Southland Science Report

Actions on the ground and what farmers can do right now

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11. Action on the ground

The following section outlines specific strategies for reducing nitrogen, phosphorus, sediment and microorganism loss from farm systems.

11.1 Specific strategies for reducing nitrogen losses

The focus of this section is primarily on dairying given the extent of dairying in Southland and the relatively high N loss rates from dairying. Some of the practices also apply to other farm systems.

These strategies are in addition to GMPs and existing requirements as specified in the pSWLP, NESFW and regulations e.g., stock exclusion, effluent management, intensive winter grazing controls, irrigation management, optimum soil nutrient concentrations, etc.

The Waikato Regional Council has a useful detailed guide to the effectiveness and costs of different practices to reduce nutrient losses to water for dairy farms, drystock farms and cropping farms: "Farm Menus". Much of that information will be applicable in Southland.

1. Fertiliser practices and tactical use of nitrogen fertiliser

The Fertiliser Associations Code of Practice for Nutrient Management, sets out best practices for N fertiliser use covering N requirements, rate, timing and form of application, soil conditions (moisture and temperature), minimum pasture covers, management of N on an effluent block. Careful control of the amounts and time of year of fertiliser application can significantly reduce N losses to water.

2. Feedpads, off paddock structures and restricted grazing

Losses of N from urine patches are responsible for most of the N leaching from grazed pastures. Removing animals from the grazed pasture in the autumn, winter and early spring periods significantly reduces the number of urine patches contributing to N leaching.

The use of feedpads and off paddock structures also reduces or avoids intensive winter grazing that can result in significant losses of N to water.

These are highly effective strategies in reducing N losses to water. Urine collected while the animals are on a feedpad or in an off paddock structure can be returned more evenly, at lower rates and at times of the year when net drainage is unlikely. However, it is critical to design and operate effluent management systems in conjunction with any of these systems to ensure that effluent is collected and stored until soil and weather conditions are suitable.

3. Wetlands and riparian attenuation zones

Trapping and retaining nutrients and sediment in wetlands and vegetation buffers alongside water courses has the potential to significantly reduce direct contamination of waterways. Local conditions such as, soil types, slope, rainfall, and land use, will contribute to the potential effectiveness of these systems.

4. Low nitrogen feed supplements

Use of feed supplements such as maize silage or barley grain as an alternative to using fertiliser N boosted grass lowers the amount of N in the diet. This translates into lower N concentrations in urine and the amount of N deposited in a urine patch, reducing the amount of N at risk to leaching.

5. Nitrification inhibitors

Nitrification inhibitors target the animal urine patch limiting the microbial conversion of urine-N to nitrate, which is the main source of N for leaching. They offer considerable potential. However, none are currently approved for use.

6. Management of soil alternatives

Some soils are more free draining than others and provide limited or no opportunities for denitrification (microbial process of reducing nitrate to gaseous forms of nitrogen) of nitrate-nitrogen. Therefore, there can often be opportunities to for example, move high N loss activities to heavier soils that provide greater potential for denitrification to occur.

7. Summary of effectiveness and costs of nitrogen loss reduction strategies

The following diagram (McDowell *et al* 2013) summarises the range of effectiveness and costs of some common strategies to reduce N losses to water.

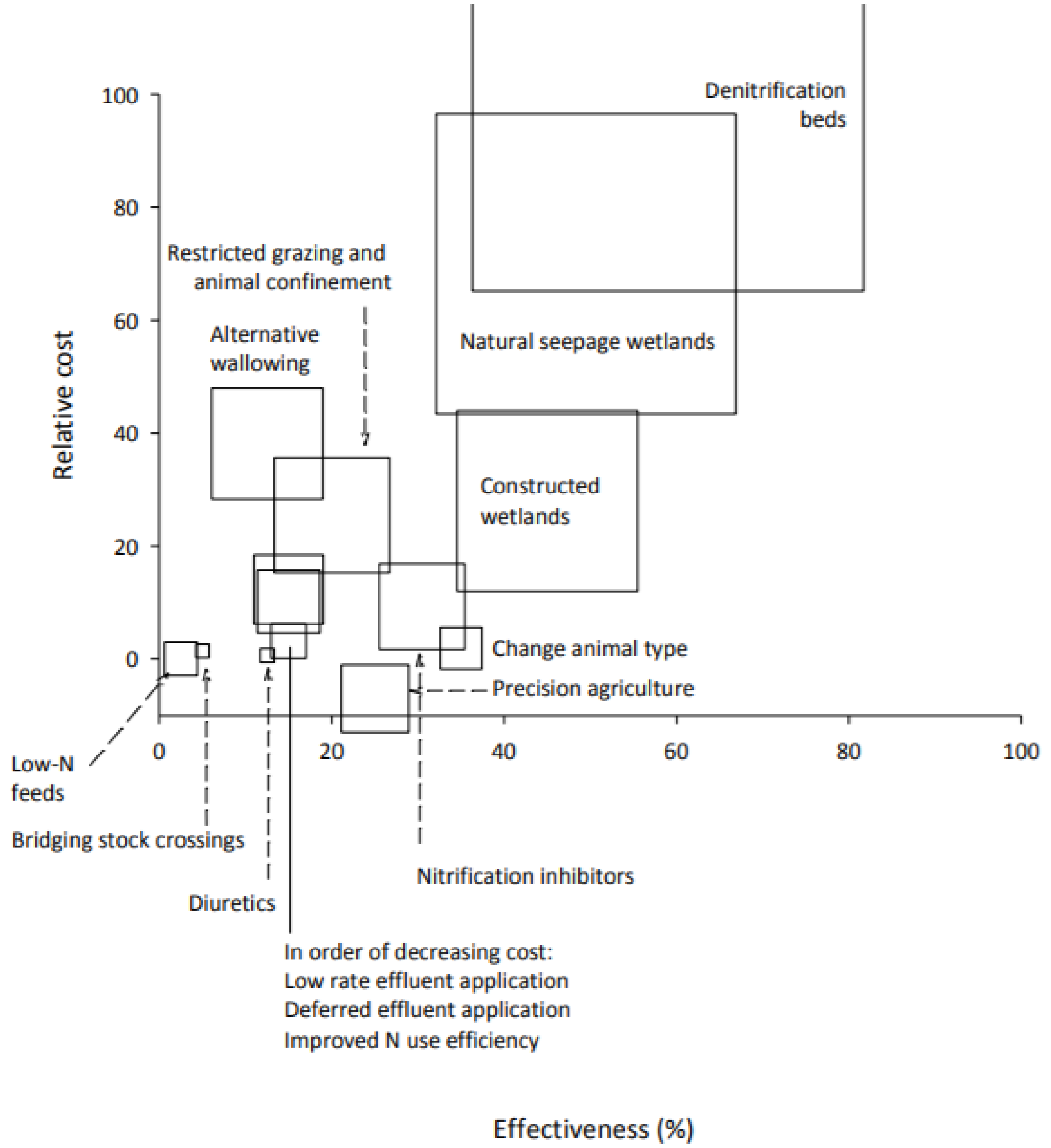

Figure 19: The relative cost and effectiveness of farm strategies to mitigate N losses to water. Cost is shown as the cost per kg of N mitigated relative to the most expensive strategy. The centre of the squares represents the mid-point in the range for each strategy, while the size represents the relative variability of each strategy (Diagram reproduced with permission of AgResearch)

The information on N loss reduction strategies indicate that there appear to be three general options for N loss reduction (Table 5):

Table 5: Summary of nitrogen loss reduction strategies

Extent of N loss reduction	Strategies involved	Approximate % N loss reduction
Minor	• Compliance with all current requirements, i.e., pSWLP, NESFW & regulations • Tactical use of fertiliser, low N feed, alternative pasture/crops • Enhanced management of tracks, laneways, critical source areas, minor farm system changes, and riparian strips • Some use of feedpads • Careful management of effluent and irrigation • Management of soil alternatives • Strategic grazing of winter crops	5 - 15
Moderate	• All of the above • Animal genetics • Development and use of off paddock structures for 3 – 5 months of the year • Significant areas of riparian buffer strips	15 - 25
Major	• All of the above • Reduced farming intensity e.g., reduce stock numbers • Major investment in constructed/modified wetlands • Catchment strategies e.g., aquifer recharge • Land use change	25 - 50

11.2 Specific strategies for reducing phosphorus, sediment, and microorganism losses to water

These strategies are in addition to GMPs and existing requirements as specified in the pSWLP, NESFW and regulations. They include stock exclusion, effluent management, intensive winter grazing controls, irrigation management, and optimum soil nutrient concentrations.

One important consideration to keep in mind is that some strategies may provide significant benefits to some contaminant loss pathways, but not others. For example, contaminant loss via surface runoff (overland flow) versus contaminants loss via deep drainage (leaching).

1. Reduced soil erosion

Soil erosion processes can result in significant losses of P, sediment, and faecal bacteria to waterways. Some locations are particularly susceptible to soil erosion from overland flow during rainfall events, for example, via slumps, slips, and stream bank erosion. There are established methods to reduce soil erosion such as tree planting, stabilisation, and retirement, to reduce soil erosion that in turn significantly reduce the amounts of these contaminants lost to water.

2. Fertiliser type and practices.

The use of slow release P fertiliser products and restricting applications during periods of high risk, for example, when significant rainfall is forecast has potential to significantly reduce P losses to water.

3. Soil management, cultivation practices and critical source areas

Minimising soil cultivation, minimising the amount of time that soil is bare, avoiding or reducing grazing of poorly drained soils will all reduce the loss of contaminants in surface run-off events. Identification and management of Critical source areas (CSAs) is an important component.

4. Feedpads, off paddock structures and restricted grazing

Restricted grazing, feedpads and off paddock structures can also be effective for reducing the loss of contaminants in surface run-off, particularly in locations with heavy soils that are prone to becoming saturated in winter.

5. Wetlands and riparian attenuation zones/systems

Trapping and retaining nutrients and sediment in wetlands, riparian attenuation zones and other systems such as bunds have the potential to significantly reduce losses of sediment phosphorus and faecal bacteria to surface waters. Local conditions such as, soil types, slope, rainfall, and land use, will also contribute to the potential effectiveness of these systems. Riparian plantings around small streams can also provide shade and improve aquatic habitat.

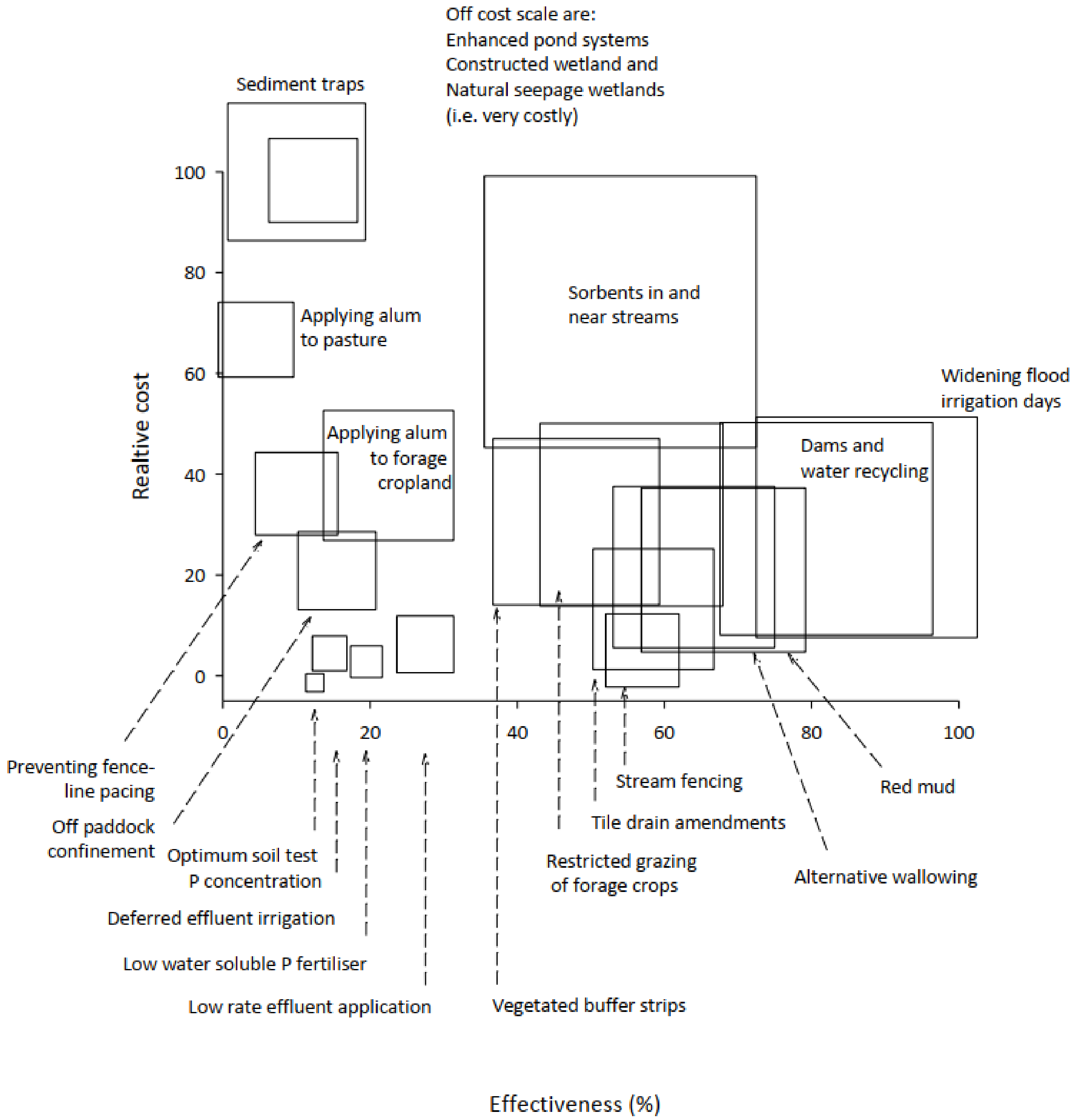

Figure 20: The relative cost and effectiveness of farm strategies to mitigate P losses to water. Cost is shown as the cost per kg of P mitigated relative to the most expensive strategy. The centre of the squares represents the mid-point in the range for each strategy, while the size represents the relative variability of each strategy (Diagram reproduced with permission of AgResearch)

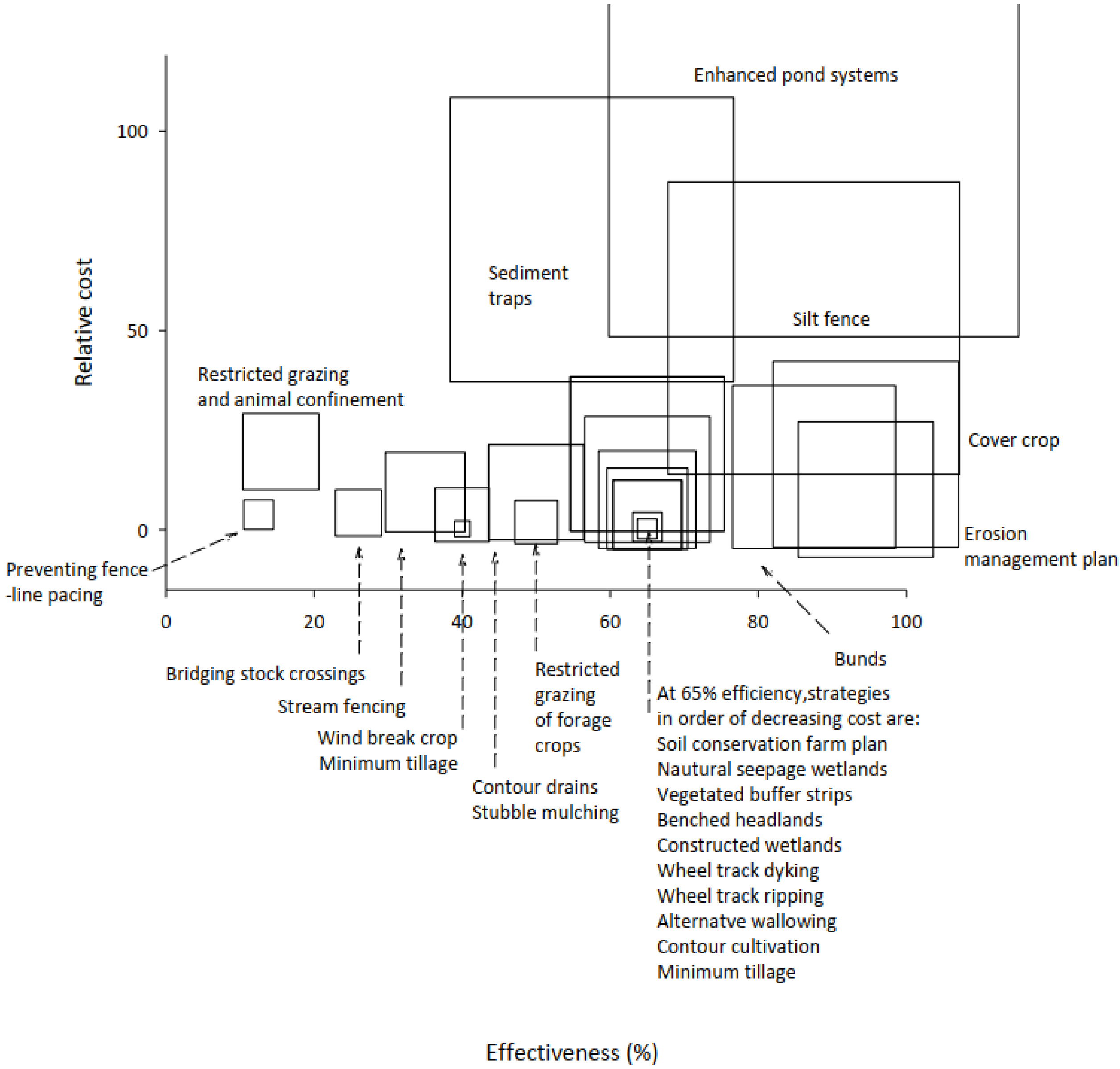

Figure 21: The relative cost and effectiveness of farm strategies to mitigate sediment losses to water. Cost is shown as the cost per kg of sediment mitigated relative to the most expensive strategy. The centre of the squares represents the mid-point in the range for each strategy, while the size represents the relative variability of each strategy (Diagram reproduced with permission of AgResearch)

It is important to appreciate that the Figures 14, 15 and 16 assume a starting point with little or no mitigation of contaminant losses, and therefore the current starting point in Southland is that for example, a significant majority of surface waters have been fenced to exclude dairy cows and cattle.

Table 6: Summary of phosphorus, sediment and faecal bacteria loss reduction strategies

Extent of loss reduction	Strategies involved	Approximate % loss reduction
Minor	• Compliance with all current requirements, i.e., pSWLP, NESFW & regulations • Tactical use of fertiliser, slow release P fertiliser, • Some use of feedpads • Careful management of effluent and irrigation • Strategic grazing of winter crops	5 - 15
Moderate	• All of the above • Development and use of off paddock structures for 3 – 5 months of the year • Significant areas of riparian buffer strips • Enhanced management of tracks, laneways, and critical source areas	15 - 40
Major	• All of the above • Reduced farming intensity e.g., reduce stock numbers • Major investment in constructed/modified wetlands • Major investment in managing all CSAs • Land use change	40 - 60

11.3 Catchment group opportunities

Catchment groups are in the ideal position to collectively work together on strategies that can be designed to address specific catchment challenges. While the focus of the general strategies outlined above has been on individual farms, catchment groups will be in the best position to tailor packages that take account of how for example, adjoining land owners can work together to create synergies that may not work as effectively if each farm operated independently. This can particularly be the case when it comes to managing run-off.

11.4 Take Action Now or Wait?

There are significant advantages in initiating changes now to start reducing contaminant losses and improve water quality.

Concerns have been expressed that any initiative taken now may make it harder to comply with future rules because most regional councils have approached the issue of setting nutrient limits and targets by requiring nutrient loss reductions compared to a 'baseline period'.

It is not certain that Environment Southland will use a baseline reference period, but this is the most commonly used method in New Zealand to develop policies and rules for catchment nutrient loss reductions.

It is extremely unlikely that any baseline period for the forthcoming SWLPPC would be set for the period post July 2020. The new National Environmental Standards for Freshwater (NESFW) that took effect on 3 September 2020 include a "reference" period of 1 July 2014 to 30 June 2019. Rule 20 of the pSWLP has a five-year reference period specified for one resource consent activity status. We consider that it is likely that Environment Southland will align with the NESFW period or a subset of that period. A 'most recent five years prior to a resource consent application' may inappropriately encourage some farms to ramp up nutrient loss prior to applying for a resource consent.

A significant amount of technical investigation work has been undertaken recently by and for Environment Southland, which will be used as technical information for the SWLPPC. A significant amount of that work will relate to detailed assessments of water quality, catchment nutrient loads, and modelling the relationships between land use and water quality. As at September 2020 we understand that the primary technical investigations and modelling has finished.

We consider that it is likely that a baseline period will be used in the SWLPPC and it will be for a three to five-year period between 2014 and 2019.

Recent approaches to nutrient loss reduction policies such as those proposed in North Canterbury have been based on percentage reductions below a suite of specific GMPs for a baseline period. A significant advantage of this approach is that it does not penalise anyone who achieves that reduction early. However, we are aware that other approaches have been used in New Zealand such as the allocation on the basis of land use capability that was used in the Manawatu Wanganui region.

Environment Southland will continue to monitor groundwater quality and surface water quality and use that information to assist with developing the SWLPPC and to provide feedback on the effectiveness of the planning framework. The achievement of water quality objectives will be a critical input into the regulatory framework.

We understand that catchment groups are focussed on improving water quality. Therefore, we think that the most appropriate approach would be to gather as much information as practicable on an individual farm basis about land management practices over the last four years to assist in understanding existing long-term annual average N and P losses. This should involve using a Certified Nutrient Management Adviser (CNMA) to model this information in Overseer. This will help to have a context for considering the contaminant loss reduction options that will be available.

We understand that some people have suggested that it may be appropriate to intensify land use to increase nutrient losses on the assumption that this would mean that with a higher baseline it will be easier in the future to comply with a requirement to reduce nutrient losses. We do not recommend this approach; both because it is almost certain that any baseline period will be for a period between 2014 and 2019 and because it could result in additional water quality deterioration. New land use intensification may also require additional resource consents under the pSWLP and/or the NESFM.

11.5 What should you do now to be ready for future new regional rules?

There are a range of practices that should be implemented as soon as possible that will contribute to improving water quality, involve minimal costs and should assist in long-term planning for future additional measures. There are also a range of precautionary procedures that should be followed.

Complete baseline assessments

Work with a CNMA to develop modelled long-term annual average nutrient losses for the four-year period 2016 – 2019.

Operational preparation:

- Make sure that you understand all the relevant current pSWLP rules and the new NESFW/regulations that apply to your farm.
- Ensure that you comply with the relevant provisions by the due dates and/or apply for resource consents if required.

- If you have any questions or need to apply for resource consents consult an experienced professional.
- Ensure that you have systems in place to ensure ongoing compliance with all your relevant resource consents. This includes having 'fail safe' systems in place particularly for effluent infrastructure.
- Ensure that you know when your current resource consents expire and that you prepare to apply to replace them at least 12 months before they expire.
- In consultation with your CNMA, develop at least two to three options for progressively reducing contaminant losses from land on the basis that it is almost certain that nutrient losses from individual farms will need to be reduced.
- Consult and coordinate with others in your catchment group, particularly neighbours to assess how measures could best be coordinated.
- Consult an experienced farm consultant/nutrient management advisor to discuss the best options for your individual farm so you understand what would be involved in implementing the options that are likely to be available to you and which methods would be most cost effective for your specific circumstances.

Implementation of additional specific contaminant loss reduction measures

Work with a CNMA to develop a range of strategies that can be quantified, such as:

- Avoid or minimise specific risk issues e.g., reducing/rerouting run-off into water from tracks, culverts, bridges, etc.
- Identify and address any potential point source risks, e.g., old effluent pumps, old 'monitoring bores' with poor well head protection or located too close to a contaminant source such as a laneway.
- Investigate the opportunities for changes to fertiliser use to see if changes or reductions could be achieved that would not adversely affect production.
- Look at farm system changes for dairy farms such as new or additional use of feedpads, increased area for effluent application and or different soil types that would result in reductions in N leaching and or P loss.
- For all farm systems look at the opportunities for increasing the width of riparian margins and opportunities for developing or enhancing wetland areas for treating runoff.
- Identify all significant critical source areas (CSAs) and prioritise measures to reduce contaminant losses from them.

All of these measures can be quantified to a greater or lesser extent and can therefore be counted towards any future nutrient loss reduction that may be required under the SWLPPC

Consider all your options

- Do not consider business as usual as an option.
- Carefully consider the potential implications of major investments. Will that potential major investment ensure that you can comply with future rules or will it become an expensive 'albatross'?

11.6 Develop a mitigation toolbox for your farm

Every farm in Southland has its own set of unique circumstances and each catchment will have differences. We think that is useful to think about a unique 'mitigation toolbox' that can be developed for each farm that takes account of both catchment and farm circumstances. For example, the key targeted contaminant may change from N to P/sediment/microorganisms depending on the catchment. Similarly, the opportunities for nutrient loss reduction will change from farm to farm depending on the type of farm, soils, slope, underlying hydrogeology, rainfall, etc.

11.7 Groundwater specific issues

The primary focus of attention for both national and regional controls has been on surface water quality management. However, groundwater plays a critical role in that in much of Southland groundwater is an important part of the recharge of surface water bodies. This is particularly the case with those catchments where a majority of river recharge comes from low altitude runoff and or drainage from agricultural areas.

Some catchments such as the Waimatuku have very little high-altitude recharge sources and the major proportion of surface water flow is sourced from runoff and groundwater from agricultural land. In contrast, for example the Waiau River has a major portion of its flow sourced from surface waters from mountains and hills in a large and extensive catchment.

This has important implications for both the quality of water in the low altitude source rivers, which is generally significantly degraded, e.g., the Waihopai River and the Waimatuku Stream, and the significant challenges that farmers will have in those catchments to improve water quality.