Policy Evaluation Report: Freshwater Quality

The Very Short Version

This is an evaluation of whether implementing the One Plan is achieving water quality objectives. By necessity, it is based on whether from our recent experience, implementation of the One Plan's policies and methods can reasonably be expected to achieve its water quality objectives, not their observed impact on freshwater quality. This is because it is too early to tell how water quality is responding to implementation.

The evaluation does not focus on implementation. Opportunities to improve implementation identified during the evaluation will be dealt with separately.

Many aspects of the Plan are working as expected, especially where they are business as usual following on from the first generation plans and the beneficial effects of improvements are immediately measureable in the waterway. However, the evaluation has also identified aspects that require review that will almost certainly result in initiation of a plan change.

Work is required to further align the Plan with the NPSFM. The Plan, although using a similar water quality framework to identify over-allocation and those resource uses needing management, does not explicitly state the equivalent of NPSFM limits or targets, nor does it explicitly state timeframes for addressing over-allocation where it is identified. Creating a clearer connection between intended outcomes, through targets and timeframes, to policy interventions will add value to our Plan.

The main issue with existing One Plan policies in relation to freshwater quality is with management of diffuse sources of contaminants from agriculture. This is not a surprise given the innovative nature of the management regime. Moreover, it relies on the interaction of two different models (LUC and OVERSEER), each with different assumptions. While model version change should not fundamentally undermine the regime, OVERSEER version changes have highlighted those divergent assumptions and the inherent uncertainty in OVERSEER itself. Use of models (OVERSEER included) is unavoidable; reliance on the interface between two of them in such a strict numerical fashion produces arbitrary outcomes at a consent level that are at odds with the Plan's policy objectives. This exacerbates the fact that the N-allocation regime (bearing in mind the 4yr rule) is more precise than is warranted by the catchment load estimates that underpin it. Implementation of the framework is especially problematic for commercial vegetable growing and cropping. Alternatives to this set of policies and rules should therefore be considered.

For point source discharges of wastewater, the major issue for policy effectiveness is the sheer volume of work to be completed by territorial authorities in obtaining resource consents for treated sewage effluent discharges. It cannot be expected that local water quality and public perception will improve before that happens.

It is noted that the work done to further align the One Plan with the NPSFM is also a pre-requisite for reviewing those parts of the Plan identified in this evaluation as requiring further attention.

Purpose & process

Learning from experience is essential if we wish our decisions in the future to improve on those made in the past. Evaluation is the term used in a policy context to describe this process of reviewing the effectiveness and efficiency of existing interventions in achieving results. Section 35 of the RMA requires every local authority to monitor the effectiveness of the policies, rules and other methods in its policy statement and plans and to prepare a report on the results of this monitoring every five years. It is a necessary precursor to developing new plans: if the reasons behind difficulties with current plans are not properly understood, changes in policy cannot reasonably be expected to overcome them.

The topic of this evaluation is management of freshwater quality. This topic was chosen for a number of reasons:

- the need to review the Plan against the 2014 version of the NPSFM;
- practical difficulties implementing intensive land-use provisions in the Plan; and
- high public interest.

Key questions have been about the consistency of the plan's objectives, policies and methods; whether assumptions underpinning the Plan remain valid; and whether the Plan can reasonably be implemented.

Ideally, evaluation would draw on evidence to show whether or not the Plan is achieving its intended outcomes. Freshwater management is a long-term challenge that demands action in the short term. The ultimate test is whether policy interventions are enhancing poor water quality and maintaining good water quality. However, it may take years, decades, or even centuries to see changes in water quality that might result from a particular intervention. In some cases we may never be able to reliably attribute these changes to current policy interventions. We must nonetheless make a start, because given both strong public interest and the potential impact on our communities, we need to check that our policies are both environmentally effective and economically efficient. For these reasons, we have not waited for evidence of water quality outcomes to evaluate whether the relevant parts of the Plan are having the intended environmental results, but have rather sought to understand whether the Plan's policies and rules can reasonably be expected to achieve its objectives. As the evaluation progressed, the focus turned to management of land use in relation to freshwater quality and the implementation of the One Plan rules related to nitrogen leaching from intensive land use. Reported teething problems with this new management regime made undertaking an in-depth evaluation of its efficiency and effectiveness both timely and prudent, and as a consequence the document is weighted toward evaluation of the nitrogen leaching management provisions.

The One Plan sets out to maintain or enhance freshwater quality to safeguard life-supporting capacity and support Schedule B Freshwater Management Values. Recent analysis of ten year trends in surface water quality shows improvement in multiple indicators across a number of sites in the Region. The removal of direct discharges of stock effluent to waterways, and continued upgrade of wastewater treatment plants around the Region, are examples of measures that Horizons and consent holders have taken to improve water quality in the last ten years. It would be convenient to assume there is a direct relationship between this work and the observed trend of improvement, however, doing this without considering other factors that may also contribute to this outcome is a risky proposition.

It is of note that, while the majority of sites throughout the Region are above the bottom line specified in the NPSFM, many do not meet the surface water quality targets in the One Plan for the

same measures. This demonstrates the higher bar the One Plan sets for water quality targets in the Region, e.g., swimming versus wading water quality.

Timeframes by which water quality improvements are to be achieved are not specified in the One Plan, although several methods (regulatory and non-regulatory) do have timeframes attached to them.

While this evaluation must necessarily take into account our experience of implementation, it is not a review of implementation. Implementation of aspects of the One Plan has proven difficult, and diverged in places from the approach envisaged by the plan. The evaluation proceeds from an understanding of where difficulties have arisen, and why adjustments in approach have been made, in order to understand the opportunities to improve the Plan itself.

This body of work has been led by the policy team, with input from consents, science, freshwater, and rural advice. It is underpinned by Horizons' science programme focused on SOE monitoring and policy effectiveness, and the programme of policy implementation monitoring established this year. Stakeholders involved in freshwater consenting processes (e.g., district councils; Dairy NZ) were invited to comment, as were iwi across the region. Responses were received from two stakeholders and six iwi groups.

This paper summarises a much larger body of analysis and thinking. It is intended for Horizons staff, with the purpose of reaching a shared understanding of which pieces of the One Plan are working well, and which provisions need review. The final sections of the paper signal how we might approach that review. It is anticipated that this summary – subject to refinement – will then form the basis of advice to the new Council on freshwater policy.

This evaluation has not addressed the One Plan approach for the management of sediment, but the strong link between management of sediment sources and achieving overall outcomes for water quality is acknowledged. This topic will be considered in a separate, but complementary evaluation report.

Our Freshwater Management Framework

NPSFM: Values, Objectives, Limits, Targets, and Timeframes

An analysis of NPSFM compliance was provided to Council in December 2015. This part of the evaluation focuses on the main areas identified as requiring further work.

The starting point for the NPSFM is the values associated with a water body, and the (numerical) parameters required to protect them. These are largely covered by the One Plan in Schedules B & E. There is only really one anomaly that will need to be addressed in due course. The One Plan lacks a particular measure for cyanobacteria in lakes. When we do decide to address this, though, there will be several other points to consider:

- Additional measures are likely to be added to the NOF in the next iteration of the NPSFM;
- The One Plan lacks specific values and objectives for groundwater;
- Feedback from iwi suggests that greater weight should be given to cultural values, e.g., trout fishery and trout spawning are identified as Surface Water Management Values, but Values relating to tuna and koura are not.

In addition, we will need to check the calibration between numerical objectives and the values they seek to protect, particularly given the rapid pace at which our scientific knowledge and

understanding of catchment processes is developing. It would also make sense to align terminology in the One Plan with the language of the NPSFM in order to avoid unnecessary confusion.

The NPSFM requires that regional plans set limits for all Freshwater Management Units (FMUs), and establish methods to avoid over-allocation or bring over-allocated resources back within allocation over a specified timeframe. While the language differs slightly, this applies to both freshwater quality and freshwater quantity. A NPSFM limit is defined as "*the maximum amount of resource use available, which allows a freshwater objective to be met*". A NPSFM target is defined as "*a limit that must be met at a defined time in the future."* A NPSFM target is basically the limit one aims for when resource accounting demonstrates that the resource is over-allocated and the resource users responsible need to be managed to bring it back within allocation.

It is, perhaps, more helpful to think in terms of takes and discharges than 'use' of quantity and quality. A limit is, in essence, the maximum amount of abstraction or discharge that the FMU can assimilate while still achieving freshwater objectives.

There has been debate about whether One Plan Table 14.2 (cumulative nitrogen leaching maximums) can be considered to contain NPSFM limits or targets. Table 14.2 provides the means of identifying on-farm limits or targets for consideration of consent applications made by intensive farming land users. It is also used as a standard (limit) for controlled activities (Rules 14-1 and 14-3) and a matter over which council has reserved discretion (a target) when processing restricted discretionary activities (Rules 14-2 and 14-4). Cumulative nitrogen leaching maximums could be considered NPSFM limits or targets if it is plausible that the NPSFM is to be applied at a farm scale level. There is no strong evidence that this is the intent. The basic spatial scale for setting objectives and limits and for freshwater accounting in the NPSFM is the FMU. This is defined as a waterbody, multiple water bodies or any part of a waterbody. It is also evident that the limit or target defines the allocation available to all resource users, e.g., non-point source and point source dischargers. It seems more likely that Table 14.2 is a means to an end, not an NPSFM limit or target itself.

This begs the question how targeted WMSZs where nitrogen leaching must be controlled were identified if there are no limits or targets specified in the One Plan. The answer is that a process similar to that contemplated by the NPSFM was used. One Plan Schedule E *Surface Water Quality Targets* were used to identify WMSZs with SIN problems and calculate SIN loads (equivalent to NPSFM limits) that allow freshwater objectives to be met. These were compared to the actual SIN loads in the river to confirm over-allocation and subsequent resource accounting identified management options to reduce nitrogen inputs. This information is available from technical documents and expert evidence prepared and presented at Hearings during the formal planning process.

The Mangatainoka River at SH2 can be used as a case study[1]:

1. Average Standard Load limit (calculated from Schedule E *Water Quality Target* 0.444 g/m^3 and river flow records) = 264 tonnes SIN per year [equivalent to NPSFM limit or target];
2. Current Measured Load = 542 tonnes SIN per year;
3. Difference shows WMSZ is over-allocated by 278 tonnes SIN per year;
4. Resource accounting of nitrogen sources demonstrates that point source contribution to current load is 4 tonnes SIN per year and non-point source contribution is 538 tonnes SIN per year; and

[1] *Supplementary Statement by Jon Roygard and Maree Clark on Nutrient Load Scenarios and Methodology*, 24 February 2012. Evidence to Environment Court.

5. Further analysis of non-point sources indicates that controlling intensive farming land use is the best option to address over allocation

Clearly, though, we still have work to do in this area. The One Plan, although using a similar water quality framework to identify over-allocation, does not explicitly state the equivalent of NPSFM limits or targets, nor does it explicitly state timeframes for addressing over-allocation where it is identified.

Additionally, as important as nitrogen undoubtedly is, it is questionable whether limiting nitrogen alone places controls on resource use such that freshwater objectives will be met. Some contributors to freshwater quality are more amenable to quantification as limits than others: flows, nitrogen, and sediment, clearly; perhaps E. Coli (expressed as a cell density, rather than a total load); but it is harder to see how a 'limit' would be either feasible or useful for MCI (an indicator of stream health using macroinvertebrate species presence) or the use of riparian vegetation, for example.

Limits are ultimately only one of the tools in the toolbox. On the one hand, while we need to think more broadly than nitrogen; on the other, we need to be careful to only apply limits where they are useful in meeting objectives. Horizons is not starting from scratch. The One Plan provides a foundation on which we can build as we establish contaminant accounting systems and develop appropriate catchment strategies to manage allocation limits. This work, carried out in conjunction with the Science Team, will be crucial to understand the dynamics of each waterbody, which discharges should be limited, and at what level.

Where limits are not currently being met, they are deemed to be 'targets' and timeframes are required to be set for their achievement. Table 14.2 includes a series of time bound leaching targets for intensive agriculture. In this regard, though, it has a problem: the leaching rates in the table were never expected to achieve instream objectives. In fact, in the Mangatainoka the modelled year 20 overall in-river SIN load from implementing Table 14.2(assuming 18% expansion of dairy farming) is roughly double the load that was estimated to achieve the instream concentrations Schedule E seeks (480 tonnes SIN/yr vs 264 tonnes SIN/yr).[2] The Table 14.2 numbers are the targets the Court decided, based on the evidence at the time, were achievable in the foreseeable future, on the way to attaining instream objectives at some point in the more distant future.

What is lacking is a clear statement of the total acceptable loads of key contaminants (NPSFM limits) for each FMU (or possibly part-FMU) and, where those loads are currently exceeded, a date by which each is to be met. Those dates may well be fifty years hence. By making them explicit we not only comply with the NPSFM, but also avoid misunderstanding about what is expected to be achieved within the lifetime of the Plan.

Regulatory and non-regulatory methods

Both in terms of NPSFM requirements and evaluating the effectiveness of our current plan, a central question is whether the Plan provides the right suite of tools to achieve freshwater outcomes. Those tools need not take the form of rules – indeed the best interventions often do not – but they do need to provide an effective response to the issues as we understand them.

Horizons took an approach of picking issues in the One Plan where the biggest gains could be made, e.g., managing intensive land uses and wastewater as top implementation priorities to address SIN through the rules in the Regional Plan, and employing non-regulatory methods like SLUI to address

[2] *Response to Dr Ledgard's Second Supplementary Statement of evidence by Dr Jon Roygard and Ms Maree Clark*, 16 May 2012. Evidence to Environment Court.

sediment loads. This is not inconsistent with the NPSFM, i.e., identifying the key issue or issues, prioritising the management approaches that would give the biggest gains, and taking steps towards addressing the problem.

One of the challenges of any plan is that these issues, and our understanding of them, continues to evolve. At the time the One Plan was developed, there was a heavy focus on nitrogen, bacteria and sediment – probably rightly so. As our understanding of the dynamics of freshwater systems develops, we will need to look at how well the suite of regulatory and non-regulatory tools we have available allows us to manage them. For example, emerging science around the drivers of periphyton growth suggests that processes relating to algae growth and proliferation are complex – substrate, flow rate and instream nutrient cycling processes can also play a significant role in where algae grows, or doesn't. Research into these mechanisms in currently underway and is being carried out in tandem with catchment accounting work to ensure that any explicit limits and/or targets developed in future are likely to achieve the desired outcome.

The evaluation raises some basic questions about effectiveness of some of the policy provisions and methods for freshwater management in the One Plan. For example, is the One Plan effective in addressing:

1. the right sources in targeted WMSZs;
2. all over-allocated contaminants in targeted WMSZs
3. contaminants in non-targeted WMSZs identified as over-allocated or under pressure

The work identified to set explicit limits and revisit resource accounting in WMSZs is a precursor to answering and responding to these questions.

The recent focus on swimmable water is a good example. Since the One Plan came into being, there has been increased attention nationally on swimmable water and public health outcomes. It is clear from water quality information that swimmability is compromised some of the time at most, if not all, swim spots. Some of these are not in targeted WMSZs, so some of the spin-off benefits of managing intensive farming land use are not available in those WMSZs. Although point source discharges are regulated in non-target WMSZs, the Plan is potentially less effectiveness in providing for this Value because some management options such as stock exclusion are not available in non-targeted WMSZs.

If target catchments are retained for nutrient management, there may be merit in considering a similar system for pathogen management in non-target WMSZs.

It is an appropriate to note that there is a greater emphasis on non-regulatory methods to manage water quality in non-targeted WMSZs and in our experience the effectiveness of these methods can be dependent on finding willing landowners and resource users with the financial capability for co-funding environmental enhancement. Given uptake can be limited by the economic climate of the day, one potential evaluation outcome is to give consideration to changes in funding models to encourage faster uptake of non-regulatory measures.

Point-source discharges

Treated Sewage Discharges

The water quality framework in the One Plan has effectively been in place, had weight, and been applied during all decision-making on applications for consents to discharge since the Plan was

notified in May 2007. Approximately 134 resource consents to discharge have been granted in that time. Consent conditions for these consents have been crafted to either maintain good or enhance poor water quality after assessment under the water quality framework in the One Plan. This should by definition, result in measureable outcomes in receiving waters that are aligned to One Plan objectives to maintain good and enhance poor water quality.

Policy 5-11 of the One Plan sets a target of 2020 for treated human sewage discharges to water to be applied to land, pass overland, or other alternative systems adequate to mitigate adverse effects on the receiving waterbody's mauri. This is supported by methods to work with TAs to reduce water volume, explore land application options and assist with funding opportunities.

There are 45 municipal plants discharging wastewater (including treated sewage). Thirty-three of these hold consents to discharge to freshwater. Eight of these were granted after the Plan was notified in 2007. Thirteen (39%) are at various stages of progress towards re-consenting. A further 8 (24%) are due to expire before 2020. Although Tararua, Manawatū and Horowhenua Districts have secured central government support for upgrades to some of their wastewater treatment plants through the Fresh Start for Fresh Water and Manawatū River Accord funds, realistically, the timeframe of 2020 in Policy 5-11 will not be met in many instances. Like the wider question of targets and timeframes, this is a challenge in terms of community expectations of how much progress can be made within a relatively short period of time and the financial consequences of doing so.

The policy intent remains appropriate, but the scale of the task is daunting for territorial authorities required to upgrade their plants, and for the regional council's ability to process what in some cases are very resource hungry consent applications. Whilst the numbers may not be large, the complexity and contestability is high and the fact a number of these applications will proceed to appeal, quick resolution of these applications does not happen. The challenge is how to keep these applications moving forward, while protected by s124 of the RMA which allows a consent holder to continue operating under an expired consent while applying for a new one. The Environment Court has already recorded that it considers use of s124 to allow wastewater treatment plants to continue to operate for too long under outdated management schemes is an abuse of the RMA[3].

A more strategic conversation may be required - beyond the regulatory process - about how to accelerate progress.

Domestic wastewater

Management of on-site domestic wastewater disposal is a permitted activity provided good practice design and management guidelines are followed. The intent of the rule framework is to raise the standard of wastewater disposal to mitigate effects on groundwater quality in leaky soils and address situations where system failure or soils with poor drainage results in overflows into local waterways. There are some difficulties in resourcing implementation because:

- Assessment of new system designs meeting Permitted Activity standards is not cost recoverable (This is or will be an issue for any Permitted Activity that requires a level of compliance checking and is confirmed by the experience of regional councils implementing a similar regime for management of nutrients); and
- There is, to date, a reluctance by some territorial authorities to take responsibility for auditing new systems while carrying out building inspections.

[3] See paragraph 14 of [2016] NZEncC 53

Despite these implementation issues the rule is working as planned. New on-site wastewater systems and those that require upgrading are being designed and installed to comply with the Permitted Activity good practice guideline or hold consents with conditions to achieve the same purpose.

On the basis that these improvements have environmental benefits the policy approach is effective. However, there is a very real challenge in getting direct evidence that implementation of the on-site wastewater rule framework is having a beneficial effect on groundwater quality or remedying the effects of systems that overflow into local waterways. This is one instance where we may never be able to reliably sheet home changes in water quality to the management intervention being implemented, but if it is considered important we need to decide how monitoring of environmental outcomes can be done effectively.

Regulating intensive land use

While the NPSFM requires councils to set catchment (FMU) limits, it does not prescribe the methods used to meet those limits. That is left up to councils. The method used to control nitrogen leaching in targeted WMSZs in the One Plan does this is by prioritising intensive land-uses in target catchments and allocating nitrogen to them, through a consenting regime, based on land-use capability (LUC). Our experience from implementation so far has resulted in a number of questions about the effectiveness of this approach:

- Do we still understand nitrogen to be the key factor requiring – and amenable to – a regulatory intervention?
- Are the target catchments still the areas that require management of diffuse nitrogen?
- Are there additional areas of the Region that require management of diffuse nitrogen?
- Are cumulative nitrogen leaching maximums set at the right levels in light of changes to Overseer?
- Is it fair and effective to focus on intensive land uses; is the definition of intensive land use correct?
- Is the natural capital/LUC approach an effective allocation mechanism?
- Are we seeing the water quality improvements we expected to see by regulating nitrogen leaching in targeted WMSZs or is it too early to tell?

The first of these questions has largely been addressed above: nitrogen remains a key element in freshwater quality, albeit not the only one; further work is required on how and whether other contaminants (*E. Coli*, sediment, phosphorus) should be more closely controlled. Similarly, answering the second and third questions requires completion of catchment accounting work. Through the consenting process, there is some doubt about the effectiveness of / requirement for regulation of nitrogen leaching in the Coastal Rangitikei (discussed below); conversely, after revisiting limit setting and resource accounting in FMUs there may be a case for managing diffuse sources as well as point sources in other catchments.

Presently, the contribution of groundwater inflow to many of the coastal lakes is yet to be determined. If the groundwater capture zones for some / all coastal lakes extend beyond their surface catchments , and attenuation processes are unable to reduce nutrient inputs to a suitable level prior to discharging into the lakes, targeting a wider area connected to the groundwater may be needed, not just the local WMSZ.

A related equity question, often raised by farmers in target catchments, is: why don't the rules apply to the whole region?

Definition of Intensive Land Use

Two particular difficulties have arisen with the definition of intensive land use in the Plan as it has been implemented. The first is what it misses: the treatment of dairy support / runoffs is ambiguous, while criticism regularly arises that the rules do not apply to (beef) feedlots. Feedlots are essentially relatively small land areas with exceptionally high stocking rates (as high as 80 cattle per h.a.) and at face value are hotspots for non-point source runoff of nutrients, bacteria and sediment. This farming practice was not heavily scrutinised during One Plan development, but is identified in this evaluation as one that is essentially unregulated and requiring attention in the future.

The second issue with the definition relates to cropping, and to some degree, to horticulture. The assumption in the way the plan approaches 'existing' intensive land use is generally fine for dairy and irrigated drystock farms: infrastructure investment means that the footprint concerned is stable from one year to the next. This assumption is less true for horticulture – where the blocks of land an operator leases may change from year to year, but the general envelope of horticultural land (across all operators) remains relatively constant – and not at all true for cropping. The area, type, and location of crops vary wildly from one year to the next, depending on market conditions. Under these circumstances, differentiating between an 'existing use' and a 'conversion', and producing a 'baseline' OVERSEER file, are essentially fictions. 'Global consents' offer a possible solution within the construct of the present plan, although more work will need to be done assessing efficiency and effectiveness.

If on review, it is confirmed that these land uses require regulation, Permitted Activity 'good management' conditions may provide a more practicable solution than consents that require judgements about what constitutes an 'existing' land use, and which land parcel should be covered in an application.

In considering the intensive land use rules, the Environment Court noted that although out of scope, inclusion of extensive sheep and beef in the regulatory framework was desirable; equity among land users and sustainable management would be enhanced. Whether exclusion of extensive land-uses more generally is effective or fair is a question best answered once we have revisited catchment accounting: while dry stock represents about half the load in target catchments, this has not changed significantly since the One Plan was developed.

It should be noted that Table 14.2 was adopted specifically as a means of limiting and allocating nitrogen leaching from a specific set of intensive land uses: if, for example, the table was applied in its current form to all land uses in the Upper Manawatū or Mangatainoka, and sheep and beef farms increased leaching to the maxima, SIN over-allocation would increase and water quality would decline.

Meeting the Table

Table 14.2 performs three functions in the One Plan. It partially sets limits on resource use, operates as a gateway between Controlled and Restricted Discretionary consenting pathways, and it provides an allocation mechanism, based on LUC.

Given the potential for real or modeled changes in leaching rates over the life of a consent, use of leaching rates as a drafting gate between different consenting pathways is discouraged by guidance on the use of OVERSEER in regulation, released in August 2016. Experience through implementing the consenting processes has been that it introduces a range of 'what if' scenarios, which generate unnecessary uncertainty and do nothing for applicant confidence in the process.

LUC was one of a range of approaches considered by the Environment Court to manage nitrogen leaching. By allowing higher leaching from better classes of land, it seeks to provide for the best economic use of the most productive land, while also reducing the impact of agriculture on the environment. This reflects the higher-level intent of Policy 5-8.

In establishing this framework, the council and Court understood that all farms would need to make some level of effort to achieve year 20 targets, but that this would be practical and affordable for "most farms" – estimated to be around 80 percent in 2007/08 when the modelling was done.

In implementing the plan (from 2014), typical modelled leaching rates have been found to be both significantly higher and more variable than the evidence before the Court anticipated. Of seventy consents so far issued in the Mangatainoka, not one has met the controlled activity conditions. Although this catchment is unlikely to be typical of the region as a whole, it is the area that was subject to most intense scrutiny during Plan development.

At least some of the reason for this is that LUC and OVERSEER reflect soils and rainfall differently – a divergence that appears to have been exacerbated by updates to OVERSEER since the One Plan development process. LUC considers the physical limitations of soil, including wetness (lack of inherent drainage) and climate factors in the context of suitability or versatility for productive use(s). A core element of OVERSEER, meanwhile, is its 'drainage model', which draws on both soil and climatic data. The drainage model was overhauled between versions 5.4 and 6.0, resulting in significant swings in estimated leaching rates. This has seriously undermined public and council confidence in OVERSEER modelling used in the consenting process.

The use of OVERSEER to model leaching estimates was not a major point of contention at the Environment Court, although Horticulture NZ did express reservations about its applicability to horticulture at that time. Whether Table 14.2 and future modelling should have been linked to a particular version of OVERSEER was tested in the High Court, which found that there was no error in law using a generic reference in the One Plan.

However, recent work at a national level by regional councils evaluating the use of OVERSEER under the RMA cautions the planning community on its use without robust mechanisms to deal with model uncertainty and model version changes, especially where its outputs are contemplated as a regulatory tool[4]. The reason is that the rules are not responsive to changes in the tool through which they were to be given effect. While it is to be hoped that the uncertainty (and the variability between versions) in the OVERSEER model will reduce over time, the leaching rates it estimates will continue to change as the model improves.

A second possible factor in divergence from expected on-farm leaching rates and those in the table is that typical leaching rates may have changed due to dairy intensification between 2008 and 2014. The current period of depressed international dairy prices make it easy to forget that high prices were driving a move to higher-input, higher-intensity farm systems until just a few years ago. A very cursory analysis of changes in stocking rates in the Tararua District over this period shows no net increase – but the information readily at hand is too coarse to draw any real conclusions about whether intensification is a factor. The question is important because, if intensification has (even partially) driven the gap in leaching rates between the table and consent applications, it suggests that the challenge is not (just) one of imperfect modelling tools, but of increasing pressure on the environment. For the Mangatainoka, review of the first 35 consents modelled 8 percent improvement from those consents in river SIN load – roughly the rate the Plan sought. The question

[4] Freemann, M, et al, 2016: *Using OVERSEER – technical resources and guidance for the appropriate and consistent use of OVERSEER by regional councils*, August 2016.

is whether, in real-world terms, that reduction is from the same starting point as the Court understood it to be.

Implementation of intensive farming land use consents in the Coastal Rangitikei has shown that substantially more than half of farms meet the table, with some having considerable 'headroom' for intensification. The purpose of controlling intensive land uses is to reduce nitrogen leaching so that SIN over-allocation observed in the river is bought back toward the sustainable load for the WMSZ. Based on the results of implementation, inclusion of the Coastal Rangitikei as a targeted WMSZ in the One Plan does not appear to be an effective way of achieving this. Implementation may be seen as an unnecessary cost being imposed on applicants and ratepayers by requiring consents of landowners who are not having any significant impact on the environment.

Detailed catchment accounting work in the Rangitikei is now close to completion, and will enable us to review WMSZ limits, re-assess whether there is over-allocation, confirm key sources of contaminants that need to be managed, and what that implies for the One Plan. This may be more about the assumptions underpinning the calculation of catchment loads than anything to do with OVERSEER version changes. For example, recent research in the Mangatainoka and Upper Manawatū highlights the variation in sub-surface attenuation of nitrogen depending on the catchment characteristics (including both soil and geology). In the One Plan modelling, attenuation between source (land use) and receptor (river) was assumed to be 50% - in other words, half of the nitrate-nitrogen input on the farm is attenuated (converted to harmless forms of nitrogen) on the way to the river. While this percentage may be broadly true for some catchments, preliminary nutrient accounting in the Rangitikei catchment suggests attenuation of around 85-90% of nitrogen inputs between farm and river. This has significant implications for the current consenting framework, and its implementation. The question then arises as to the necessity of limiting nitrogen loss from farm, if the natural environment has the capacity to assimilate it.

The inevitable conclusion is that the use of Table 14.2 and its relationship with OVERSEER has not been effective as an allocation method. It is important to note that this is a comment on the situation in practice. While further research would be required to separate this from the question of whether it *could* be an effective allocation mechanism in principle, emerging science suggests that there is an array of other factors (beyond LUC) that could be taken into account when establishing an effective and efficient nitrogen allocation framework. While it remains an attractive approach from a policy perspective, given the technical difficulties, some change in approach appears necessary. Indeed, there is growing scepticism nationally about the role of hard nitrogen numbers in achieving freshwater outcomes.

It may be that something analogous to Canterbury's Matrix of Good Management (in which LUC target rates are dynamically linked to catchment loads and updates to the model by which compliance will be assessed), or Southland's physiographic units (which link soils, geology and climate more explicitly with environmental risks), could provide a more effective allocation mechanism. International examples, such as Denmark's nitrogen reduction classes (Ernstsen et al., 2008), also offer an alternative allocation framework based on the identification of nitrogen attenuation capacity within different catchments.

Matters of Discretion

Because so many consent applications processed to date have been so far above the cumulative nitrogen leaching rate maximums in the table, with little apparent prospect of reaching it, most consents have been processed under the Restricted Discretionary Rule stream. In this case, the distance from the table is one of several matters of discretion. In simple terms, consent planners are

required to consider which set of conditions represent a fair and practicable level of effort on the part of the applicant to reduce the environmental impact of their farming operation.

How do we, as the regulator, assess a fair level of effort? Planners and Rural Advisors have struggled to find robust criteria, given the specificity of particular farming operations and particular receiving environments. ECan has led work with industry to develop national good management practice. While valuable, this work remains difficult to incorporate into a regulatory regime since good management practice lacks specificity and will be subject to ongoing improvement (from 'good' to 'better') over time. Nonetheless, in light of the challenges of using nitrogen thresholds the role of good management practice warrants closer attention.

In the case of horticulture and cropping, the difficulties of either applying OVERSEER or an alternative, and developing agreed good practice guidelines are such that progress with consenting has been slow. At the time of writing, approaches which the consents and rural advice teams, and the respective sectors, consider workable are being rolled out. Although two consents have been granted for commercial vegetable growing, it is too soon to tell whether the approaches will be effective.

In the case of dairy farming, Horizons finds itself in the position of trying to assess the affordability of individual mitigations for individual farming operations – a task for which we lack to tools, information, or mandate. We are, in effect, trying to implement Good Management Practice through a Restricted Discretionary consenting pathway – without the benefit of agreed guidelines or standards. While we could in theory develop a robust GMP framework to apply in this context, the need was not foreseen and there are limits to what we can deliver with the available resources. Consent conditions are thus partly the outcome of a process of negotiation between the regulator and the applicant. Our reality is not the transparent and efficient process participants in the plan development process probably imagined.

In this way, we are maintaining a sound overall level of nitrogen reduction – but potentially introducing inequities between applicants, depending on how forthcoming each is. Indeed, while one of the clear successes of the One Plan has been to foster a strong understanding of environmental impacts and willingness on the part of farmers to 'do their bit', there is a risk of perverse incentives if a perception arises that hard negotiation is 'rewarded' with higher consented leaching rates. The immediate objective – reducing N-leaching – is achieved, but in doing so possible future issues are created.

Conversions

Nutrient management rules apply to conversions throughout the region, not just in target catchments. There have been fewer than modelled in the numerous scenarios put before the Court. Whether this is predominantly due to a chilling effect of the Plan or prevailing market conditions would be speculation.

Whereas nutrient management rules in target catchments were intended to contribute to bringing nitrogen loads down to an acceptable level, the rationale for restricting conversions elsewhere is to keep land use intensification from exceeding the natural capital of the land. There is some question about the effectiveness of this approach, given what we now understand about the potential differences in leaching rates from high- and low-input farming systems. That is, there is the potential for intensification within existing operations to increase loads in non-target catchments. We have no evidence at this time to support or refute this possibility, as we have not checked. The only mechanism we have to collect this information currently is the fertiliser application rule which makes it difficult for future planning processes.

There has been some concern about Restricted Discretionary consents being issued for conversions because there is no explicit policy guidance related to that activity status such as exists for existing intensive farming land uses: this is an inconsistency in the plan that should be corrected. While the policies are clear that conversions should meet Table 14.2, Rule 14-4 exists for conversions to be consented that do not meet Controlled Activity conditions, including the cumulative nitrogen leaching maximums in the table. The proper solution to this quandry (providing policy guidance or amending the rule) will depend on wider questions (canvassed above) about how the effects of farming are to be managed.

Enforceability

Both compliance with individual farm nitrogen leaching numbers and implementation of specific mitigations (which are a prediction of what they might actually do, e.g., use of fodder crops) are potentially difficult to enforce.

The current uncertainty with overseer numbers and the fact they are constantly changing (with no actual change to inputs into the farm), makes enforcing an actual nitrogen leaching number specified in the consent impractical. This also raises the question over the enforceability of the numbers within the SMP.

Enforcing mitigations and what is occurring on farm is easier. Ultimately, if the farmer has agreed to specific mitigations within specified timeframes, then compliance can be checked. Some mitigations will be easier than others to ground truth (e.g., fencing off streams, crossings v planting crops at certain times of the year, areas in crop). A monitoring regime can be developed to address some of these issues, however, this would more than likely require multiple inspections per year of a property.

The former is an evaluation issue, the latter is an implementation issue.

Balance of effects

At core of the difficulty with intensive land-use consenting is affordability – the Plan's assumption that water quality objectives can be achieved without significantly impacting on economic wellbeing. There are two aspects to this challenge: whether that assumption is fundamentally valid; and the Council's ability, through the consenting process, to assess a fair level of effort.

The basic premise of Table 14.2 is that it represented the balance between economic and environmental effects sought through the Regional Policy Statement. There is conflicting evidence as to whether the failure of most applicants to meet Table 14.2 challenges the internal consistency of the Plan, or fails to give effect to the guidance for nitrogen leaching maximums in Policy 5-8(a).

Modelled leaching rates across target catchments are so grossly at odds with the table as to call its relevance into question. This has been traversed above. Without a clearer picture of what good practice entails and how it impacts on leaching rates in this region, however, it is not possible to rule out the possibility that this essentially still reflects the very problem (and varied practice) the Court anticipated the Plan would need to address.

As has been noted, the NPSFM will require us to revisit the catchment loads that underpin the numbers in Table 14.2. This, in effect, would validate the environmental side of the equation. On the economic side, analysis of the first 87 consents issued under the intensive farming land use

provisions[5] indicates that the cost of complying with consent conditions (reducing or mitigating environmental effects) is relatively low – a median of $4.85/Ha, and less than $20/Ha for three quarters of operations. The cost of mitigations was significantly more expensive for a very small number of consents. These farms required installation of bridges or culvert or chose to install a feedpad, had large increases in off-farm grazing, or included full riparian planting. In practice, the typical cost of on-farm N mitigation is probably less than the cost of obtaining the consent itself. This does not automatically mean that consent conditions should have been tougher: it is hypothetically possible that marginal abatement costs are non-linear. That is, the next mitigation on the list for each farm could have been cripplingly expensive, even though those taken up were cheap.

It is also interesting to compare this data with Federated Farmers' member survey results, which reports that the average dairy farmer in Horizons Region has spent $110,000 in the last five years in order to improve their farm's environmental footprint. The equivalent figure based on LCR's study is approximately $20,000 for those farms not requiring additional capital works or up to $90,000 for a small number of farms where additional expenditure is required. The two results are not necessarily in conflict: Federated Farmers' data will include stream fencing required by the dairy companies, and effluent management required under separate rules.

A final question we tested was whether it was theoretically possible for more farms to reach the table without significantly undermining profitability. This is the premise of Policy 5.8. An indicative study of half a dozen 'typical' farms suggests that it is, and in some cases moving from high input to low input farming systems results in both lower N leaching and more profit for the farmer.

This in no way invalidates consent decisions. What it suggests is that, if updated environmental modelling endorses the current cumulative nitrogen leaching maximums set out in Table 14.2, there are alternative tools at our disposal to get there. Through the consent process, we are seeing movement towards good management practice (consciously lower case) within a farm system. This analysis suggests more fundamental changes, effectively between farm systems, may need to be made. In most cases, it involves sacrificing production: this may rationally make sense, but may be difficult in practice (for example, standard bank lending criteria). Further thought would be required as to the likely barriers to achieving this, and how they might be overcome. The answer may not be regulatory, but lie with the business model of the dairy industry itself.

Opportunity Costs

We are certainly seeing reductions in modelled nitrogen leaching as a result of implementing the intensive farming land use rules. However, nutrient management has occupied a significant proportion of Council's management and staff time in the regulatory area; the Rural Advice team has become almost entirely consumed with technical assessments for land-use consents, with very little time for outreach or providing other forms of advice to farmers. The process itself has benefits in terms of the profile of nutrient management as an issue in the rural community, and in providing us with a better understanding of farm practice and modeled leaching rates – both of which are important for us to refine our approach in the future. There remains, however, the question of whether this amount of time and effort could produce better results invested elsewhere.

The same applies to applicants: the cost of obtaining a consent is one aspect of this (in the order of $5000).

[5] Landcare Research, May 2016: *Impact of the Horizons One Plan on farmers and the agricultural community.*

One of the underlying assumptions of the OVERSEER model is that good practice is followed on farm, e.g., storage lagoons are lined, deferred irrigation is used, there is no uneven application of effluent. The effect of not following nine of highest risk sources not included in OVERSEER modelling has been tested and, although there are some gains to be made by addressing these sources, it was concluded the main sources of N and P are captured in OVERSEER[6].

The broader question is whether the set of mitigations the process pushes us toward represents the best return on their environmental protection effort. It is a question to which we are unlikely to ever have an entirely adequate answer, but one that it will be important to bear in mind as we consider any changes to the plan.

Conclusions: Policy Issues

This evaluation considered how effectively the provisions of the One Plan address water quality issues, and the requirements of the NPSFM. Ideally the evaluation would be based on an assessment of the environmental outcomes from Plan implementation, however, the nature of the management interventions mean that it is too early to tell for the management of nitrogen leaching. This is why the approach used in this evaluation is to understand whether the Plan's policies and rules can reasonably be expected to achieve its objectives.

Many aspects of the Plan and its implementation are working well:

- There is evidence the One Plan is causing a shift of attention and resources to addressing water quality degradation within the Region, especially in targeted WMSZs. This is entirely appropriate because water quality degradation was identified as one of the four key issues during public consultation and confirmed by research during its development;
- There is growing acceptance of the need for action to manage non-point source discharges from intensive farming land use;
- There is a growing body of knowledge through the nutrient consenting process on which to base future refinements to the Plan;
- Despite difficulties with implementation of the nitrogen leaching rule framework nitrogen leaching reductions being achieved by dairy farmers in the Tararua and Horowhenua Districts, and through the Restricted Discretionary Activity pathway in the Coastal Rangitikei.

The One Plan was innovative in its attempt to manage diffuse sources of nutrients from agriculture. It is not surprising that difficulties have been encountered with implementation. Some of these are not 'policy issues' per se. This is not to trivialise them; they just don't need a plan change to fix them. These are:

- reluctance to set 'year 20' leaching targets or issue short-term consents in the absence of information as to how farmers might achieve those rates; and the subsequent decision to rely on review clauses if greater reductions are required (noting uncertainty about review would be triggered under s128)
- difficulty assessing the effects of stock crossings, or of unlined effluent ponds
- lack of uptake of 'global consents' (for example, a scheme to cover horticulture in Horowhenua)
- Territorial authority recourse to 'existing use rights' once STP consents have been applied for, and general lack of urgency
- Workload, resourcing levels, clear processes and tools to do the job.

[6] Lucci, G, and Laurenson, S, 2016: *Estimates of nitrogen, phosphorus and sediment losses from source areas in the Mangatainoka catchment*, Agresearch, Februrary 2016.

Nonetheless, there are a number of aspects of the Plan that require review in light of the NPSFM and our experience of implementation:

- Less overt emphasis in the One Plan than in the NPSFM on public health outcomes
- Fuller reflection of iwi values (e.g., tuna) in Schedule B; alignment of values, attributes and numerical objectives (Schedules B & E) with the NOF;
- Consideration of values, attributes and objectives for groundwater
- Incorporation of explicit limits, targets and timeframes (for all FMUs) into the Plan
- Review of whether the set of regulatory and non-regulatory methods to improve water quality are sufficient to achieve targets and timeframes (including contaminants other than nitrogen) once those targets have been determined and appropriate resource accounting has been done
- Review of the rules for diffuse sources (One Plan, Section 14.3), with particular consideration of:
    - alternatives to a numerical, nitrogen-focused consenting regime to address the environmental impact of intensive land-use (e.g., *E. coli*)
    - treatment and definition of different land uses (e.g., activities such as feedlots and 'existing use' versus 'conversion')
    - spatial coverage
    - use of nitrogen leaching rates to determine activity status
    - whether property-scale leaching targets (if retained) are set at the right level to achieve the Chapter 5 objectives in the different parts of the region
    - whether LUC and OVERSEER are compatible models in a regulatory context, if property-scale leaching targets are retained
    - efficacy of consent conditions in achieving environmental improvements
    - effectiveness of specific provisions (e.g., Policy 14-6(b)(ii); Rule 14-4) in light of the above
- Cost-effectiveness and general efficiency of the Plan's suite of interventions (methods)

Any changes required to improve the effectiveness of our approach to erosion and water quantity (evaluations yet to be conducted) will need to be integrated into any review process, as will proposed changes to the NPSFM.