that these regimes take into account limitations in knowledge and

that there is transparency about how and when the regime will respond as knowledge improves.

177. Regardless of whether a catchment is immediately moving to a property/entity-scale discharge allocation approach for a particular contaminant, there must be catchment- or sub-catchment-scale limits (which may be expressed as maximum total contaminant loads) in place which constrain both point and non-point source discharges.

Recommendation 23: For the total contaminant load, the plan must make it clear and the accounting framework must reflect:

- **a. the proportion and sources of that load which will not be explicitly managed (for example parts of the Conservation estate that aren't in productive use)**
- **b. the proportion and sources of that load which is being allocated for use and will be explicitly managed.**

Recommendation 24: Over time, and providing the precursor steps to allocation have been met, councils should adopt management approaches which allocate diffuse source discharges to individual entities or groups.

Pre-cursors to using allocative approaches for diffuse source discharges

178. The RMA requires diffuse source discharges to be controlled as well as point source discharges. Ensuring that the accounting framework is fit for the purpose of enabling a discharge allocation approach to diffuse sources that are capable of being allocated is a foundational step that should be taken everywhere regardless of whether or not an allocation regime is being considered immediately in order to provide maximum flexibility in the future. This means accounting for diffuse source discharges at the property or entity scale and continuing to improve the understanding of assimilative capacity in the catchment (e.g. groundwater flows and denitrification potential between the root zone and waterbody) so that there is confidence that the regime will efficiently and effectively manage the impacts of land use on water quality outcomes. This is particularly important for going beyond allocating discharge caps to establish a regime which allocates transferable discharge allowances.

Recommendation 25: Councils should take the following precursor steps for all catchments that are, or are likely to become, fully allocated in the foreseeable future or are over-allocated:

- **a. ensure that all activities that cumulatively make a more than minor contribution to the catchment load (through point source or diffuse discharges) are directly controlled**
- **b. ensure that those controls explicitly refer to the full range of discharges that may arise from the relevant activity**
- **c. account at the individual land or water user level for diffuse discharges from all activities that cumulatively make a more than minor contribution to the catchment load.**

Maximising economic benefits and enabling access

179. Allowing discharge allowances to be transferred to where they are most valued (on a temporary basis and/or for the duration of the allowance) can reduce the cost of reductions to meet a limit and provide for productivity gains. Where discharge allowance transfer occurs within a market, flexibility and price signals will incentivise innovation and efficiency in discharge-producing activities (by enabling the right holder to realise a benefit from reducing their discharges).

180. Much of what we have said in this and previous reports to enable more transfer of water takes is also true for enabling transfer of discharges (for example, the benefit of standardising consent specifications, separating discharge allocations from site conditions in consents, and transitioning all existing discharge consents and permitted activities in the catchment to the new standardised discharge consent format). There are however additional considerations for discharges that add complexity, including:

    a. the spatial variability in assimilative capacity associated with discharges at a granular level – which is necessary if we are to design a regime that minimises transaction costs while providing certainty that the transfer of an allowance will not breach a limit
    b. uncertainty arising from reliance on modelled estimates of discharges – which will affect the 'quality of title' associated with an authorisation, and means there will be some level of reliance on administrative systems for defining and allocating discharge allowances for diffuse sources.

181. Alternative approaches to enabling some movement of discharges can be put in place in the interim, or as an alternative long-term approach. Building on the collaborative planning approach we have recommended for setting and managing within limits, supporting the formation of user groups and enabling them to manage discharges within a group cap or allowance (e.g. via a group consent) is likely to be key.

182. An additional consideration for communities that affects economic efficiency is whether to set caps on maximum discharges from land in the plan or authorise some or all diffuse discharges through consents (which cumulatively add up to no more than the limit). Although the use of caps may reduce or remove the need for consents, it can put constraints on the flexibility of land and water use. This is because the accounting system will need to assume that all land and water users are making full use of the cap even though some may actually be below, and the difference may not be available to other users.

Recommendation 26: To facilitate the future adoption of transferable discharge allowance approaches central government should:

a. Provide model plan provisions, which enable the easy transfer - in full or in part - of a discharge authorisation for the length of an authorisation or for a temporary duration.
    i. These model provisions must be developed collaboratively with local government, iwi, sector groups and NGOs, and should provide a template for enabling and managing the transfer of authorisations between or within zones.
    ii. New consents should be constructed in accordance with this model format.
    iii. Consent holders should be able to request their consents be reconfigured to

make them consistent with these model formats, consistent with the approach suggested in recommendation 46c.

b. Specify nationally consistent requirements for discharge allowance registries, and support the development of a common transfer platform.

c. Work with early starter councils, iwi, sector groups, NGOs and communities who are considering implementing a transfer regime for discharge allowances to:

i. provide guidance and support

ii. identify exemplar approaches and/or further opportunities for national guidance, direction or other support.

Recommendation 27: Where transferable discharge allowances have not been, or will not be, introduced councils should:

a. support the use of group approaches to discharge management that enable group members to manage discharges amongst themselves (e.g. enabling discharge caps to be averaged across multiple properties or issuing group consents).

b. specify in their plans how and when the allocable load will be reduced down to the target or limit in over-allocated catchments.

c. specify mechanisms in their plans for enabling access for new uses/users in the future.

Deciding who gets what – allocation during the transition

183. We have described the advantages of allocating nutrients to individual enterprises or to groups once limits have been set, and allowing them to be transferred between users. How to allocate nutrient allowances during the transition to the new approach is, however, a difficult question.

184. That is because the allocation of nutrients will often take place when reductions in emissions are required to meet the limits set for the catchment, and does not take place in a vacuum. Some higher-emitting land and water users have already committed themselves, often over a number of years, to activities and investments to which they and their communities attach great value. Some lower-emitting users have - just as long - held land whose potential they have nurtured, and they are unwilling to forgo the opportunity to develop it further. Those who have had land taken from them feel they have been unjustly excluded from participating in the productive economy and seek the opportunity to do so. Others again are concerned about where intensive land uses are located. These groups often overlap. The introduction of water quality limits through the 2011 NPS-FM, and through its amendment in 2014, requires change, however, and the way in which nutrients are allocated over the transition to an allocation regime will have important repercussions for all.

185. This transition takes place against an increasing knowledge of soils and hydrology which is changing our appreciation of where different farm systems and activities are most practical. Technological advances and investment in infrastructure may make it possible to carry out high-emitting activities on more vulnerable soils, but there may equally be significant longer term productivity - and environmental - benefits from changing land uses or rearranging them within a catchment to match productive and assimilative capacity better. A regulatory system which allows discharge permits to be transferred, and allows adjustment to take place over

time, is therefore desirable, whatever approach we take to the allocation of discharge permits over the transition. It can allow landholders and others to respond to the wide range of different circumstances which affect their businesses - changes to markets, changes to cost structures, changes to climate, and improvements in science and technology, including better understanding about land and hydrology.

186. Allocation during transition is however where the base for future changes is set, and it seems to us that even if these difficult questions cannot be resolved in full at the national level, and we do not believe that they can be, there is great advantage in reaching a national understanding both about the nature of the issues and how they can be approached. Although that will not avoid the need for final decisions to be made in catchments, it will facilitate them. Not all of the issues will have to be traversed in every place every time. That is why, although we have not been able to agree a formal recommendation on this topic, we have set out here the way we approach this issue, and recorded both the elements on which we think there is (at least conditional) agreement, as well as those which will need to be worked out locally.

187. Our approach has several important elements. The first is the notion of the threshold, which needs to be set for each catchment or sub-catchment, and is the level of emissions at or below which reductions beyond catchment good management practice do not have to be made. Those below the threshold will be able to increase or transfer their emissions within established timeframes until they reach it.

188. The second is the notion that all emitters receive at the outset an initial allowance based on the amounts that they have emitted each year over an agreed baseline period, but modified to the numeric level required by the good management practice set out in the catchment plan. This serves as the base from which emitters above the threshold (see above) will make any further reductions required over time to bring the catchment within limits.

189. . The third is transfer, which can help to minimise the disruption caused by reductions in emissions, and will help users to reallocate nutrients over time to their highest value use and in response to other changes.

190. What we have not tied down is exactly how, or at what level, the threshold we have referred to above should be set, and the extent to which allocations, or a portion of an individual's allocation, should be tied to and remain with the land. These are issues which we expect will need to be worked out in catchments with affected communities and iwi. We hope that this discussion will make those processes easier.

191. We set out the points which we have resolved and those that we have not more schematically in the box below.

We have discussed at length the question of how discharge allowances or caps should be distributed to rural land/users when transitioning to an allocative regime. We have not been able to reach full agreement on a general approach but there are a large number of elements on which we do agree, and we have decided to set them out along with those which we haven't been able to resolve.

We all agree the following points:

- Decisions on how discharge caps will be set and/or how allowances distributed should be taken at the outset of the regime. The way in which this is done will have to take account of catchment circumstances. It should be reviewed at regular intervals.
- All rural land which could be used for productive purposes should get an allocation for catchment accounting purposes reflecting the discharge from natural cover.[8] The purpose of this allocation is to account for emissions that would occur if no productive activity were occurring on this land.
- Existing users should receive an initial transitional allocation based on their current level of discharges over a period agreed through a collaborative planning process.
- This amount would be set based on the assumption that they are operating at the level of catchment specific GMP decided in the catchment plan.
- Land and water users discharging above an agreed threshold would reduce their discharges over time to achieve the limit for the catchment as specified in the catchment plan.
- Land and water users discharging below an agreed threshold would not be obliged to make reductions other than the implementation of GMP discussed above, and could increase their discharges up to the agreed threshold.
- These adjustments would be scheduled in a plan, and the higher dischargers would make the larger contribution.
- To prevent an intensification of emissions prior to transition in order to secure a higher initial emissions allowance, persons who intensify land or water use in a manner that increases abstractions and/or contaminant loads should do so at their own risk - until such time as councils have clear rules in place in their plans to ensure that diffuse discharges do not exceed specified limits or will achieve reductions required to meet targets.

We have not been able to resolve the following issues:

- How should the threshold below which discharge rates do not have to be reduced be set? Some of us believe that this threshold should be set at the catchment average for “like” land. Others consider it should be negotiated catchment by catchment.
- All are prepared to take factors beyond current levels of discharges on individual properties into account. Some of us however would give a higher weighting to land characteristics, including its natural production capacity and/or vulnerability to leaching.
- Some of us consider that at least a proportion of allocations to discharge above natural cover should also be attached to the land. This would have implications for transfer - allocations

[8] Natural cover can be seen as the baseline for the reference state nutrient loss that would have occurred in the catchment.

attached to the land could not be permanently transferred. (Some believe that longer term transfers, perhaps through a lease, could still encourage these shifts) Whether and to what extent allocations are attached to the land would have implications for how provision is made to resolve the rights and interests of iwi.

The differences between us are not absolute. Those who place a relatively higher premium on minimising economic impacts to existing businesses and communities and the protection of current investment prefer allocation approaches that recognise this. Those who place a relatively higher weighting on allocation approaches that promote the flexible use of all rural production land, encourage specific uses to be located on land with the most appropriate natural productive and assimilative capacity prefer different approaches. Both groups cite long-term economic welfare in favour of their approaches.

Translating existing authorisations into a transferable discharge allowance regime

192. When a catchment is moving to a transferable discharge allowance regime existing authorisations will need to transition to new standardised consent formats – this includes point and non-point source discharges, some of which may have previously been authorised in the plan rather than through consent. At this point there should be a test to ensure that existing users are operating at the agreed level of good management practice for their land or water use activity. This process will ensure that poor practice is not carried through into the new allocation regime.

193. Where there is a need to reduce total discharges in order to meet community-agreed water quality outcomes, the new consents will generally be subject to planned reductions over time. Within a catchment some users may not be required to reduce beyond GMP expectations if it has been agreed that others in the catchment will undertake the reductions required to meet the catchment limit.

Recommendation 28: When shifting to a transferable discharge allowances regime all existing authorised discharges should be translated into a new consent format. The process of translating any authorised discharge into a new format should evaluate the discharge against relevant and agreed measures of good management practice.[9]

[9] This recommendation needs to be seen in light of our recommendations on managing over-allocation and on independently audited industry self-management schemes for good management practice.

Stock exclusion

194. Government has publically signalled its intention to introduce a national regulation to exclude dairy cattle from waterways by July 2017 and has specifically requested advice from the Forum on its design. This section sets out a policy framework that the Forum proposes Government use as a basis for public consultation.

Benefits of excluding stock from waterways

195. Excluding stock from waterways is one of a number of GMPs that can be implemented on-farm to help manage water quality. Its benefits are more universal (i.e. less context-dependent) than other GMPs and it is better suited to being regulated nationally. Three major types of contaminants can be reduced by excluding stock from waterways:

    a. Pathogens – from direct deposition of urine and faeces into waterways and also on stream banks, which can be flushed into streams by rising water levels or subsequent stock incursions. E. coli is typically used as an indicator of pathogen levels
    b. Sediment – from livestock disturbing and carrying soil into waterways.
    c. Nutrients – Nitrogen (N) and Phosphorus (P). Nitrogen levels can be increased by direct deposition of effluent into or very near water; however this contribution will be small in comparison with inputs from paddocks through surface and groundwater flow pathways. Historic applications of phosphorus fertiliser can enter waterways along with sediment.

196. In addition to reducing the contaminants entering waterways, livestock exclusion can prevent significant damage to local habitat quality. This includes damage to riparian plants, greater bank erosion and damage to in-stream habitat.

Our approach

197. The Forum's view is that stock exclusion requirements should vary according to the type of livestock being farmed, and the terrain. This balances environmental imperatives with the costs and impracticalities of excluding stock from waterways in different farming contexts. The key considerations in designing these stock exclusion requirements for different livestock and terrain types were:

    - the environmental risk arising from stock in waterways
    - the relative effectiveness of livestock exclusion compared to other management tools
    - the costs and practicality of exclusion
    - current government and industry targets.

198. The recommendations below build on the significant progress farmers have already made in voluntarily excluding stock from waterways, through measures such as the Sustainable Dairying: Water Accord (the Accord). Using the Accord as a base, these recommendations would:

    - require a wider range of livestock types to be excluded
    - require exclusion from a greater range of waterbodies

- allow more flexibility in how stock are excluded
- allow more time for a stock exclusion regulation to come into effect in more difficult farming contexts.

What stock types should a national stock exclusion regulation apply to?

199. Some livestock types cause more damage from incursions into waterways than others. The main livestock types that can cause significant damage are dairy cattle, beef cattle, deer and pigs. A national stock exclusion regulation that applied to some of these livestock types but not others would be unfair and less effective.

Recommendation 29: A national stock exclusion regulation should apply to all those livestock types that can cause significant damage from incursions into waterways, including:

a. dairy cattle
b. beef cattle
c. deer
d. pigs.

200. Sheep are smaller animals than cattle or deer and do less damage to stream banks and beds. They also do not have the same affinity for water - they avoid it and do not like to wallow. As they pose a lower level of environmental risk, a national stock exclusion regulation should not include them.

What should the definition of "exclusion" be?

201. There are a variety of methods of excluding stock from waterways besides permanent fencing. Temporary fencing (e.g. an electrified wire/tape and pigtail standards) is an effective means of excluding cattle from waterways and it can be more practical in areas where regular flooding can destroy permanent fences if they are placed too close to areas of flood and erosion risk. Temporary fencing is also appropriate in places where cattle are grazed infrequently - such as third-party graziers who farm sheep most of the time.

202. Other farming practices can also be used to achieve the same goals as stock exclusion. Some of these are useful for deer in situations where permanent deer fencing is cost-prohibitive. These include (but are not limited to):

- excluding deer from paddocks with waterways
- constructing alternative wallows away from waterways
- diverting wallow drainage away from waterways (e.g. to constructed wetlands).

Recommendation 30: In the context of a national stock exclusion regulation, "excluded" should mean effectively barred from access to water and to the banks of waterways either through a natural barrier (such as a cliff) or a fence. For milking platforms a fence must be permanent. Temporary fencing may be used for intermittent, concentrated and short-term grazing near waterways. Permanent deer fencing will be expensive and impractical in certain landscapes, so other approved GMP measures can be used.

203. If permanent fences are being erected to exclude stock, consideration needs to be given to the distance the fence is placed from the waterway. The appropriate setback distance will vary at different points along the waterway. The Forum's recommendations on riparian setbacks and management are set out in the next section. However, a national stock exclusion regulation should also reference these requirements as they apply to those erecting permanent fences to exclude stock.

Recommendation 31: The national stock exclusion regulation should include a requirement that when permanent fences are erected to exclude stock, they should be placed the appropriate distance back from the waterway. The appropriate setback distance will vary at different points along the waterway and will be determined by an on-farm assessment required as part of GMP, as per recommendation 39 of this report.

When and where should a national stock exclusion regulation take effect?

204. Achievable timeframes for excluding stock will vary according to:

- the different levels of progress different industries have already made in excluding stock (e.g. dairy have a head start with progress made on the Sustainable Dairying: Water Accord)
- the costs and impracticalities of excluding different livestock types (e.g. the high cost of deer fencing)
- the costs and impracticalities of stock exclusion in particular terrain types (e.g. hill country).

205. Variation in the environmental benefits of stock exclusion should also be considered when setting timeframes.

206. Table 1 (below) sets out the Forum's preliminary recommendations on achievable timeframes for excluding stock from waterways. More detailed consultation with affected parties should be undertaken on these dates (along with all the proposals on stock exclusion and riparian management). The intent of the table is that the most intensive farming that has the biggest impact on fresh water would be captured earlier, as it takes place on the plains. Farming systems become more extensive as you move up into lowland hills and the impracticality and costs of exclusion increase: so more time is allowed. A national stock exclusion regulation would be impractical in hill country areas so they are excluded from the table. Instead, councils will set stock exclusion rules in critical source areas or areas of ecological significance based on a risk-assessment undertaken in the catchment.

207. Terrain is an important consideration for the design of a stock exclusion regulation. Plains and rolling hills typically have U-shaped gullies, while hill country has V-shaped gullies. It is much easier to exclude stock and do riparian management in U-shaped, rather than V-shaped gullies.

208. Table 1 uses a terrain classification similar to land classification systems used by the New Zealand Land Resource Inventory (NZLRI) Land Use Capability (LUC) tables in order to specify stock exclusion requirements. The classifications are:

- plains/alluvial (slopes of 0-3 degrees)
- lowland hills (rolling hills/down lands) (slopes of 4-15 degrees)

- hill country (slopes of 16-28 degrees)
- steep hill country (slopes greater than 28 degrees).

209. Councils will have to classify the land adjacent to waterways according to the terrain types identified above in order to determine where a national stock exclusion regulation applies. To assist with this, councils should draw on work already done by industry bodies. This classification could occur at a sub-catchment, property or intra-property level. While an intra-property classification would provide the most environmental benefits, it would require costly terrain mapping and some councils have found that making terrain differentiations within farms leads to implementation problems, such as intermittent stretches of fencing being required along particular waterways where the slope varies. The appropriate level should be one of the factors included in public consultation.

Recommendation 32: Councils should classify the terrain adjacent to waterways in their catchments according to the slope angle to identify where a national stock exclusion regulation applies. Whether the classification should occur at a sub-catchment, property or intra-property level should be determined by public consultation. The classifications are:

a. plains (0-3 degrees)
b. lowland hills (rolling hills/down lands) (4-15 degrees)
c. hill country (16-28 degrees)
d. steep hill country (>28 degrees).

Recommendation 33: Stock of different types and on different terrains should be excluded according to different dates. Table 1 provides an example of how this could be structured that Government should use as a basis for public consultation.

Table 1: Preliminary recommendations for when a national stock exclusion regulation should apply

Farm type	Plains (alluvial)	Lowland hills (rolling hills/down lands)
Dairy milking platform	Mandatory exclusion by July 2017	Mandatory exclusion by July 2017
Dairy grazing owned by the same person as the milking platform	Mandatory exclusion by 2020	Mandatory exclusion by 2020
Third-party dairy grazing	Mandatory exclusion by 2025	Mandatory exclusion by 2025
Beef	Mandatory exclusion by 2025	Mandatory exclusion by 2030
Deer	Mandatory exclusion by 2025	Mandatory exclusion by 2030 for intensive farms. Lightly stocked farms can use alternative mitigation measures.
Pig farming	Mandatory exclusion by July 2017	Mandatory exclusion by July 2017

*Note that the definition of exclusion that applies in this table would be the one outlined above in recommendation 30.

210. Interim milestones and provisions for fencing waterways during significant land use changes (such as dairy conversions) will speed implementation. If a landowner is changing their land use

to a farm type proposed to eventually be covered by the national stock exclusion regulation (as per Table 1), they will be erecting fences anyway and so should be required to fence their waterways then. This requirement should not be triggered by changes of land use that do not require a large amount of new fencing.

Recommendation 34: Government should:

a. **consult on interim milestones for excluding stock from waterways**
b. **require fencing of waterways during significant land use changes to a farm type and on terrain that the proposed national stock exclusion regulation will eventually apply to.**

Which waterbodies should stock be excluded from?

211. Exclusion from some waterbodies should be required by the national stock exclusion regulation, but additional stock exclusion requirements should still be able to be set by local communities, councils and collaborative processes.

212. This recognises that identification of particular waterbodies has to happen at a local level and allows local communities to decide on whether or not stock should be excluded from them on the basis of a risk assessment. The key consideration is weighing the environmental benefits of exclusion from these waterbodies against the costs, impracticality and disruption of grazing practices that landowners would suffer. Local discretion also allows communities to move to exclude stock faster than the dates outlined in a national regulation if they identify critical source areas for contaminants or areas that have particular ecological, cultural or social value.

Recommendation 35: A national stock exclusion regulation should apply to:

a. **permanently flowing waterways and drains greater than one metre in width and deeper than 30 cm**
b. **permanently flowing waterways smaller than those outlined above on the plains. Landowners should be given until at least 2020 to achieve this (i.e. any exclusion dates before 2020 in Table 1 should not apply for smaller waterways)**
c. **natural wetlands – as qualified by recommendation 37 of this report**
d. **where specific management practices that could result in significant damage to waterways (such as strip-grazing beside a waterway) are being used.**

213. In some areas, such as hill country farms, a national stock exclusion regulation is impractical. In these areas, councils should identify, and require stock to be excluded from, critical source areas and/or areas of particular ecological, social or cultural value. These could include:

- wetlands
- headwater seeps
- lakes

- intermittent waterways with an 'active bed'[10]
- springs
- areas of fish habitat – e.g. for freshwater fish and inanga, or spawning areas
- tarns
- estuaries and coastal areas.[11]

214. Even in areas where a national stock exclusion regulation does apply, local communities should be free to move faster than the dates proposed in the national stock exclusion regulation.

Recommendation 36: Councils should have discretion to exclude stock from waterbodies not included in a national stock exclusion regulation or ahead of the timeframes mandated by it (i.e. those in Table 1). This discretion should be exercised where a waterbody, or part of a waterbody is a critical source area for contaminants or has particular ecological, cultural or social value.

215. Much of New Zealand's natural wetlands have been destroyed, and those remaining need to be protected. To this end, it would be desirable to include wetlands in the list of waterways that a national stock exclusion regulation applies to. The difficulty is in identifying what counts as a wetland and therefore needs to be protected. Section 2 of the RMA defines wetlands as follows:

Wetland includes permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions.

216. Many small damp areas dominated by pastoral species, and/or areas surrounding and including artificial water storage and conveyance infrastructure could potentially be classified as wetlands according to this definition. The Forum agreed that for management and implementation purposes of a national stock exclusion regulation this definition should be refined to clarify the types of wetlands that need to be protected.

[10] 'Active bed' means the bed of a river that is intermittently flowing and where the bed is predominantly unvegetated and comprises sand, gravel, boulders or similar material. (Where 'bed' and 'river' are defined by Section 2 of the RMA.)

[11] The stock exclusion requirements in the New Zealand Coastal Policy Statement (NZCPS) are that *where water quality has deteriorated* in a coastal environment, stock are required to be excluded within a prescribed timeframe. This seems inconsistent with the National Policy Statement for Freshwater Management (NPS-FM) *maintain or improve* requirement. The water management approaches outlined in both should be aligned toward maintain or improve.

Recommendation 37: A national stock exclusion regulation should clarify that 'natural wetlands' subject to the regulation are 'wetlands' as defined by the RMA but not including:

a. **wet pasture, damp gully heads, or where water temporarily ponds after rain or pasture containing patches of rushes**
b. **effluent ponds**
c. **artificial storage facilities and detention dams**
d. **artificial water courses such as conveyance and drainage canals**
e. **reservoirs for firefighting, domestic or community water supply**
f. **engineered soil conservation structures.**

217. There will be circumstances, some of which cannot be foreseen, where it would be unreasonable to exclude stock because it would be impractical and/or result in large costs relative to the expected environmental benefit. Some examples include:

- where small streams branch into a number of small 'fingers' that if fenced would seriously impede the ability of farmers to graze the land
- in emergencies – e.g. during a snowstorm when the troughs are frozen stock should be able to be temporarily watered in a creek
- where effective alternative exclusion measures have been implemented (e.g. Westland)
- water races used for stock drinking water.

Recommendation 38: Exceptions from national and regional stock exclusion requirements should be provided in limited situations where large costs and significant impracticalities relative to the environmental benefit can be demonstrated. Councils should consider these factors when classifying terrain for stock exclusion purposes.

Incentive programmes

218. The costs of implementing (and monitoring compliance with) a national stock exclusion regulation are likely to be significant. A stocktake of existing council incentives for stock exclusion, undertaken by the Forum, suggests that they are effective, and the Forum encourages councils who do not currently provide incentives for stock exclusion to do so. This could include: financial incentives, subsidies and matching funds; planning and advisory services; workshops, seminars and field days; community group engagement; and physical labour.

219. To avoid any perverse incentives:

a. councils should ensure that, after stock are excluded, landowners are still able to take small volumes of stock drinking water through installing troughs, pipes and reticulation
b. the IRD schedule of tax deductible items should be reviewed to ensure stock water reticulation pipes and troughs are included.

Riparian management

220. Riparian zones are where the land-water interface is most direct. They are the 'last line of defence' before contaminants enter waterways and can have a significant influence on water quality. Although only minimal setback distances are needed to keep stock out, larger riparian setbacks that are appropriately vegetated can sometimes be a useful mitigation measure in their own right. They can also be useful in contexts that do not involve livestock, including in urban settings.

221. Management of riparian areas requires significant investment from land-owners (and/or other contributors such as councils) and unless the fenced areas are well planted can have other negative impacts like allowing the growth of weeds such as gorse and blackberry that may require extra spraying and maintenance. An increase in weed can result in culverts becoming blocked and cause small-scale flooding. Most importantly, setbacks result in land being removed from production which reduces profitability for landowners, and economic activity within the catchment. (However, there are smart ways of using riparian zones for productive purposes, some of which are described later in this section.)

222. Riparian management is a more context-dependent mitigation than stock exclusion. Its benefits vary according to many factors such as terrain, land use type, and drainage. It is therefore necessary to understand the variety of environmental benefits riparian buffers can provide, and how these vary according to the context, in order to optimise the setback widths and management strategies along the length of the waterway and to balance environmental and economic imperatives. This is discussed below.

Stream bank stabilisation

223. The planting of trees, shrubs and grasses on stream banks can help prevent erosion and the entry of sediment into waterways. Hedges which also provide shelter for stock are useful to consider and provide co-benefits for productive farming systems.

Filtering contaminants from overland flows

224. Riparian buffers can act as a physical barrier preventing sediment and nutrients carried in overland flows from entering waterways. Long grasses, sedges, flaxes and thick leaf litter beneath shrubs and trees can block the water, allow it to pool, and the sediment (and any nutrients bound to it, such as phosphorus) to settle out.

225. The degree to which overland flows are likely to be a problem depends on:

- drainage class – non-porous soils or ineffective artificial drainage results in higher overland flows
- the gradient of slopes – steeper slopes will likely have greater overland flows
- slope length – longer slopes will likely have greater overland flows
- soil type (e.g. clay or sandy) – clay soils have more fine particulates that are harder to settle out
- if flows are diffuse rather than channelised – where they are channelised it is better to address the flow in the channel rather than have a buffer strip along the entire waterway.

226. Effective overland flow filtering normally requires buffers of 5-10 metres in width (although smaller buffers can also be effective in some situations – where there is less runoff or slower flowing water) and appropriate vegetation to act as a physical buffer. Exclusion of livestock improves the filtering effect by reducing soil compaction and allowing the runoff to better infiltrate into the soil.

Removal of nutrients from subsurface water

227. Vegetation in the riparian area can help remove nutrients from subsurface water and prevent them entering waterways, through:

- uptake into plant biomass
- enhancing denitrification – by supplying carbon and aerobic/anaerobic interfaces.

228. Uptake of nutrients in subsurface water requires larger areas, i.e. setbacks of 10-30 metres in width. The area should be planted with vegetation that has significant uptake potential. Shrubs and trees with deep rooting systems (e.g. carex and cabbage trees) become more important as depth to groundwater increases.

229. Artificial drains allow subsurface flows to effectively bypass riparian areas and therefore should reduce riparian treatment of groundwater relative to the proportion of drainage they carry. (However, the effect of artificial drains on *groundwater* nutrient inputs may be counterbalanced by *lower surface runoff* from paddocks that have artificial drainage.)

230. If the receiving waters in the catchment are N-limited, then in areas without comprehensive artificial drainage, larger riparian setbacks of 10-30 metres in width with appropriate vegetation should be considered as part of the suite of mitigations in the catchment.

Preserving/enhancing natural riparian ecosystems and habitat

231. Riparian zones when forested or vegetated can support terrestrial biodiversity values, as well as providing important instream habitats for native fish and trout (e.g. overhanging branches, bank under-cutting, creating pools and areas of day time and flood refuge). Vegetated or forested riparian zones also support the adult life stages of aquatic macroinvertebrates along with terrestrial insects which often form a major component of the diet for many native and sport fish at certain times of the year. Grassy or forested river banks also provide spawning habitat for Inanga and other Galaxias species.

232. To restore natural riparian/stream habitats (with trees, shrubs, flaxes, rushes or sedges – depending on the natural riparian vegetation in the area) then setbacks of at least 10-30 metres are required for the forest/vegetation to be self-seeding. More maintenance is required for smaller buffers.

Policy implications

233. As described above, riparian buffers can perform a wide variety of functions, but their relative effectiveness varies between catchments, between farms and even within farms depending on the terrain, land use type, the contaminants being managed in the catchment, and the other mitigation options available. In particular, the presence and effectiveness of farm drainage systems is an important consideration. Effective farm drainage prevents water pooling in

paddocks and speeds its journey to waterways. This reduces overland flows and allows subsurface flows to largely bypass the riparian area. This significantly reduces the filtering, uptake and denitrification effects that can occur in riparian zones – rendering them a less useful mitigation measure.

234. Riparian setback and management requirements should specifically allow ways of using riparian zones productively when this will not significantly interfere with the environmental outcomes being sought. These include, but are not limited to:

- bailing riparian pasture into feed
- growing trees for selective harvest
- producing bee products
- lightly set-stocking the riparian zone with sheep over summer or when pugging is not an issue.

235. For these reasons, riparian setbacks and management strategies should be considered alongside other mitigations at a property-level and included in GMP requirements where appropriate. Ideally, a property-level assessment should be undertaken to determine the optimal setback width and management strategy at every point along all waterways.

Recommendation 39: Riparian setbacks and management strategies should be included in GMP requirements, either as part of industry GMP schemes or council GMP rules, where they are an appropriate mitigation.

236. Assessments of the appropriate riparian setback widths and management strategies should be made using robust scientific information. There is a wealth of riparian management guidance that is available to assist landowners and councils in assessing the appropriate setbacks and management strategies in different situations, for example, NIWA's riparian management classification materials and DairyNZ's regional riparian guidelines. However, some of this material is out of date and needs to be consolidated and updated to be relevant for all land uses in both rural and urban areas.

Recommendation 40: Government should commission a review and update of existing riparian management assessment tools to produce a new consolidated riparian management assessment tool to assist in identifying and implementing the appropriate riparian setbacks and management strategies across the full range of circumstances.

237. In catchments with specific water quality issues requiring additional management, catchment-wide riparian management rules, over and above national GMP requirements, should be considered. This would be appropriate where an analysis of competing mitigation options suggests larger setbacks and/or more active management strategies provide the best value for money (any analysis should take into account the costs to landowners of removing land from production). Catchment-specific rules may also be appropriate for dealing with critical source areas, or areas of particular ecological, social or cultural value.

Recommendation 41: Councils should impose riparian setback and management rules over and above GMP requirements in catchments with specific water quality issues, where this is an effective way of managing a particular issue. Councils should also consider catchment-specific riparian management rules for critical source areas and areas of specific ecological, social or cultural value.

238. To aid councils, collaborative processes and landowners in consistently and effectively managing riparian zones, approaches to this issue should be included as part of the national information sharing platform.

Quantity

239. Amendments made to the NPS-FM in 2014 clarify the process for setting limits to define the volume of water available for extraction and allocation to commercial users. These limits will comply with nationally prescribed bottom lines for freshwater quality and will be set in accordance with the overarching objective of protecting and providing for Te Mana o te Wai - the health and vitality of fresh waterbodies.

240. In our third report we recommended that, when setting limits, councils should be required to acknowledge and consider uncertainty, and to take a precautionary approach where there is potential for irreversible effects on the health of a waterbody. We also recommended that, once limits have been set, any changes to the limit (or the system for allocating water within that limit) will be agreed through a planning process. This means the impact of any downward changes to a limit will be dealt with robustly and transparently through a collaborative catchment planning process.

241. Once the regime recommend by the Forum has been implemented, and once environmental, social and cultural objectives have been agreed and reflected in limits:

    a. Users will be required to manage within those limits – or manage down to those limits within agreed timeframes if in a context of over-allocation.
    b. Councils will need to generate and share information about the state of a waterbody and the activities of users, and to take actions to preserve a limit and protect the entitlements of users.
    c. Existing entitlements will be translated into the new regime in a way that preserves their value, aside from reductions to address over-allocation or paper over-allocation - this may include reducing the quantum of water available but increasing its reliability.
    d. Takes authorised under section 14(3)(b) of the RMA will be brought within the management regime. This will help maintain abstraction within limits and protect the entitlements of users from derogation.
    e. Consents will be designed so they are responsive to hydrological change (e.g. seasonal and climactic variation) and will specify reliability bands and low-flow, dry-year and drought provisions.

242. If effectively implemented, this framework will increase certainty that environmental limits will be maintained and community objectives met. At the same time, the greater emphasis on transparent and robust (science-informed) decision-making, clearly defined limits, and robust monitoring, reporting and compliance will mean existing holders of authorisations have clearer rights, a more certain operating environment and face less risk that their rights will be derogated (e.g. weakened by over-allocation or re-allocation).

243. One key aspect of this framework is that it encourages maximum use of water within the limit. Under the new system, holders of authorisations that aren't being used will be encouraged to transfer them to new or other users, thereby maximising the economic value that can be extracted from water within the limit. This means it is more likely water will be abstracted up to limit more frequently and for longer periods than is presently the case. Limits will need to be

set with this in mind - councils and communities will no longer be able to rely on an informal 'buffer' of unused portions of authorisations to protect and provide for Te Mana o te Wai.

244. Although these changes will improve the performance of the water management system, more can and should be done to ensure we are able to manage within limits and maximise the value we gain from New Zealand's water economy. A number of significant issues need to be addressed and the Forum has made recommendations about them, for instance:

    a. Authorisations to take water can still be issued for short durations, can be refused or significantly altered at the end of their term, and have the potential to be undermined by the granting of other authorisations to take water from the same waterbody.
    b. Formal and informal (perception-based) barriers to transferring authorisations to take water remain, and further steps need to be taken to proactively encourage transfer.
    c. The cost to new users of accessing water for new commercial uses can be high, especially where they are required to purchase land to secure this water.
    d. Iwi have rights and interests in water that go beyond cultural and ecological values, and are provided for under the Treaty of Waitangi. The fact these rights and interests remain unresolved is a source of significant uncertainty in the way authorisations are allocated and managed.

Reliability and the role of infrastructure

245. The reliability of access to water that water-take authorisations grant a user is a key determinant of productivity and the value of those authorisations. Changes in reliability have significant implications for commercial users and must be clearly signalled and their rationale understood.

246. In recommendations 28, 29 and 32 of our third report we suggested that: limits should define the reliability of water that is available for allocation; these limits and the design of the allocable quantum should take into account changes in catchment flows and recharge rates; and the regional plan should specify how and when authorisations should change in response to changes to the allocable quantum. To maximise certainty, and to reduce the administrative burden of having to formally review consents and consent conditions, authorisations themselves should clearly describe the circumstances in which the rate, volume and/or duration of abstraction will vary. This might happen, for instance, during times of low flows and/or water shortage, or in response to changes to a limit made through a planning process.

247. A primary means to increase the economic value of water within a limit is to invest in infrastructure or other actions that increase the amount or reliability of water available for abstraction – for example storage and distribution infrastructure, and actions such as managed aquifer recharge. In our third report we recommended that councils enter into iterative cycles of assessment and deliberation when setting objectives and limits, thereby allowing them to take into account a full range of strategies and methods for achieving them - the development of infrastructure is an option that must be given consideration in this context. Recommendation 9 of this report requires councils to investigate the full array of benefits infrastructure could provide; identify any barriers to private investment; and identify what the council's role in the development and provision of infrastructure should be.

248. Introducing water storage and conveyance infrastructure to a catchment, and/or implementing options such as managed aquifer recharge, may significantly alter the hydrological characteristics of a catchment. This may in turn require the council - in collaboration with the party or parties participating in or affected by the infrastructure - to review minimum flows and flow regimes, approaches to allocation and the design or nature of authorisations to take water. Any changes must be undertaken in a way that preserves the value of existing authorisations to take water, safeguards limits and provides for te mana o te wai.

Recommendation 42: Authorisations to take water must be designed to maintain consistency with plan objectives and limits, and clearly specify:

a. the expected reliability of access to water they grant users
b. the circumstances in which the rate, volume and/or duration of abstraction will vary.

Consent duration and treatment on expiry

249. To maximise the value we gain from our freshwater resources and to encourage long term investment and decision-making, we need to increase the level of investment certainty - the duration of an authorisation and its treatment on expiry are intrinsically linked to investment certainty.

250. The Forum recommended in its third report (recommendation 43) that, once the new water management regime is in place, authorisations should have timeframes of between 20 and 35 years unless shorter durations are required for temporary purposes (e.g. to manage the transition to the new regime and/or to align expiry dates to facilitate integrated management).

251. There may be some circumstances where it is appropriate to go further and set an expectation that authorisations will be granted for their maximum permissible duration. Longer durations would significantly increase investor certainty, and more accurately reflect the design life of infrastructure, which is often well in excess of 35 years and which can be further extended through ongoing investment to maintain and optimise the value of the asset. Longer durations may also provide the certainty needed to encourage investment in technologies and efficiency measures that increase the economic value able to be extracted from the water within a limit.

252. In addition, the effort required to gain consent, construct the business case, secure financing for and ultimately build long-lived water infrastructure can be extremely significant. These steps take time, can be subject to unexpected delaying events (e.g. economic downturns) and often consume a significant proportion of a consent term. Requiring the owners of a scheme of this scale to re-apply for consent within a decade or two of completing construction reduces the attractiveness of the investment, and potentially undermines the business case for long-lived water infrastructure that can deliver benefit streams for generations. To remove this potential barrier to investment, the term of a consent for projects of this scale should not begin until the consent itself is “given effect” to. In order to avoid water being tied up and unused in the period between a consent being granted and a consent being given effect to, the water should be able to be transferred to other users in the interim.

253. In its third report the Forum considered extending the maximum permissible duration of authorisations for large-scale projects and long-lived infrastructure that have been provided for through a collaborative process. The Forum agreed steps should not be taken to extend the maximum permissible duration of authorisations until other aspects of the new regime had been implemented fully - specifically until it was clear environmentally robust limits were being set and adhered to, and until iwi rights and interests had been resolved. This matter cannot be advanced until the regime has been implemented more fully than it currently has. The review referred to in recommendations 44a and 44b of our third report should be undertaken and the matter of consent duration should be considered again at that time. In the interim, however, steps can be taken to enhance the certainty of authorisations and encourage investment that grows the value of New Zealand's water economy while managing within limits.

Recommendation 43: When considering applications to 'renew' authorisations on expiry, consent authorities should be required to give additional weight to the value of sunk capital, and recognise the potential value of continuing to operate and optimise existing infrastructure.

Recommendation 44: For applications to develop new long-lived water infrastructure, consent authorities should be able to specify that the term of an authorisation begins when the authorisation is "given effect to" rather that once it is granted.

Facilitating transfer and providing for new users

254. Under the current system water available for abstraction and commercial use is largely tied to land parcels and capitalised into the value of land or assets. This means new entrants primarily enter the water economy in fully or over-allocated catchments by buying land and transferring the water attached to that land. The high cost of accessing water can 'lock in' land uses and existing patterns of water allocation and frustrate investment – especially in long-term or large-scale projects that have the potential to grow the economic value of New Zealand's freshwater resource. Current land uses and patterns of allocation may not be efficient or equitable, which is a particular concern given that water is a common pool resource.

255. Where it is practically achievable, the ability to transfer authorisations to take water will be the primary means to facilitate the entry of new users to the water economy, encourage innovation in water use, and enable water to flow to its highest valued use. Metered authorisations to take water, or a portion of those authorisations, should be able to be transferred to someone other than the holder with an absolute minimum of regulator involvement. It should also be clear that the party who receives an authorisation through transfer also holds responsibility for complying with the conditions and responsibilities attached to that authorisation.

256. Currently transfers can and do occur (e.g. a modest number of transfers using the hydro-trader platform, informal transfers between consent-holders on adjacent properties, between scheme shareholders and also within water user collectives) but it is relatively limited, even in places where there is demand. Reluctance to transfer water could be due to a perception that the act of transferring water will count against a user when they apply for an authorisation on expiry. This is a significant concern to landowners where the value of water has largely been capitalised into the value of land at purchase or through subsequent investment.

257. Lack of access to high-quality information also creates a barrier to transfer. If users can't see who is and isn't using water at specific times, it will be much harder for them to capitalise on opportunities for temporary transfer and improve the productivity and efficiency of water use within limits.

258. To enable the easy transfer - in full or in part - of an authorisation to take water for the length of an authorisation or for a temporary duration, we noted that:

    a. Councils would need to set up water registries (potentially outsourcing this role to private providers) and that councils would need to be informed of temporary transfers for monitoring, accounting and enforcement purposes.
    b. Government should facilitate the establishment of markets by investigating the design elements required in transfer platforms and test their applicability to various catchments in New Zealand.
    c. Plans would need to make it clear that authorisations transferred temporarily from one party to another are able to return to that original holder - including instances where the transfer requires the point of abstraction to move downstream then return upstream to the original holder of the authorisation.
    d. There would be value in introducing baseline expectations for efficient and effective administrative tasks (e.g. processing timeframes) that councils need to meet when authorisations are being temporarily transferred between users.
    e. There would be value in central government providing templates and advice on the design of support systems to facilitate permanent and temporary transfer (e.g. pro forma legal agreements that define responsibilities and accountabilities of parties to a transfer).

259. Diffuse discharges of contaminants are difficult to measure and monitor, which makes the management of discharges somewhat more complicated than the management of water takes. This complexity prompts some councils to include water quality-related considerations in consents for water abstraction. This blurs the nature of the 'right' conferred by a consent to take water, increases the risk that decisions on water within the limit (the "allocable quantum") will be constrained by conditions designed to address environmental matters (matters that do not relate directly to the quantity of water allocated to a user) and makes it more difficult to transfer water between parties who plan to put the water to different uses. We note that implementation of the NPS-FM will require councils to introduce specific controls over activities that discharge contaminants that are subject to quality-related limits. We expect that under the NPS-FM many activities currently permitted explicitly or tacitly will require consent or other permissions. This means councils will no longer have to use conditions on consents to take water to control discharges or the effects of land use.

260. To address the current 'blurring' of authorisations and streamline the process of transferring water-take authorisations, steps should be taken to clearly distinguish between conditions on authorisations that relate to RMA section 9, 14, and 15 controls. It will clarify which effects are being managed by which mechanisms and under which statutory mandate. This will also make it easier for the water-take aspects of an authorisation to be 'carved off' and transferred to another site, facilitating the movement of water through a catchment to its highest valued use. It is important to note that transferees – those receiving the water – must hold authorisations

governing the effects of a take structure, and the effects of an activity on land, water or other users. This will ensure that enhancing transferability of the allocable quantum does not impede or frustrate management of the effects of that transfer.

261. The unbundling of consents could significantly increase the ease with which authorisations are able to be transferred between users, but are conscious of the administrative burden that might arise should this be mandated. For this reason, we consider that once authorisations have been re-engineered and their conditions clearly related to section 9, 14 and 15 requirements, users should be empowered to request the council 'unbundle' their authorisations if they see value in doing so.

262. Possibly the most significant barrier to transfer is that users will need to invest to drill a bore, establish a means to abstract water, or build distribution and storage infrastructure to make transfer viable. Without any confidence of being able to access a sufficient quantity of sufficiently reliable water, it is unlikely that investment will occur. Councils will have an important role to play in ensuring that those seeking water are aware of who holds authorisations and when and where water may be available for transfer.

Recommendation 45: Once limits have been set, holders of authorisations to take water should be able to easily transfer those authorisations (or a portion of those authorisations) to other users with minimal regulator involvement so long as the act of doing so does not breach a limit, frustrate efforts to reach targets (interim limits) or derogate the rights of others.

Recommendation 46: Government should:

- **a. provide model plan provisions, as described in the text of this report, which enable the easy transfer - in full or in part - of an authorisation to take water for the length of an authorisation or for a temporary duration. These model provisions must be developed collaboratively with local government, iwi, sector groups and interest groups, and should provide a template for enabling and managing the transfer of authorisations between or within zones**
- **b. provide model formats for authorisations that distinguish between conditions that relate to the location and quantum (rate or volume) of abstraction and conditions that deal with the site-specific effects of abstracting water, using water or discharging contaminants in a particular location. New consents should be constructed in accordance with this model format**
- **c. amend the RMA to enable councils to reconfigure the structure of authorisations to make them consistent with these model formats without requiring or triggering a formal review, providing:**
  - **i. consent holders agree to having their authorisations reconfigured**
  - **ii. the reconfiguration does not change the nature of the authorisation or the intent and effect of conditions, or derogate the rights of other users.**

Recommendation 47: Councils should:

- **a. design plan policies and rules to make the transfer of authorisations to take water (in whole or in part, temporarily or for the duration of an authorisation) as simple as possible**

b. clearly define through their plan the extent to which the transfer of a consent to take water (in part or in full) is a relevant matter when:

i. determining whether a consent has been "given effect to"

ii. considering an incumbent's application for consent on expiry

c. implement measures that bring together people who are interested in transferring authorisations to take water (e.g. by developing and operating platforms that make water data publicly accessible so people can identify when and where water may be available).

Implementation of lapse provisions

263. Section 125 of the RMA specifies the timeframes and circumstances by which a resource consent lapses. Five years is the norm for consents to lapse if they have not been given effect to. Short lapse periods are not conducive to development - developers need a reasonable period to complete the detailed design, finalise commercial arrangements and arrange logistics before commencing construction. For projects seeking to develop long-lived infrastructure this can take many years.

264. Councils are generally doing a good job of implementing lapse provisions but it would be helpful to extend lapse periods for long-lived (infrastructure) projects, including civic infrastructure and catchment-scale mitigation projects, to reflect the time necessary to take them from concept approval to construction.

265. If water is temporarily transferred during the period in which a long-lived infrastructure project is being developed, the developer should not be penalised for facilitating the productive use of the water. If water is temporarily transferred, the consent should be seen to have been given effect to once the water is being used.

Recommendation 48: Lapse provisions in the RMA should be amended to provide for a standard ten year lapse period for long-lived water infrastructure projects and to facilitate councils taking a flexible approach to applying lapse provisions to enable staged development.

Methods for defining technical efficiency

266. In our third report we recommended that councils should apply a "reasonable technical efficiency test" on transition to the new water management regime to remove paper over-allocation. We also recommended that unconsented authorisations (i.e. permitted activities and section 14(3)(b) takes) need to be accounted for in the management regime to ensure limits are met and to prevent surges in these takes from breaching limits and reducing the reliability afforded by consented users' authorisations. Some councils and many industries, but not all, have developed methods for defining technical efficiency that could be used to support these actions. There would be value in a degree of standardisation and centralisation, to promote consistency, avoid the proliferation of approaches and reduce debate at regional level.

Recommendation 49: Government should work with sector groups, councils and other stakeholders and draw on existing industry guidance to specify the methods councils must use for defining technical efficiency standards when:

a. **applying the "reasonable technical efficiency test" on transition to the new water management regime**
b. **accounting for takes within a catchment.**

Management of small takes

267. In its third report the Forum recommended that once past a scarcity threshold small takes, specifically those provided for under section 14(3)(b) of the RMA, should be brought into the regime and managed the same way as other takes to avoid derogation of others' rights and breaches of limits.

268. Existing regulations require all takes greater than 5 litres/second to be metered. A very small portion (~2.5%) of takes are not captured by metering regulations and these need to be managed in a way that is reasonable and proportionate. In many catchments it will be sufficient to maintain a register of small takes and rely on models (validated by targeted metering) to estimate the volume attributable to those takes. Many councils have developed good approaches for doing this (e.g. Waikato Regional Council).

269. If the volume of takes is found to be significant or if there is evidence to suggest more volume is being extracted from small takes than expected, councils will need to actively address the situation to maintain the integrity of limits (e.g. increase their emphasis on compliance with planning controls). In a fully allocated catchment where small takes are a significant part of the demand profile it may be necessary to monitor, meter or measure those takes to confirm users are complying with acceptable allowances.

Recommendation 50: Central government should provide national direction on the management of small takes less than 5 litres/second and not covered by water metering regulations. This direction should set out a progressive approach to managing small takes, stepping from registration and modelling to metering and direct management, and should:

a. **specify that small takes must be modelled, but need not be metered unless they cumulatively add up to a material portion of the limit (allocable quantum) and risk breaching the limit or derogating the rights of others**
b. **clarify the nature and accuracy of data that should be collected if small takes require more active management and metering.**

Residential potable water supply and use

270. In urban contexts, there are a large number of users in close proximity with very different profiles of water use and effect. Metering and charging are mechanisms to help manage urban residential water use and to make water available for other uses.

271. Recommendation 51 in the Forum's first report stated that volumetric metering and direct billing should be worked through collaboratively with stakeholders. The following

recommendations extend this recommendation in regard to metering (but not charging) as there are significant benefits of metering to the water supply network and making more water available for other uses.

272. Introducing meters across all municipal water users could be costly and ineffective, particularly for smaller towns with declining populations where the rates-base is small and metering would have minor effects on a catchment's allocable quantum. However, in areas of population growth or projected population growth, the increase in takes or consents for municipal supply can make water unavailable for other productive uses. In this context, metering can provide a more accurate measure of demand, potentially delaying the need to increase the consented water take or to construct new water supply infrastructure.

273. Reducing residential water use has broader benefits, as it simultaneously reduces wastewater and pressure on wastewater networks, also delaying the need to upgrade wastewater infrastructure.

274. Metering can also allow for the identification of leaks in the water supply networks, creating reductions in demand on the total water supply as leaks are fixed. Identification of leaks is partly dependent on appropriate levels of metering.

Recommendation 51: Water suppliers should meter municipal supply at scales that are appropriate for asset management purposes. Depending on the population and local context of each community, this may be at the household, business, zone, suburb, catchment or district level.

Recommendation 52: Additionally, volumetric metering for households on municipal supply should be required in urban areas where the population growth is or is projected to be significant and where increasing demand on municipal supply is creating competition with other water uses, or in over-allocated catchments where the municipal take is a material portion of the water use.

Recommendation 53: Water suppliers must monitor and publicly report on levels of leakage and actions they are taking to mitigate leakage in the potable water system, and should set targets to reduce the water loss from leaks in their networks.

275. Some regional plans prioritise municipal supply during times of scarcity (as per regional plans and consistent with the priority given to water for human consumption and sanitation in section 14(3)(b) of the RMA), but municipal networks may supply water for both essential domestic uses and commercial or industrial production purposes. In times of scarcity, it is perceived that some councils do not restrict commercial water users on municipal supply, while some commercial water users outside of municipal supply are restricted. Municipal supply managers already have the ability to restrict certain uses during scarcity (such as commercial production purposes), and some municipal supply managers implement this well. There needs to be a distinction between these uses within municipal water supply to:

    a. avoid commercial or industrial water users outside of municipal networks being disadvantaged when decisions are made on the allocation of water

b. enable water managers to apply restrictions in a targeted way to domestic and commercial uses in times of low inflows and water scarcity.

Recommendation 54: Councils and water suppliers should be required to distinguish between municipal supply that is for essential domestic needs (i.e. drinking and sanitation needs for households, offices, retail, hospitals and education) and municipal supply that is for commercial or industrial production purposes to:

a. allow for targeted application of restrictions during times of scarcity

b. treat metropolitan commercial users' access to high reliability water on the same basis as commercial water users outside of municipal supply.

Addressing over-allocation

276. Over-allocation may exist regardless of whether or not formal allocation of the resource to individual entities or properties has occurred. Whether or not an allocation regime is in place will affect the tools available for addressing over-allocation.

277. In our third report we said that timeframes for transition should be, to the greatest extent reasonable, defined by local communities and appropriate to the situations. As an example, where water abstraction is in danger of creating a salt water intrusion into an aquifer, there may be a need to act with speed, while where no irreversible ecological damage is imminent, longer time periods will be able to be applied for land and water users to make the changes required while maintaining their investment.

278. Our recommendations were that timeframes for adjustment should be well defined, not cause unnecessary economic and social dislocation and not be unnecessarily extended. All land and water users that impact on the over-allocation should bear some of the cost of transition – everyone should take a fair and reasonable level of responsibility for getting to limits and 'lift their weight'. A fair and reasonable level of responsibility implies that resource users will need to internalise the costs of production and the effects of their activities to the greatest extent possible.. In some places contaminant lag times and legacy issues may make this difficult or impractical.

A range of options

279. Many contaminants cannot currently be allocated to individual entities or properties and, even for those contaminants which can be allocated (nitrogen and potentially phosphorus), it may be some time before the accounting framework needed to enable a discharge allocation approach is in place. In these situations, the range of tools for managing over-allocation are effectively the same as those available for keeping water quality within limits, including:

- implementing GMP
- requiring practices over and above GMP (which includes water sensitive urban design in urban areas)
- using infrastructure and catchment-scale mitigations, such as storage and distribution schemes, constructed wetlands, swales, and riparian buffers
- requiring changes in land use
- retiring land from productive use.

280. When implementing the measures above, critical source areas in the catchment should be targeted so that assimilative capacity is freed up as quickly and efficiently as possible. This may mean that a greater proportion of the impact of addressing over-allocation is borne by some users than others and consideration should be given to how such measures can be equitably funded.

281. For allocated contaminants, where technically efficient water use, GMP and the development of new infrastructure and catchment-scale mitigations are not sufficient for resolving the over-

allocation problem, approaches that directly reduce individual take and discharge allowances will need to be used. These approaches fall into three broad categories:

a. administratively determined 'haircuts'
b. negotiation-based voluntary reductions
c. volumetrically driven auctions and tenders.

282. There are a variety of ways each of these approaches could be applied. Haircuts could be pro-rata percentage reductions, based on industry benchmarking or target critical contaminant source areas. Allowing takes/discharges to be transferred while the cap is being reduced will reduce the costs of adjustment. Communities should consider a range of options. We do not however consider that fixed quantity haircuts are appropriate (i.e. reducing all consents by the same volume of take or discharge) as these will typically unfairly disadvantage smaller users or dischargers.

283. When deciding which tool(s) to use communities should consider how well the overall approach will:

a. deliver / guarantee the limit
b. allow for new entrants and/or higher-value uses
c. make individual responsibilities clear and transparent
d. be workable in practice, given the knowledge and capability requirements
e. provide for dynamic efficiency
f. cope with changes in information, practice, etc.

284. Enabling transfer of takes and discharges will be important for addressing over-allocation at least cost as transfer will help to ensure that within the reduced overall cap, takes and discharges move to the best economic uses. It is critical that our recommendations to remove paper over-allocation and apply reasonable technical efficiency/GMP tests are put in place before enabling transfer.

285. In some places, discharges may be authorised in a way that does not allow transferability (such as through the use of discharge caps in permitted activity rules). This has important implications for decision making on the choice of tools and how they are applied as economic efficiency will be affected as well as equity.

Recommendation 55: When developing catchment-level policies and rules for managing over-allocation councils should:

a. **target critical contaminant source areas in the catchment where this will enable efficient reduction of over-allocation**
b. **consider the potential for resolving the over-allocation problem through the development of new infrastructure and catchment-scale water quality mitigations**
c. **require all land and water users to make a fair and reasonable contribution to the achievement of limits**
d. **recognise prior investment in measures that have led to greater efficiency in water use or water quality mitigation measures**
e. **clearly specify how measures designed to achieve a limit will impact existing authorisations (e.g. reduced annual take/discharge, reduced instantaneous take or reduced reliability).**

Recommendation 56: Recommendation 51 of our third report should be read as applying to freshwater quality as well as quantity.

Government support for addressing over-allocation

286. In addition to the above guidance, the government should ensure its funding schemes enable it to effectively contribute to efforts to bring highly over-allocated catchments back within limits. Co-funding from local communities and councils should be required. A recommendation for a new fund (or rationalisation of existing funds) is provided later in this report (recommendation 60a).

Charges and taxes for water use

287. The Forum's third report noted that there was no resolution on the matter of charges and taxes on fresh water, and recorded the key elements of the discussion. Discussions on this issue as part of the development of this report have still reached no resolution.

288. There is a clear distinction between charging to recover costs associated with water management, and charging or taxing for the use of (or the right to use) fresh water. Consideration of this issue must address the full range of costs and benefits associated with its use. The following points are a short description of the areas discussed by the Forum on the use of water charges and taxes.

    a. They could help councils recover the costs associated with the management of fresh water.
    b. Members have strongly opposed views on charging or taxing for water use in relation to promoting the efficient use of water; providing a return to the community; funding of specific activities including restoration of waterbodies; and increasing taxation efficiency.
    c. Significant design issues arise associated with charging, including the need to consider both efficiency and equity impacts. These issues are technically difficult and poor design and implementation can have a negative effect even if their rationale is sound.

289. A fuller discussion of this issue is contained on pages 68-71 of the Forum's third report.

Concerns over aggregation and speculation

290. The Forum has discussed concerns about the possible aggregation of water take and discharge consents, and speculation in the value of those consents, leading to undesirable economic and community outcomes, including restricting the ability of iwi to access water and assimilative capacity.

291. These concerns arise from the possibility that a greater degree of flexibility in the transfer of water will lead to consents being:

    a. acquired and hoarded with the aim of speculation
    b. aggregated to a limited number of users within a catchment.

292. A similar concern has been expressed in relation to discharge consents when transfer is enabled.

293. There are two possible issues that the Forum has identified. The first is that this might lead to inefficient market outcomes. It is unclear that this will actually be a problem. If it is, it is not likely to be universal, and may vary in its nature across catchments.

294. A general regulatory fix to try and resolve what is unlikely to be a general national problem (or no problem at all) would potentially reduce the flexibility of any transfer system, and put at risk some of the benefits that come about from greater flexibility.

295. Rather than this approach, the Government should monitor markets for water and discharge consents as they emerge. If a market dominance or efficiency problem arises, and is not able to be dealt with by the provisions of the Commerce Act, the Government should consider a response that is able to target the particular problem that has emerged. This is an approach that is in place for a number of industries – electricity, telecommunications, airports, dairy and gas pipelines. The response may be regulatory or non-regulatory.

296. The second issue concerns the impact of such aggregation on the social fabric of rural New Zealand. The Forum noted that there are already trends towards farm aggregation/ amalgamation, without mature water or discharge transfer systems. It is not clear the extent to which our recommendations might alter current trends.

Recommendation 57: The Government should:

- **a. monitor the emergence of markets for the transfer of water and discharge consents**
- **b. consider whether any market dominance or efficiency problems arise**
- **c. address them through the provisions of the Commerce Act where possible**
- **d. develop a specific response that targets the problems that arise if they are not able to be dealt with by the Commerce Act.**

What enables change

Capacity

297. The Forum's recommendations, and the expectations placed on councils, sectors and communities by the NPS-FM, comprise a significant body of work. There are expanded roles and expectations for central government, regional and unitary councils, city and district councils, sector bodies, iwi, NGOs, scientists and researchers, land and water users and individual and collective participants in the 'water economy'.

298. The work needed to set limits, make sure that they are met, and do so in a way that maximises the economic benefit from land use is large. It will be a challenge for all groups.

299. Capacity building will inevitably take time so not all things will be able to be done at the same time. This report's recommendations make some suggestions that will, at least in part, offset some capacity concerns. These include:

    a. a greater emphasis on central government direction and guidance, to reduce the amount of work required by councils
    b. a stress on setting priorities based on the tractability of the problem so that limited resources are put to their best use.

300. An information sharing platform (including a website and stakeholder workshops) that is accessible to all councils, iwi, CRIs, sector groups and communities will support effective and efficient freshwater management decisions.

Recommendation 58: Regional councils and territorial authorities, iwi, CRIs, sector groups, Crown entities, NGOs, universities and communities need to be able to share innovative approaches and best practice for managing within limits over time. Central government should work with these groups to establish an information sharing platform, in the form of a website and ongoing workshops. The information sharing platform will need to cover a broad range of issues, including:

a. exemplar approaches to discharge allocation regimes
b. innovation in three waters management, in particular, for smaller towns upgrading wastewater systems
c. the costs and effectiveness of GMP, including various on-farm mitigations
d. monitoring of actual use compared to allocations (either take or discharge)
e. the costs and effectiveness of various catchment-scale mitigations
f. approaches to unbundling consents and standardising consents
g. different approaches to defining the level of reliability afforded by a consent under a limits-based regime.
h. information on the range of public and private sector funds available to assist with managing within limits, along with information to assist in applying
i. approaches to riparian setbacks and management practices.

Priorities for government action and resources

301. A large amount of work is needed to set and manage within limits. To aid in this task, central government should ensure:

    a. the level of existing government funding for freshwater management is not reduced
    b. the public is getting the best possible value for money from existing government funding
    c. more funding is provided where necessary in high priority areas.

302. These priorities must be seen alongside the need to resolve iwi rights and interests in fresh water.

Rationalising central government funding relating to fresh water

303. A myriad of existing funding schemes directly or indirectly related to freshwater management already exist. A review and stocktake of existing government funding relating to freshwater management should be undertaken to consider whether:

    a. the quantum of existing funding available is commensurate with the size of the problem (or opportunity) in high priority areas. This will help identify where additional funding should be provided
    b. funds should be re-targeted according to the central government funding criteria proposed in Appendix 2
    c. separate 'pots' of funding should be combined, to:
        i. remove unnecessary administrative overheads from separately administered schemes that fund similar things (e.g. separate funds in each region, or duplication between central government and local government schemes)
        ii. ensure proposals are funded on the basis of the sum of their environmental, economic, social and cultural outcomes rather than ring-fencing funding for a particular outcome (i.e. only economic benefits, or only environmental benefits), a particular waterbody, or for a particular mitigation measure (such as the $100 million proposed for land retirement).

304. It is also difficult to find and successfully apply for assistance from existing (government and non-government) funds. They are administered by a wide variety of organisations: different central government agencies; local government; and private organisations. Information on all funds provided by central government, local governments, private and community groups, and assistance with applying, should be provided on the proposed national information sharing platform. Additional information should also be provided to reduce the administrative costs of accessing these funds, including:

    - clear funding criteria and guidance about purpose of funds
    - assistance with preparing applications, such as pro-forma templates.

Recommendation 59: Central government should:

- **a. undertake a stocktake of all central government funding that may impact on fresh water**
- **b. consolidate and rationalise existing central government funds related to freshwater management**
- **c. provide information on all central government, local government and private funds available, and assistance with applying, on the national learning platform.**

High priority areas

305. This report has identified three main high priority areas for additional government action and resources:

a. A central government fund (either newly established, or the product of a rationalisation of existing funds) to aid councils in meeting environmental limits and providing headroom for further economic development. The fund should provide assistance to regional initiatives, such as infrastructure and catchment-scale mitigations, according to the proposed central government funding criteria outlined in Appendix 2.

b. Improvements to the capacity and capability of local government and industry groups (e.g. establishing a national information sharing platform and running national processes to develop and certify technical efficiency standards for water use; and industry GMP schemes.

c. Science and research to aid in managing within limits – we have proposed the establishment of an information framework (as per recommendation 5 of this report) which will involve a stocktake of data and models needed for managing within limits and identification of gaps. This will identify specific priorities for new central government funding. In the meantime, the level of funding for research in this area should be at least maintained and more research funding provided for the initial priorities identified by the Forum in paragraph 55 of this report, particularly spatial variation in assimilative capacity, improvements to OVERSEER, tools to improve highly degraded urban streams, and information on the relationship between freshwater values, water quality parameters and ecological thresholds.

Recommendation 60: Central government should:

- **a. Provide additional funding (either through establishing a new fund, or rationalising existing funds) to assist communities with managing over-allocation, legacy effects (e.g. environmental clean-up), and the creation of headroom to generate greater economic activity and provide for new users. The fund should use the central government funding criteria proposed in Appendix 2.**
- **b. Improve the science and information base needed to manage within limits, by:**
  - **i. establishing a national information framework**
  - **ii. prioritising research into spatial variation in assimilative capacity**
  - **iii. prioritising research to improve OVERSEER**
  - **iv. prioritising research into tools for the restoration of highly degraded urban streams.**

c. Improve the capability/capacity of councils and industry groups, by:

- **i. establishing a national information sharing platform**
- **ii. running processes with industry and other stakeholders to develop and approve independently audited industry self-management schemes**
- **iii. running processes with industry to develop and approve technical efficiency standards for water use.**

The future

306. This report is the first part of a three part mandate given to the Forum by Ministers. The Forum has also been asked to do two further pieces of work.

NOF and NPS

307. The Forum has been asked to:

- contribute to the further population of the National Objectives Framework (NOF), through the review of work carried out by the NOF Reference group, and providing advice to Ministers
- include a commentary on the overall implementation of the NPS-FM (2011 and 2014), drawing on the experience of councils' implementation of the NPS-FM.

This advice is to be completed by 30 September 2016.

308. Urban areas face different challenges to rural areas and contaminants that are key concerns in urban areas should be considered in the development of further attributes in the NPS-FM. E. coli is a major contaminant in urban areas, and is already an attribute with national bottom lines in the NPS-FM. Other urban contaminants for consideration in the NOF are: sediment (particularly from greenfield developments), heavy metals, pathogens, stored toxic chemicals, heat and emerging contaminants (e.g. from disintegrated rubbish). Setting attributes for these urban contaminants will assist the process for managing these contaminants at source.

Further refinements to the water management system

309. The Forum has been asked to review the overall changes to water policy and its implementation, lessons learned, and the further work required to achieve the overall objective of improved water management in New Zealand. The experience of councils will be drawn on during this review.

310. Some of the areas that might form part of this work are:

a. The ongoing work by LGNZ, the Department of Internal Affairs and the Treasury's National Infrastructure Unit on three waters infrastructure management, governance and institutional arrangements.
b. Evaluating the water and land use implications of urban expansion to ensure efficient water management outcomes.
c. The interactions of the NPS-FM and the New Zealand Coastal Policy Statement, and if provisions are sufficient to ensure that the impact of land uses and land development on the coastal receiving environment is addressed when designing freshwater objectives and limits.
d. The extent to which the Forum's recommendations have been implemented.

Other planned work

311. The Forum intends to review discharge transfer regimes in New Zealand, along with a representative selection of international regimes.

Summary of recommendations

Recommendation 1: The government should complete implementing the Forum's recommendations from its three previous reports as soon as possible. Unless otherwise explicitly stated in this report, those earlier recommendations remain unchanged.

Recommendation 2: The responsibility for reaching agreement on how to recognise iwi rights and interests in water rests with the Crown and iwi, including agreed allocable quantum and discharge allowances. The responsibility for giving effect to those agreements lies with the Crown. When reaching and giving effect to these agreements the Crown's approach should have regard to the Forum's previous statement on iwi rights and interests in fresh water.

Recommendation 3: To enable agreements between the Crown and iwi to be given effect to, central government should:

a. require councils to implement any agreements between the Crown and iwi to recognise iwi rights and interests in fresh water
b. enable councils to allocate authorisations to iwi to deliver any agreements between the Crown and iwi, including by using their plans:
    i. in anticipation of agreements being reached, to reserve for iwi unallocated portions of the allocable quantum and discharge allowances in under-allocated catchments
    ii. after agreements have been reached, to provide for iwi over time access to the allocable quantum and discharge allowances in fully- or over-allocated catchments
c. ensure existing holders of authorisations are fairly compensated should their rights be adversely affected by any agreements made between the Crown and iwi
d. support councils to make any necessary changes to their planning frameworks to accommodate any agreements made between the Crown and iwi.

Recommendation 4: A broad range of mechanisms should be considered for giving effect to agreements between the Crown and iwi. These could include but not be limited to:

a. giving iwi priority access to:
    i. unallocated water and discharge allowances in catchments that have not yet reached full allocation
    ii. allocable quantum that is created through application of the "reasonable technical efficiency test" on transition to the new freshwater management regime
    iii. discharge allowances or load for unallocated contaminants that are created through the application of good management practice requirements on transition to the new freshwater management regime
    iv. water, discharge allowances or additional contaminant load created through government investment in infrastructure to generate 'new water' or 'headroom' in quality limits
    v. water or discharge allowances that are voluntarily surrendered
b. facilitating commercial partnerships and joint ventures between iwi and incumbent holders of authorisations to take water and discharge contaminants
c. acquiring a portion of the allocable quantum, total available discharge allowance or total contaminant load through:

i. commercial agreements between the Crown and other users to transfer authorisations to iwi
ii. running a voluntary reverse auction as a means to find the most efficient way for the Crown to access authorisations to transfer to iwi.

Recommendation 5: Central government should work closely with regional councils and territorial authorities, iwi, sector groups, Crown research institutes, Crown entities, NGOs and universities to establish an integrated freshwater management information framework that:

a. presents a high level stock take and gaps assessment of the data and modelling available that is suited for the purposes of setting and managing within limits
b. contains criteria for prioritising gaps, and a process to direct filling those gaps, including prioritising relevant research programmes and aligning work to achieve the NPS-FM
c. includes mātauranga-derived knowledge to feed into decision-making.

Additionally, to encourage interoperability and consistency, the information framework should:

d. identify opportunities for multi-purpose data and models in order to reduce costs and maximise the benefits of knowledge (e.g. data and models that can be used in multiple catchments and regions, and accounting systems and monitoring networks to be used for both setting and managing within limits)
e. define nationally agreed data standards to:
    i. provide for scaleability and ability to aggregate data to improve decision-making, monitoring and reporting at a national and regional level
    ii. lead to a robust national data set for quantifying water quality and quantity state and trends that is resilient and flexible for future water management needs.

The framework should be started immediately and established no later than 2017, and be maintained and updated regularly.

Recommendation 6: Councils' freshwater accounting systems (as required under the NPS-FM) and central government's guidance on freshwater accounting, should be relevant for ongoing phases of water reform, integrated catchment management, and both setting and managing within limits.

Recommendation 7: Councils should work collaboratively with relevant groups when commissioning and developing the data and models that are used for decisions on managing within limits in their regions and use co-design where appropriate. Councils' accounting systems, data and modelling should be transparent and accessible for all stakeholders to test and analyse water management decisions.

Recommendation 8: As part of limit setting and managing within limits, councils in collaboration with iwi, communities, NGOs and sector groups, should identify and classify within their catchments:

a. areas that have particular ecological, social or cultural value
b. current and potential critical source areas for various contaminants
c. terrain information needed for land and water management purposes, including that required to implement the national stock exclusion regulation.

This information should be used to target areas where initial interventions will have the greatest effect.

Recommendation 9: As part of catchment planning, councils should:

a. investigate the role that infrastructure and catchment-scale mitigations could play in:
    i. meeting environmental limits
    ii. creating headroom for economic growth through increasing the amount and reliability of water and/or assimilative capacity
    iii. providing other economic, environmental, social or cultural benefits
b. identify barriers to private investment in and deployment of infrastructure and catchment-scale mitigations
c. identify what role they should play in the development and provision of infrastructure and catchment-scale mitigations.

Recommendation 10: Councils should be required to produce two-yearly a report card to iwi and their communities on:

a. progress that the combined interventions being used to manage water quality and quantity are making towards the achievement of objectives, limits and targets set under the NPS-FM
b. steps the council will take if the combined interventions are not sufficient.

Recommendation 11: Central government should monitor and publicly report on the performance of regions in setting and managing within limits.

Recommendation 12: Improvements in catchment-by-catchment information on the spatial variability in assimilative capacity, particularly groundwater flows, lag times and denitrification potential, should be a high priority for government investment.

Recommendation 13: For the purpose of managing within limits, councils should model and quantify the impact of the range of currently and potentially achievable management practices (including GMP) and mitigations for the contaminants of concern (e.g. nutrient losses) in each catchment.

Councils should adjust requirements on land and water users, including considering additional mitigations, if monitoring and modelling of the impact of the interventions used shows that the objectives, limits and targets set under the NPS-FM will not be met.

Recommendation 14: When using modelled numbers in regulation:

a. plans should clearly outline when new model versions will take effect in regulation
b. the model version used at the activity-scale and the catchment-scale should be updated simultaneously.

Recommendation 15: Alongside improvements in catchment-scale models, the continued development of OVERSEER should be a priority.

Recommendation 16: Good Management Practice is the minimum requirement for all industries. In developing GMP-related policies and methods, councils should consider in the first instance the national *Industry Agreed Good Management Practices related to Water Quality* framework and other recognised sector GMPs.

Recommendation 17: Discharges should be managed through the Resource Management Act by way of a consent requirement unless the council demonstrates using permitted activity rules will be sufficient for achieving the limits within the agreed timeframes. Whatever approach is used, there must be a transparent process to audit performance, either through an approved independently audited industry self-management scheme and/or a council compliance process that is documented and clear to both land and water users and the groups involved in the planning process.

Recommendation 18: Central government, with input from sector groups, councils, iwi and NGOs, should develop a national process for approval of industry audited self-management schemes and have this process in place by 1 July 2017.

Recommendation 19: Regional councils and territorial authorities should prioritise the alignment of the planning, investment and delivery of 'three waters' infrastructure, roads, residential development and land use controls to meet water quality objectives in regional plans for freshwater and coastal environments.

Recommendation 20: A "Water sensitive urban design" process must be adopted in the building and upgrading of stormwater and roading infrastructure and residential urban development (and redevelopment).

Recommendation 21: Where wastewater systems overflow into stormwater or directly into waterbodies, in either a controlled (designed) or uncontrolled manner, local authorities should be required to report publicly on:

a. the maximum acceptable frequencies that are set through consent conditions or plan rules, and the actual number of overflows
b. planning and progress towards phasing out overflows
c. how overflows will be managed to achieve objectives and limits.

Recommendation 22: Territorial authorities should review or revise trade waste by-laws to encourage or require the pre-treatment and recycling of trade waste before disposal into municipal wastewater systems.

Recommendation 23: For the total contaminant load, the plan must make it clear and the accounting framework must reflect:

a. the proportion and sources of that load which will not be explicitly managed (for example parts of the Conservation estate that aren't in productive use)
b. the proportion and sources of that load which is being allocated for use and will be explicitly managed.

Recommendation 24: Over time, and providing the precursor steps to allocation have been met, councils should adopt management approaches which allocate diffuse source discharges to individual entities or groups.

Recommendation 25: Councils should take the following precursor steps for all catchments that are, or are likely to become, fully allocated in the foreseeable future or are over-allocated:

a. ensure that all activities that cumulatively make a more than minor contribution to the catchment load (through point source or diffuse discharges) are directly controlled

b. ensure that those controls explicitly refer to the full range of discharges that may arise from the relevant activity
c. account at the individual land or water user level for diffuse discharges from all activities that cumulatively make a more than minor contribution to the catchment load.

Recommendation 26: To facilitate the future adoption of transferable discharge allowance approaches central government should:

a. Provide model plan provisions, which enable the easy transfer - in full or in part - of a discharge authorisation for the length of an authorisation or for a temporary duration.
    i. These model provisions must be developed collaboratively with local government, iwi, sector groups and NGOs, and should provide a template for enabling and managing the transfer of authorisations between or within zones.
    ii. New consents should be constructed in accordance with this model format.
    iii. Consent holders should be able to request their consents be reconfigured to make them consistent with these model formats, consistent with the approach suggested in recommendation 46c.
b. Specify nationally consistent requirements for discharge allowance registries, and support the development of a common transfer platform.
c. Work with early starter councils, iwi, sector groups, NGOs and communities who are considering implementing a transfer regime for discharge allowances to:
    i. provide guidance and support
    ii. identify exemplar approaches and/or further opportunities for national guidance, direction or other support.

Recommendation 27: Where transferable discharge allowances have not been, or will not be, introduced councils should:

a. support the use of group approaches to discharge management that enable group members to manage discharges amongst themselves (e.g. enabling discharge caps to be averaged across multiple properties or issuing group consents).
b. specify in their plans how and when the allocable load will be reduced down to the target or limit in over-allocated catchments.
c. specify mechanisms in their plans for enabling access for new uses/users in the future.

Recommendation 28: When shifting to a transferable discharge allowances regime all existing authorised discharges should be translated into a new consent format. The process of translating any authorised discharge into a new format should evaluate the discharge against relevant and agreed measures of good management practice. [12]

Recommendation 29: A national stock exclusion regulation should apply to all those livestock types that can cause significant damage from incursions into waterways, including:

a. dairy cattle
b. beef cattle

[12] This recommendation needs to be seen in light of our recommendations on managing over-allocation and on independently audited industry self-management schemes for good management practice.

c. deer
d. pigs.

Recommendation 30: In the context of a national stock exclusion regulation, "excluded" should mean effectively barred from access to water and to the banks of waterways either through a natural barrier (such as a cliff) or a fence. For milking platforms a fence must be permanent. Temporary fencing may be used for intermittent, concentrated and short-term grazing near waterways. Permanent deer fencing will be expensive and impractical in certain landscapes, so other approved GMP measures can be used.

Recommendation 31: The national stock exclusion regulation should include a requirement that when permanent fences are erected to exclude stock, they should be placed the appropriate distance back from the waterway. The appropriate setback distance will vary at different points along the waterway and will be determined by an on-farm assessment required as part of GMP, as per recommendation 39 of this report.

Recommendation 32: Councils should classify the terrain adjacent to waterways in their catchments according to the slope angle to identify where a national stock exclusion regulation applies. Whether the classification should occur at a sub-catchment, property or intra-property level should be determined by public consultation. The classifications are:

a. plains (0-3 degrees)
b. lowland hills (rolling hills/down lands) (4-15 degrees)
c. hill country (16-28 degrees)
d. steep hill country (>28 degrees).

Recommendation 33: Stock of different types and on different terrains should be excluded according to different dates. Table 1 provides an example of how this could be structured that Government should use as a basis for public consultation.

Recommendation 34: Government should:

a. consult on interim milestones for excluding stock from waterways
b. require fencing of waterways during significant land use changes to a farm type and on terrain that the proposed national stock exclusion regulation will eventually apply to.

Recommendation 35: A national stock exclusion regulation should apply to:

a. permanently flowing waterways and drains greater than one metre in width and deeper than 30 cm
b. permanently flowing waterways smaller than those outlined above on the plains. Landowners should be given until at least 2020 to achieve this (i.e. any exclusion dates before 2020 in Table 1 should not apply for smaller waterways)
c. natural wetlands – as qualified by recommendation 37 of this report
d. where specific management practices that could result in significant damage to waterways (such as strip-grazing beside a waterway) are being used.

Recommendation 36: Councils should have discretion to exclude stock from waterbodies not included in a national stock exclusion regulation or ahead of the timeframes mandated by it (i.e.

those in Table 1). This discretion should be exercised where a waterbody, or part of a waterbody is a critical source area for contaminants or has particular ecological, cultural or social value.

Recommendation 37: A national stock exclusion regulation should clarify that 'natural wetlands' subject to the regulation are 'wetlands' as defined by the RMA but not including:

a. wet pasture, damp gully heads, or where water temporarily ponds after rain or pasture containing patches of rushes
b. effluent ponds
c. artificial storage facilities and detention dams
d. artificial water courses such as conveyance and drainage canals
e. reservoirs for firefighting, domestic or community water supply
f. engineered soil conservation structures.

Recommendation 38: Exceptions from national and regional stock exclusion requirements should be provided in limited situations where large costs and significant impracticalities relative to the environmental benefit can be demonstrated. Councils should consider these factors when classifying terrain for stock exclusion purposes.

Recommendation 39: Riparian setbacks and management strategies should be included in GMP requirements, either as part of industry GMP schemes or council GMP rules, where they are an appropriate mitigation.

Recommendation 40: Government should commission a review and update of existing riparian management assessment tools to produce a new consolidated riparian management assessment tool to assist in identifying and implementing the appropriate riparian setbacks and management strategies across the full range of circumstances.

Recommendation 41: Councils should impose riparian setback and management rules over and above GMP requirements in catchments with specific water quality issues, where this is an effective way of managing a particular issue. Councils should also consider catchment-specific riparian management rules for critical source areas and areas of specific ecological, social or cultural value.

Recommendation 42: Authorisations to take water must be designed to maintain consistency with plan objectives and limits, and clearly specify:

a. the expected reliability of access to water they grant users
b. the circumstances in which the rate, volume and/or duration of abstraction will vary.

Recommendation 43: When considering applications to 'renew' authorisations on expiry, consent authorities should be required to give additional weight to the value of sunk capital, and recognise the potential value of continuing to operate and optimise existing infrastructure.

Recommendation 44: For applications to develop new long-lived water infrastructure, consent authorities should be able to specify that the term of an authorisation begins when the authorisation is "given effect to" rather that once it is granted.

Recommendation 45: Once limits have been set, holders of authorisations to take water should be able to easily transfer those authorisations (or a portion of those authorisations) to other users

with minimal regulator involvement so long as the act of doing so does not breach a limit, frustrate efforts to reach targets (interim limits) or derogate the rights of others.

Recommendation 46: Government should:

a. provide model plan provisions, as described in the text of this report, which enable the easy transfer - in full or in part - of an authorisation to take water for the length of an authorisation or for a temporary duration. These model provisions must be developed collaboratively with local government, iwi, sector groups and interest groups, and should provide a template for enabling and managing the transfer of authorisations between or within zones
b. provide model formats for authorisations that distinguish between conditions that relate to the location and quantum (rate or volume) of abstraction and conditions that deal with the site-specific effects of abstracting water, using water or discharging contaminants in a particular location. New consents should be constructed in accordance with this model format
c. amend the RMA to enable councils to reconfigure the structure of authorisations to make them consistent with these model formats without requiring or triggering a formal review, providing:
    i. consent holders agree to having their authorisations reconfigured
    ii. the reconfiguration does not change the nature of the authorisation or the intent and effect of conditions, or derogate the rights of other users.

Recommendation 47: Councils should:

a. design plan policies and rules to make the transfer of authorisations to take water (in whole or in part, temporarily or for the duration of an authorisation) as simple as possible.
b. clearly define through their plan the extent to which the transfer of a consent to take water (in part or in full) is a relevant matter when:
    i. determining whether a consent has been "given effect to"
    ii. considering an incumbent's application for consent on expiry
c. implement measures that bring together people who are interested in transferring authorisations to take water (e.g. by developing and operating platforms that make water data publicly accessible so people can identify when and where water may be available).

Recommendation 48: Lapse provisions in the RMA should be amended to provide for a standard ten year lapse period for long-lived water infrastructure projects and to facilitate councils taking a flexible approach to applying lapse provisions to enable staged development.

Recommendation 49: Government should work with sector groups, councils and other stakeholders and draw on existing industry guidance to specify the methods councils must use for defining technical efficiency standards when:

a. applying the "reasonable technical efficiency test" on transition to the new water management regime
b. accounting for takes within a catchment.

Recommendation 50: Central government should provide national direction on the management of small takes less than 5 litres/second and not covered by water metering regulations. This

direction should set out a progressive approach to managing small takes, stepping from registration and modelling to metering and direct management, and should:

a. specify that small takes must be modelled, but need not be metered unless they cumulatively add up to a material portion of the limit (allocable quantum) and risk breaching the limit or derogating the rights of others
b. clarify the nature and accuracy of data that should be collected if small takes require more active management and metering.

Recommendation 51: Water suppliers should meter municipal supply at scales that are appropriate for asset management purposes. Depending on the population and local context of each community, this may be at the household, business, zone, suburb, catchment or district level.

Recommendation 52: Additionally, volumetric metering for households on municipal supply should be required in urban areas where the population growth is or is projected to be significant and where increasing demand on municipal supply is creating competition with other water uses, or in over-allocated catchments where the municipal take is a material portion of the water use.

Recommendation 53: Water suppliers must monitor and publicly report on levels of leakage and actions they are taking to mitigate leakage in the potable water system, and should set targets to reduce the water loss from leaks in their networks.

Recommendation 54: Councils and water suppliers should be required to distinguish between municipal supply that is for essential domestic needs (i.e. drinking and sanitation needs for households, offices, retail, hospitals and education) and municipal supply that is for commercial or industrial production purposes to:

a. allow for targeted application of restrictions during times of scarcity
b. treat metropolitan commercial users' access to high reliability water on the same basis as commercial water users outside of municipal supply.

Recommendation 55: When developing catchment-level policies and rules for managing over-allocation councils should:

a. target critical contaminant source areas in the catchment where this will enable efficient reduction of over-allocation
b. consider the potential for resolving the over-allocation problem through the development of new infrastructure and catchment-scale water quality mitigations
c. require all land and water users to make a fair and reasonable contribution to the achievement of limits
d. recognise prior investment in measures that have led to greater efficiency in water use or water quality mitigation measures
e. clearly specify how measures designed to achieve a limit will impact existing authorisations (e.g. reduced annual take/discharge, reduced instantaneous take or reduced reliability).

Recommendation 56: Recommendation 51 of our third report should be read as applying to freshwater quality as well as quantity.

Recommendation 57: The Government should:

a. monitor the emergence of markets for the transfer of water and discharge consents
b. consider whether any market dominance or efficiency problems arise
c. address them through the provisions of the Commerce Act where possible
d. develop a specific response that targets the problems that arise if they are not able to be dealt with by the Commerce Act.

Recommendation 58: Regional councils and territorial authorities, iwi, CRIs, sector groups, Crown entities, NGOs, universities and communities need to be able to share innovative approaches and best practice for managing within limits over time. Central government should work with these groups to establish an information sharing platform, in the form of a website and ongoing workshops. The information sharing platform will need to cover a broad range of issues, including:

a. exemplar approaches to discharge allocation regimes
b. innovation in three waters management, in particular, for smaller towns upgrading wastewater systems
c. the costs and effectiveness of GMP, including various on-farm mitigations
d. monitoring of actual use compared to allocations (either take or discharge)
e. the costs and effectiveness of various catchment-scale mitigations
f. approaches to unbundling consents and standardising consents
g. different approaches to defining the level of reliability afforded by a consent under a limits-based regime.
h. information on the range of public and private sector funds available to assist with managing within limits, along with information to assist in applying
i. approaches to riparian setbacks and management practices.

Recommendation 59: Central government should:

a. undertake a stocktake of all central government funding that may impact on fresh water
b. consolidate and rationalise existing central government funds related to freshwater management
c. provide information on all central government, local government and private funds available, and assistance with applying, on the national learning platform.

Recommendation 60: Central government should:

a. Provide additional funding (either through establishing a new fund, or rationalising existing funds) to assist communities with managing over-allocation, legacy effects (e.g. environmental clean-up), and the creation of headroom to generate greater economic activity and provide for new users. The fund should use the central government funding criteria proposed in Appendix 2.
b. Improve the science and information base needed to manage within limits, by:
    i. establishing a national information framework
    ii. prioritising research into spatial variation in assimilative capacity
    iii. prioritising research to improve OVERSEER
    iv. prioritising research into tools for the restoration of highly degraded urban streams.

c. Improve the capability/capacity of councils and industry groups, by:
    i. establishing a national information sharing platform
    ii. running processes with industry and other stakeholders to develop and approve independently audited industry self-management schemes
    iii. running processes with industry to develop and approve technical efficiency standards for water use.

Glossary

Allocable quantum	The total quantity of water available for allocating to users as determined by the limit based on the following parameters: a. the total flow or volume that can be extracted (surface) or the total volume that can be extracted (groundwater) b. any temporal constraints (such as seasonal variability) based on the differences of flow (primarily for surface flows) c. any flow restriction or condition (e.g. minimum flow) for surface water being a flow at which no further abstraction is allowed. Can include water made available by diversion or storage. The allocable quantum will reflect reliability of the available water based on these parameters.
Allocation	A process whereby a total amount of water that may be utilised, or an amount of contaminants that may be discharged, is divided and distributed to individuals, or groups of individuals for their use. The individual amounts of a resource so allocated are often referred to as **allocations**, and the total can be said to be the total allocation.
Aquifer	An underground deposit of water-bearing sand, gravel or rock capable of yielding supplies of water. This excludes geothermal aquifers.
Assimilative capacity	. Refer to paragraphs 110-117 of this report.
Audited Self-Management (ASM)	A management programme (individual, industry, or land user collective) which allows for the credible and transparent demonstration (audit) that agreed actions have been implemented (in this instance for water quality).
Authorisation	Resource use that is provided for (or authorised in a legal sense) by, for example: a. National Environmental Standard b. Section 14(3) of the RMA c. permitted activities set out in a regional plan d. water or discharge permits (consents).
Bottom line	A nationally defined minimum (described either numerically or narratively) above which councils must set numeric fresh water state objectives.
Catchment	The total area of land draining into a river, reservoir, or other body of water.

Collaboration/ collaborative approach/collaborative process	Working with a wide range of interested parties in each aspect of a decision-making process, including the development of alternatives and the preferred solution(s). Collaboration provides a greater level of input on the design of the approach and the options and solutions identified than consultation and many other forms of public and sector engagement. Recommendations 15-28 and Appendices 7-10 of the Forum's second report, *Setting Limits for Water Quality and Quantity Freshwater Policy- and Plan-Making Through Collaboration* sets out more fully the Forum's proposed collaborative approach.
Contaminant	Biological (e.g. bacterial and viral pathogens) or chemical (e.g. toxicants) introductions capable of producing an adverse effect in a waterbody.
Critical source area	An area that accounts for the majority of contaminant (e.g. N, P, sediment, E. coli) loss from a field, farm or catchment despite occupying a minority of the field, farm or catchment's area.
Cumulative	Resulting from successive additions at different times or in different ways.
Data standards	Rules with criteria or technical specifications by which data is collected, recorded and represented.
Derogation	The partial removal of a right by a later act that limits its scope or impairs its utility and force. In a water management context it means the actions of one party that adversely affect the rights of another party.
Diffuse discharges	Pollutants sourced from widespread or dispersed sources (e.g. from pasture runoff of animal wastes, fertiliser and sediments, as well as runoff of pollutants from paved surfaces in urban areas). Also called non-point source discharges.
Discharge cap/allowance	The maximum amount of contaminant discharge that is allowed to occur from a property or activity. A cap is set in a plan rule and may apply to sets of properties or activities. An allowance is authorised via consent and may be transferable.
Efficiency	Generally considered to have three concepts: a. **Technical efficiency –** for example, the amount (say, %) of water beneficially used in relation to that taken. It relates to the performance of a water use system, including avoiding water wastage. b. **Allocative efficiency** – relates to water uses resulting in the optimum outcome as water is allocated to the use which has the highest value to society. c. **Dynamic efficiency** – relates to the use of water adjusting over time, in order to maintain or achieve allocative efficiency. **These concepts also apply to the efficiency of use of contaminants.**
Fresh water	Naturally occurring water on the Earth's surface in bogs, wetlands, ponds, lakes, rivers and streams, and underground as **groundwater** in aquifers. This excludes geothermal water.

Good management practice (GMP)	GMP refers to the evolving suite of tools or practical measures that could be put in place at a land user, sector and industry level to assist in achieving community agreed outcomes (in this case for water quality).
Greenfield development	New urban developments (including industrial, commercial and/or residential developments) that extend the urban network onto previously undeveloped rural land.
Groundwater	Water located underground in rock crevices and in the pores of geologic material. It supplies springs and wells. (See 'aquifer'.) This excludes geothermal water.
Headwater seep	A shallow, wet area in the upper tributaries of a river, where the land water margin supports a natural ecosystem of plants and animals that are adapted to wet conditions.
Hydrology/hydrological	The science dealing with the occurrence, circulation, distribution and properties of water.
Integrated catchment management	A process through which people can develop a vision, agree shared values and behaviours, make informed decisions and act together to manage the natural resources of their catchment. Decisions are made at the catchment level by considering the effects on all of the resources and people within the catchment, by integrating science and governance.
Intermittent waterway	A waterway that dries periodically - that periodic drying may range from high frequency long-duration drying to rare occasions of brief drying
Iwi	Tribe.
Limit	The maximum amount of resource use available, which allows a freshwater objective to be met (definition from NPS).
Mātauranga Māori	Māori knowledge originating from Māori practices, observations, science and ancestors, including the Māori world view and perspectives, creativity and cultural practices.
Municipal supply	Water supplied by district councils (or a delegated local government organisation) to users connected to the municipal supply network. Uses include essential drinking and sanitation purposes, and other non-essential purposes (domestic and commercial, such as industrial production, watering gardens, washing cars, firefighting, street washing and maintaining municipal parks and swimming pools).
National Environmental Standard (NES)	Regulations to protect the environment and human health developed under the Resource Management Act 1991. These are binding on local authorities.
National instrument	Includes legislation, national policy statement or regulations.
National Policy Statement for Freshwater Management 2014 (NPS-FM)	The NPS prepared under the Resource Management Act that came into effect on 1 July 2011 and was amended in August 2014.

Nutrient	Minerals needed by plants and animals for growth.
Objective (freshwater objective, environmental state objective)	Describes the intended environmental outcome(s) (definition from NPS). Freshwater objectives are sometimes referred to as **freshwater state objectives**. It describes the desired state of the waterbody, having taken into account all values.
Over-allocation	The situation where the resource: a. has been allocated to users beyond a limit, or b. is being used to a point where a freshwater objective is no longer being met. This applies to both water quantity and quality (definition from NPS).
Paper over-allocation	The situation where the resource is over-allocated in the total resource allocated by consents, but is not over-allocated in terms of the actual use of the resource by consent-holders.
Point source discharge	Discharge of contaminants into a waterbody from a single fixed point, such as a pipe or drain (e.g. from the likes of sewerage, factory and dairy shed outfalls). (See Diffuse discharges.)
Reasonable technical efficiency test	Refers to the Forum's third report (recommendation 40) that ensures that existing users are as efficient as can be reasonably expected given the use to which water is being put and taking the local context into account.
Riparian planting	Planting along the banks of rivers and streams to reduce erosion and pollutant runoff to the waterway.
RMA	Resource Management Act 1991.
Rule	A rule in a regional plan, as prescribed under the RMA (e.g. sections 68, 69 and 70).
Scarcity threshold	A scarcity threshold is a denominated level within the allocable quantum that marks when the remaining water available to be allocated is becoming scarce. This is distinct from a period of dry weather (drought or prolonged dry spell), where existing allocations are restricted. Once a scarcity threshold is reached the catchment is considered to be under demand pressure and all allocation processes need to align with the regime identified in the regional plan.
Sediment/sedimentation	Unconsolidated mineral and organic particulate material in the waterbody.
Spatial	Of, relating to, involving or having the nature of space. For example, areas which are able to be mapped.
Spatial variation	Occurs when a quantity that is measured at different spatial locations exhibits values that differ across the locations.
Standard	An established norm or requirement. It is usually in a formal document that establishes uniform technical criteria, methods, processes and practices. A standard has regulatory force if defined in a regulatory instrument.

Stormwater	Surface water runoff arising from rain storm events. Often refers to runoff from impervious surfaces.
Taonga	Treasured possessions, both tangible and intangible.
Target	A limit which must be met at a defined time in the future. This meaning only applies in the context of over-allocation (definition from NPS).
Technical efficiency	(See Efficiency.)
Territorial authorities	Refers to city and district councils and unitary authorities.
Three waters	Water services provided by territorial authorities, which comprises stormwater, wastewater and municipal supply.
Transfer	The reassignment of an allocation from one person to another. Usually used in the context of the transfer of a resource consent (or part thereof) from one person to another.
Wastewater	Water that has been adversely affected in quality by direct use in an anthropogenic process that is then returned to the environment. E.g. liquid waste discharged by domestic residences, commercial properties, industry and agriculture.
Waterbody	Excludes geothermal water.
Water sensitive urban design (WSUD)	A process that draws on natural hydrological systems in the design of urban areas and the built environment to minimise the negative effects of urban activities on water. WSUD favours stormwater management approaches that mimic the natural environment as closely as possible (such as swales) before resorting to hard engineering approaches (such as stormwater devices or piping). WSUD can be incorporated at the household, street, suburb or catchment level.
Wetland	A wetland, as defined by the RMA, "includes permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions."

Appendices

Appendix 1: Brief summary of earlier Forum recommendations

- The Land and Water Forum noted in its third report:

  All New Zealanders know how important water is to this country and its people – fresh water is one of our primary national advantages. It sustains our unique environment; it supports a wide range of activities which are critical to our economy, including primary production and energy generation; it underpins our social values and our life-style, which attract (and retain) people and skills to the country; it is a key aspect of our reputation abroad, including for tourists and export markets. For iwi, fresh water is a taonga and part of their identity; for all of us, it is deeply embedded in our culture. All these uses and values overlap, and having fresh water of good quality can be just as important as having access to fresh water in large or reliable quantities.

- The Forum came together because we agreed that better water management was critical and that it was in the interests of all stakeholders to explore jointly what that should involve.

- The Forum has produced three reports to the Government on better water and related land management. In our first report we proposed a number of changes to the New Zealand freshwater management system, including recommending that central government should define objectives for the state of our waterbodies, and regional councils should express these objectives as measureable environmental states and link them to catchment-based limits. The report also:

  a. underscored the importance of better water management to ensure limits were met, and highlighted the need for an improved system for allocating fresh water to enable this
  b. proposed governance changes, including to improve the effectiveness of national direction and to recognise the role of iwi as Treaty partners, and as stakeholders
  c. proposed changes to national and regional planning and decision-making processes, including to recognise the potential contribution of rural water infrastructure to achieving social, cultural, environmental and economic objectives
  d. discussed the essential role of science and knowledge in freshwater management, the issue of improving water services management, and issues relating to the management of drainage and flooding.

- One of the key recommendations of our first report was that the Government should promulgate a National Policy Statement for fresh water quickly.

- In our second report, we built on the direction set by the NPS-FM and proposed a national framework by which limits would be set for each catchment. This entailed:

  a. Enhancement of the objectives currently in the NPS-FM to include acknowledgement of the relationships of tangata whenua with fresh water (through the Mana Atua Mana

Tangata framework) and their connections with freshwater objectives, and to expand the scope of existing objectives regarding risks to human health from micro-organisms and toxic contaminants.

b. National direction and guidance (including national 'bottom lines') to frame regional council freshwater state objectives and resource use limits for the taking of water and discharge of contaminants for all waterbodies.
c. The effective control of effects on waterbodies, including cumulative effects, through the transparent and predictable application of and compliance with limits.
d. Discretion for regional councils to set the timeframes and policies for achieving objectives and limits, taking into account the circumstances of each catchment.
e. A collaborative approach being preferred for the development of the freshwater-related components of regional policy statements and related regional plans, including setting objectives and limits (and for freshwater-related national instruments).
f. The involvement of iwi in freshwater management both as decision-makers, and as participants in policy- and plan-making processes.
g. A more agile and integrated policy- and plan-making process that enables minor and technical changes to be made to freshwater-related national and regional instruments in a timely and efficient manner.

- Our third report recommended how the earlier recommendations should be given effect to. It specifically addressed how to manage water quality and allocate water, including ways to ensure that freshwater management encourages investment, incentivises efficient practices and contributes to economic growth. The report noted that:

  a. Prioritisation of at-risk catchments is needed, and that in some cases steps will be needed to prevent further degradation of water quality prior to the development of limits and water quality management frameworks.
  b. All discharges need to be brought within the water management regime, and industry GMP and audited self-management schemes were part of the toolkit for managing water quality.
  c. Water should be encouraged to move to the highest valued use over time through consents to take water being exclusive, non-derogable and effectively enforced.
  d. The transfer of consents to take water should be facilitated through the removal of regulatory barriers.
  e. Scarcity thresholds should identify when a catchment is coming under demand pressure and, once that threshold has been met, all takes in a catchment should be formally accounted for and existing users grandparented into the management framework through a process that ensures that they only get what they need.

Appendix 2: Proposed central government funding criteria

Two sets of criteria are provided. They should be used:

a. to assess whether a central government funding contribution is justified at all
b. to prioritise between competing projects central government should fund.

The criteria for assessing whether a central government funding contribution is justified are:

- Market failure - conventional economic logic suggests that public provision or funding should only be required where there is an obvious market failure that prevents the optimal level of private funding being obtained. Sources of market failure are:
    - externalities
    - public goods
    - coordination failures
    - asymmetric information
    - market power.

- Distributional/equity objectives - another consideration for central government funding or provision is when distributional/equity objectives are best achieved that way. For example, regional projects may also have significant national benefits and it may be seen as fair for everyone to contribute a portion of the funding through taxes.

- National consistency/standardisation - even if there is a good case for public provision/funding, it doesn't necessarily have to come from central government – it can also come from local government or other collectives such as industry bodies or water user groups. Central government funding or provision may be more efficient when:
    - it minimises duplication of effort between councils or other groups
    - there are benefits from standardisation (such as positive network effects).

- Perverse incentives/moral hazard – sometimes the provision of public funding can provide perverse incentives or moral hazard problems. A perverse incentive is when an undesirable outcome is encouraged. Moral hazard occurs when someone takes more risks because the burden of those risks is borne by others. Public provision or funding should be carefully designed to avoid these problems as far as possible.

If the criteria above are met, a second set are still needed for prioritising everything that makes it 'over the line'. These are:

- Value for money – a cost-benefit analysis should be undertaken to determine the bang-for-the-buck central government will get in terms of:
    - economic
    - environmental, and
    - social/cultural outcomes.

- Temporal priority – is central government investment needed now, or can it wait? How big are the opportunity costs of delaying investment?

- Adequacy of other contributions – how adequate is the level of contribution from other sources? e.g:
    - How wealthy is the local community/council?
    - What other funding will be sourced privately or from NGOs?
    - Are land and water users operating at GMP?

Appendix 3: Plenary organisations

Aqualinc Research Ltd, Ballance Agri-Nutrients, Beef + Lamb New Zealand Limited, Business NZ, Contact Energy, DairyNZ, ECO, Ecologic, Environmental Defence Society, Federated Farmers, Federated Mountain Clubs of New Zealand, Fert Research, Fonterra, Forest and Bird, Foundation for Arable Research, Genesis Energy, Horticulture New Zealand, Ihutai Trust, Institute of Public Works Engineering Australasia, Institution of Professional Engineers New Zealand, Irrigation New Zealand, King Country Energy, Lincoln University, Massey University, Meridian Energy, Mighty River Power, MWH, National Institute of Water and Atmospheric Research, New Zealand Farm Forestry Association, New Zealand Forest Owners Association, New Zealand Institute of Forestry, NZ Landcare Trust, New Zealand Winegrowers, Newmont Waihi Gold, Ngati Kahungunu, Oji Fibre Solutions; Opus International Consultants Ltd, Pioneer Generation, Rural Women New Zealand, Spiire, Straterra Inc, Sustainable Business Council, Te Arawa Lakes Trust, Te Rūnanga o Ngāi Tahu, Tourism Industry Association, TrustPower, Tuwharetoa Māori Trust Board, Waikato River Authority, Waikato-Tainui, Water New Zealand, Watercare Services Ltd, Whitewater New Zealand, Wood Processors Association of New Zealand, Zespri.

Active Observers to the Plenary - Auckland Council, Department of Conservation, Department of Internal Affairs, Environment Canterbury, Environment Southland, Ministry for the Environment, Ministry for Primary Industries, New Zealand Conservation Authority, Otago Regional Council, Tasman District Council, Treasury, Waikato Regional Council, Wellington City Council.

Chair, Land and Water Forum - Alastair Bisley.

Appendix 4: Small Group members

Auckland Council (Gael Ogilvie), Beef + Lamb New Zealand (Kirsten Bryant), Contact Energy (Rosemary Dixon), DairyNZ (Carol Barnao, Mike Scarsbrook), Ecologic (Guy Salmon), Environment Canterbury (Ken Taylor), Environment Southland (Rob Phillips), Environmental Defence Society (Madeleine Wright), Federated Farmers (Chris Allen, Ian Mackenzie), Fonterra (Emma Parsons), Forest and Bird (Kevin Hackwell, Chris Todd), Horticulture New Zealand (Chris Keenan), Irrigation New Zealand (Andrew Curtis), Meridian Energy (Hamish Cuthbert), Ministry for the Environment (Guy Beatson, Kay Harrison, Catherine Neill), Ministry for Primary Industries (David Wansbrough, Martin Workman), National Institute of Water and Atmospheric Research (Dr Clive Howard-Williams), New Zealand Forest Owners Association (Brigid Jenkins), Ngati Kahungunu (Ra Smith), Otago Regional Council (Stephen Woodhead), Tasman District Council (Richard Kempthorne),Te Arawa Lakes Trust (Roku Mihinui), Te Rūnanga o Ngāi Tahu (David Perenara-O'Connell, Donna Flavell), Treasury (James Haughton), Tuwharetoa Māori Trust Board (Topia Rameka), Waikato Regional Council (Vaughan Payne), Waikato-Tainui (Julian Williams, Kevin O'Shannessey), Water New Zealand (Peter Whitehouse), Wellington City Council (Haydn Read), Whitewater New Zealand (Hugh Canard).

Appendix 5: Participants supporting the report

Aqualinc Research Ltd, Ballance Agri-Nutrients, Beef + Lamb New Zealand Limited, Business NZ, Contact Energy, DairyNZ, ECO, Ecologic, Environmental Defence Society, Federated Farmers, Federated Mountain Clubs of New Zealand, Fert Research, Fonterra, Foundation for Arable Research, Genesis Energy, Horticulture New Zealand, Ihutai Trust, Institute of Public Works Engineering Australasia, Institution of Professional Engineers New Zealand, Irrigation New Zealand, King Country Energy, Lincoln University, Massey University, Meridian Energy, Mighty River Power, MWH, National Institute of Water and Atmospheric Research, New Zealand Farm Forestry Association, New Zealand Forest Owners Association, New Zealand Institute of Forestry, NZ Landcare Trust, New Zealand Winegrowers, Newmont Waihi Gold, Ngati Kahungunu, Oji Fibre Solutions; Opus International Consultants Ltd, Pioneer Generation, Rural Women New Zealand, Spiire, Straterra Inc, Sustainable Business Council, Te Arawa Lakes Trust, Te Rūnanga o Ngāi Tahu, Tourism Industry Association, TrustPower, Tuwharetoa Māori Trust Board, Waikato River Authority, Waikato-Tainui, Water New Zealand, Watercare Services Ltd, Whitewater New Zealand, Wood Processors Association of New Zealand, Zespri.

Appendix 6: Flexi-Group members

Flexigroup 1 - Core elements and nature of rights

Jeremy Stevenson-Wright (Chair) (Genesis)
David Perenara-O'Connell (Ngai Tahu)
Jim Sinner (Cawthron)
Stephen Colson (Mighty River Power)
John Pask (Business NZ)
Charlotte Rutherford (Fonterra)
Andrew Curtis (Irrigation NZ)
Jonathon Streat (Greater Wellington)
Kevin Guerin (MfE)
Peter Nelson (MfE)

Flexigroup 2 - Allocation of Contaminants

Paul le Miere (Chair) (Federated Farmers)
Philip Mladenov (Fert Research)
Chris Keenan (Horticulture NZ)
Billy Brough (Brough Resource Management)
Corina Jordan (Fish & Game)
Sue Ruston (Fonterra)
Sally Strang (Hancock Forest Management)

Ben O'Brien (Beef + Lamb)
Chris McLay (Waikato Regional Council)
Darran Austin (MPI)

Flexigroup 3 – Quality: Other management tools, Mitigation and GMP

Jon Roygard (Chair) (Horizons Regional Council)
James Ryan / Shirley Hayward (DairyNZ)
Alison Dewes (Headlands Consulting)
Brigid Jenkins (NZFOA)
Dave Bull (Golder)
Matt Harcombe (Beef+Lamb)
Jamie Falloon (Federated Farmers)
Matt Dolan (Horticulture NZ)
Oliver Hendrickson (MPI)

Flexigroup 4 – Urban issues

Jenni Vernon (Chair) (Waikato River Authority)
Peter Whitehouse (Water NZ)
Garry Maskill (Watercare)
Kevin O'Shannessey (Waikato-Tainui)
Chris Livesey (ECO)
Chris Keenan (Horticulture NZ)
Greg Holland (Auckland Council)
Kirsten Forsyth (MfE)

Flexigroup 5 - Implementation of Water Allocation

Billy Brough (Chair) (Brough Resource Management)
Jens Rekker (Whitewater NZ)
Laura Marra (Trustpower)
Mark Henry (Mighty River Power)
Cathy Begley (Federated Farmers)
Andrew Curtis (Irrigation NZ)
Peter Weir (NZFOA)
Mary Anne Baker (Tasman District Council)
Peter Nelson (MfE)

Flexigroup 6 – Stock exclusion

Mike Scarsbrook (Chair) (Dairy NZ)
Kirsten Bryant (Beef + Lamb)
Chris Allen (Federated Farmers)
Corina Jordan (Fish and Game)
Simon Stokes (Environment Bay of Plenty)
Fiona Pearce (MPI)

Flexigroup 7 – Over-allocation

Christina Robb (Chair) (Environment Canterbury)
Laura Marra (Trustpower)
Chris Keenan (Hort NZ)
Ra Smith (Ngati Kahungunu)
Guy Salmon (Ecologic)
Andrew Curtis (Irrigation NZ)
Sue Ruston (Fonterra)
Cathy Begley (Federated Farmers)
Philip Millichamp (Oji Fibre Solutions)
Irene Parminter (MPI/MfE)

Appendix 7: Land and Water Trust and Secretariat

Trustees of the Land and Water Trust - Alastair Bisley (Chair Land and Water Forum), Ian Mackenzie (Federated Farmers) to July 2015, Kevin Hackwell (Forest and Bird), Kirsten Bryant (Beef and Lamb) from July 2015, and Roku Mihinui (Te Arawa Lakes Trust).

Secretariat - Alastair Patrick, Alastair Smaill, Andrew Schollum, Andrew Sweet, Anya Pollock, Dieter Katz, Jennie McMurran, Lillian Fougere, Natalie Crane and William McGimpsey.

Appendix 8: Thanks

Thanks to Ministry for the Environment for office space, meeting rooms and support, to Water New Zealand for the provision of accounting and payroll services, and to Meridian Energy, Beef+Lamb New Zealand, Buddle Findlay, Fonterra, Genesis Energy, Wellington City Council, Horticulture NZ, Martin Jenkins, Ministry for Primary Industries, NIWA, Waikato River Authority and WaterCare for providing the use of meeting rooms and video conference facilities.

Thanks to Glen Lauder for his assistance and guidance.

Thanks to Jim Sinner for his contribution to the Forum and its working groups.

Thanks also to the range of people and knowledge organisations that gave freely of their time and resources to assist the Forum and its working groups, including those below:

Science Workshop:
Ton Snelder (Ministry for the Environment)
Scott Larned (NIWA)
John Quinn (NIWA)
John Bright (Aqualinc)
David Hamilton (University of Waikato)
Rich McDowell (AgResearch)
Martin Neale (Golder Associates)
Graham Sevicke-Jones (Greater Wellington Regional Council)
Ken Taylor (Environment Canterbury)
Justine Young (Waikato Regional Council)
Viv Smith (Ministry of Business, Innovation and Employment)

Economics Workshop:
Doug Watt (Electricity Authority)
Geoff Simmons (Morgan Foundation)
Suzi Kerr (Motu Economic and Public Policy Research)
Andrew Sweet (Firecone)
Suzie Greenhalgh (Landcare Research)
John Ballingall (NZIER)
Alistair Mowat (Ministry for Primary Industries)
Dr Paul Dalziel (Lincoln University)
John Yeabsley (NZIER)
Dieter Katz (Treasury)
Emma Moran (Environment Southland)
Blair Keenan (Waikato Regional Council)
Chris Parker (Auckland Council)