Preparing for the Changing Tide

How can DairyNZ Support Southland Dairy Farmers to Adapt to Changing Environmental Regulations?

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Executive Summary

The regional council of Southland (Environment Southland) is mid-way through its Water and Land 2020 and Beyond (WL2020) Project. This project consists of three stages, and is the council's response to the government's National Policy Statement for Freshwater Management. It aims to prevent any further decline in water quality, and to help the Southland community achieve its goals for water.

Dairy farming has increased significantly in Southland over the previous 20 years, and is now a substantial contributor to the Southland economy. With this intensification, has come water quality pressures. The changing environmental regulations of the WL2020 project will impact Southland dairy farmers, as well as the Southland community.

The aim of this project was to investigate how Southland dairy farmers had been involved in the WL2020 process so far, and how to increase this involvement. From this, the aim was to find ways in which DairyNZ, the industry levy body, can support Southland dairy farmers to adapt to changing environmental regulations. Thirteen people, a mixture of industry members and Southland dairy farmers, who have been very involved with the WL2020 process so far, were interviewed.

It was found that engagement by dairy farmers in the WL2020 project was between 10 and 20%. This low engagement restricted the majority of dairy farmers from being able to have knowledge of the proposed rules and changes of the WL2020 project, the impacts of these and from being prepared for these impacts.

Five broad recommendations were made that would contribute to Southland dairy farmers and their communities adapting to the changing environmental regulations:

1. Water quality is a social science issue as well as a science issue – dairy farmers must understand the water quality issue, accept that there is an issue and understand the effect of their actions on it.

2. DairyNZ should continue what it is doing in Southland but build on this – the work of DairyNZ in Southland is effective and appreciated. There were some recommendations for building on this, but overall DairyNZ is on the right track.
3. Engagement is the first step – dairy farmers needed to be engaged before they could have knowledge of the proposed changes, their impacts and adapt to these. Personalising the issues and one-on-one meetings were important in this step.
4. Sustainable Milk Plans (SMPs) are an effective tool but need a follow up visit – SMPs helped increase the knowledge and preparedness for the proposed rules and changes, but a follow up visit and auditing system would increase their effectiveness.
5. Relationships and leadership are key – relationships within the community and with ES are important. Dairy farmers must be prepared to show leadership.

It was found that Southland dairy farmers themselves have a responsibility to build relationships in their own community. Although DairyNZ has an important supporting role to play, dairy farmers must be prepared to show leadership. If this occurs, not only will Southland dairy farmers and their communities adapt to the changing environmental regulations, they with thrive within them.

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Foreword

Dairy farming in Southland is something that I am incredibly passionate about. My husband and I arrived in Southland five years ago, to our first contract milking job. The opportunities that we have had, and the calibre of the people that we have met since then, are far beyond what we had thought possible. Now we are equity owners and sharemilkers of a 200 hectare dairy farm in Southland, and I work fulltime as a dairy farm management consultant.

I was motivated to do this research because I want the Southland dairy industry to continue to thrive and to be a positive part of the Southland community. I also place importance on the water quality of Southland (and New Zealand in general), and the fact that as dairy farmers we need to be environmentally sustainable for our industry to not only survive but to flourish. The changing environmental regulations that we are part way through in Southland will impact the industry and the Southland community. I want to find ways in which Southland dairy farmers and our community can adapt to these changing regulations and thrive within them, so that we can have an economically and environmentally sustainable province.

This project was completed prior to the release of Southland's Water and Land Plan (due to be released in June 2016).

Acknowledgements

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Thank you to the individuals and institutes that provided me with information. Especially thanks to Hadrian Taylor for all of his help from the Lincoln library. Also thanks to Adrian

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The photo on the front cover was taken by the author at Colac Bay in Southland.

1. Introduction

The dairy industry is Southland has grown significantly in the last twenty years and has become a substantial economic contributor to the region. Permissive regional council rules has meant that this growth has been largely unrestricted. Now the tide is changing. Southland dairy farmers will have to adapt to changing environmental regulations.

The National Policy Statement for Freshwater Management (NPS-FM) directs regional councils to, amongst other things, maintain or improve the overall quality of fresh water within a region. Environment Southland (the regional council of Southland) is implementing the NPS-FM in the Southland region with its Water and Land 2020 and Beyond (WL2020) project. This project involves three stages. Firstly, 'focus activities' for good management practices. Secondly, forming of the new Water and Land Plan, which will replace the existing Regional Water Plan for Southland. Thirdly, the limit setting process for Southland's catchments. Currently, the Southland community is approximately mid-way through the WL2020 process, with the Plan due to be notified in June 2016.

The aim of this project was to investigate how Southland dairy farmers had been involved with the WL2020 process already, and to find ways as to how this involvement could be improved. Engagement with the process, knowledge of the proposed changes and rules and their possible impacts, as well as preparedness for these, were investigated by interviewing Southland dairy farmers and dairy industry members. The results were used to develop recommendations for ways that DairyNZ, the levy funded body, could help Southland dairy farmers adapt to the changing environmental regulations that will be part of the WL2020 process.

This project was not designed to be quantitative and no statistical analysis was attempted. Instead, it was designed to gather the views and opinions of Southland dairy farmers and industry members that had been involved in the WL2020 process to investigate barriers that may prevent more dairy farmers becoming involved in the process, and to develop initiatives that DairyNZ could use to help Southland dairy farmers adapt to the changes that will occur as part of this process. Ultimately the aim for Southland dairy farmers is to adapt so that they can continue to thrive.

2. Literature Review

2.1 The New Zealand Dairy Industry

The New Zealand dairy industry plays a significant part in the New Zealand economy. Historically, it has been New Zealand's highest export earner but was overtaken by tourism in 2015[1], due largely to a downturn in global dairy prices. Annual dairy exports totalled $13 billion for the year ended September 2015, where they had peaked at $16 billion.[2] Dairy farming typically earns over 40 percent of New Zealand's primary industries' export revenue,[2] and New Zealand is the largest dairy exporter in the world.[3] Domestically, dairy farming provides approximately 48,000 jobs (excluding those that are self-employed).[4] The dairy industry drives many rural economies such as Southland, Taranaki and Waikato – "when dairy farmers are smiling, the whole region smiles."[5] However, dairy farming returns have been very volatile. Dairy farmers received a record payout for milk in the 2013/14 season, which has been followed by two years of prices below the average break even cost of producing milk, including the current 2015/16 season.[6]

The mid-1980s marked a significant change for New Zealand agriculture. The New Zealand government removed all government intervention, which meant that farmers were exposed to international competition, global prices and market fluctuations.[3] The dairy sector had received less subsidies than other parts of the sector[7], but this change was still significant. New Zealand dairy farmers were forced to become more productive and profitable to survive, which led to an increase in innovations, which has helped the industry succeed.[8] New Zealand agriculture currently has the lowest level of government support of all the OECD countries.[9]

New Zealand's trading partners for dairy products have changed over the last decades. Reliance on traditional partners such as Britain and North America has decreased, and China has become the biggest importer of New Zealand's dairy produce.[2] Lower international prices in the last two seasons, have increased the quantity imported by Southeast Asian and North African countries.[2]

DairyNZ Incorporated (DairyNZ) is the single dairy industry good body, formed in November 2007 after New Zealand dairy farmers voted to merge Dairy InSight and Dexcel. It is funded

by a levy that all New Zealand dairy farmers pay on each kilogram of milksolid produced. Investment of this levy is guided by "Strategy for Sustainable Dairy Farming 2013-2020." This is a joint strategy by DairyNZ in partnership with Federated Farmers (dairy), the Dairy Companies Association of New Zealand and the Dairy Women's Network. One of the ten objectives of this strategy is environmental stewardship.[4]

2.2 Dairy Farming in Southland

The Southland Region is the southernmost region of New Zealand, incorporating the southern part of the South Island, as well as Stewart Island. In total the region covers 3,176,000 ha, although 53% of the region is public conservation land. Approximately 36% of the region is pastoral land.[10] Although the region has had an established dairy industry since the 1880s, prior to the 1990s the predominant agriculture was sheep, deer and beef farming with only 25,000 dairy cows in the region.[11] The late 1980s and the early 1990s saw the Southland "dairy boom," where the size of the dairy industry expanded exponentially, signalling a significant land use change in the region. This was catalysed by depressed returns for meat and wool, increased presence of corporate farming and a campaign run to attract North Islanders to move to the province where land was relatively cheap.[12] Southland now contains 11.4% of the national dairy herd, and the average herd size is 40% larger than the New Zealand average.[4] The Southland dairy industry has continued to grow as can be seen in Figure 1.

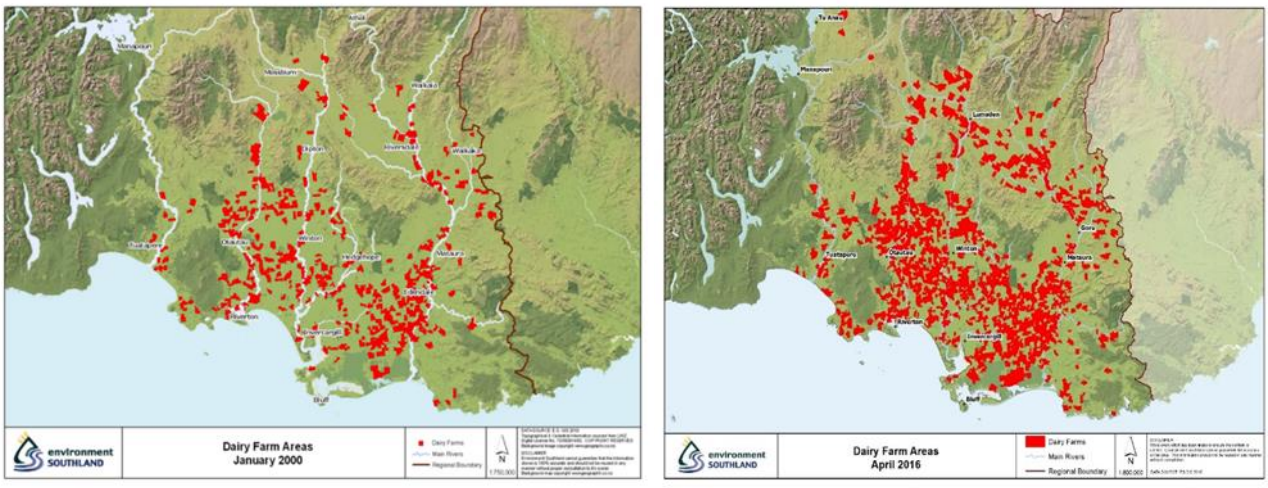

Figure 1. The increase in dairy farm area from January 2000 to April 2016 in Southland. Source Environment Southland.

There has been a 190% increase in the total number of dairy cows and a 170% increase in the total area of dairy farms (ha) in Southland, between the 1999/2000 season and the 2014/2015 season, (Table 1). Average production (both per cow and per hectare) has also increased significantly over the same time, while stocking rate has remained similar. Dairy farming is now a significant contributor to Southland's economy. It is estimated that 7.6% of the region's employment comes from dairy farming, and that dairy farming contributes 10.7% of the region's gross domestic product (GDP).[13] In the decade between 2000 and 2010, the dairy volume expansion has delivered an additional $650 of income per person in the Southland region.[5]

Table 1. Southland dairy statistics between the 1999/2000,[11] and 2014/2015 seasons.[4]

Southland Dairy Statistics	1999/2000 Season	2014/2015 Season
Total number of dairy cows	196,864	573,120
Total area in dairy farms (ha)	75,920	206,938
Average herd size (number of cows)	379	590
Average farm size (ha)	146	213
Average stocking rate (cows/ha)	2.7	2.77
Average production per cow (kgMS/cow)	323	381
Average production per ha (kgMS/ha)	838	1055

2.3 Water Quality Impacts of Dairy Farming

2.3.1 Background

The water quality impacts of dairy farming have received a lot of media attention in recent years and received public criticism.[14-16] The impact of dairy cows on New Zealand's fresh water quality was specifically mentioned in Environment Aotearoa 2015.[17] Work by Foote *et. al.* (2015) concluded that the cost to the New Zealand environment of dairy intensification was close to the sum of the export revenue from dairy and dairy's contribution to the 2012 New Zealand's Gross Domestic Product (GDP). Therefore the dairy industry is a "zero-sum" gain to New Zealand,[18] however, the methods and conclusions in this work were criticised.[19] A significant amount of New Zealand and international research into the water quality impacts of dairy farming (and other types of agriculture) has helped provide an understanding of this issue.[20-25] Specific Southland research has also been conducted.[26-29]

Nitrogen (N), phosphorus (P), sediment and faecal micro-organisms (mainly *Escherichia coli*) are the four contaminants that are commonly reported when measuring water quality, and these are specifically identified in Environment Southland's (ES's) Water Plan.[30] Intensive agriculture, particularly dairy farming and dairy wintering, contributes to the increased presence of these contaminants in waterways.[3, 27, 28, 31-38]

2.3.2 Nutrient Losses

Nitrogen and phosphorus enter the waterways through two distinct pathways. Excess nitrogen leaches through the soil as dissolved nitrate and enters groundwater. Phosphorus runoff occurs when phosphorus containing soil particles (or excrement) are washed across land or through artificial drainage and into waterways. These are diffuse or non-point source rather than critical or point source pathways. In 2014, ES estimated that point source discharges (where industrial and residential waste water discharges directly into a waterway) accounted for less than 10% of the estimated total nitrogen load, and less than 25% of the estimated total phosphorus load for Southland.[39] Direct application of nitrogen and/or phosphorus containing fertilisers to waterways can also occur.[30, 40]

The majority of leached nitrogen on grazed pasture comes from stock urine. The concentration of nitrogen in a dairy cow's urine patch is between 800-1000kgN/ha.[41] This is far greater than the amount of nitrogen which is able to be taken up by the growing pasture so the excess leaches.[10, 42] Bacterial denitrification can occur, particularly in water-logged soils, which reduces the amount of nitrogen leaching but causes the formation of nitrous oxide, a greenhouse gas.[42] The timing of the depositing of the urine patch influences the potential leaching, with large losses possible for urine deposited just prior to the on-set of drainage.[10] For most parts of New Zealand drainage occurs predominantly over winter when rainfall levels are high and evaporation is low, however, in Southland drainage may occur from autumn to early summer.[42]

Phosphorus runoff increases under intensive farming. This is due to Olsen P levels being increased (more phosphorus present in the soil), farming practises such as cultivation exposing soil, compaction increasing runoff and application of effluent. [38]

There are two ways that excess nutrients can affect water quality. Excess nitrogen and phosphorus in waterways can encourage the growth of unwanted plant life, particularly in waterways were algae growth was previously limited by a lack of nitrogen or phosphorus. Excess growth of algae, slime and weeds can degrade fishing and swimming spots as well as depleting oxygen levels in the waterways which can suffocate aquatic life.[43] Increased nitrogen levels can cause nitrate and ammonia toxicity. This can render groundwater unsuitable for drinking by exceeding the Ministry of Health limit of against the drinking water standard of 11.3 mgN/L.[44]

OVERSEER® (OVERSEER) is a nutrient modelling program that is owned by the Ministry of Primary Industries, the Fertiliser Association of New Zealand and AgResearch.[45] It was developed originally as a way to estimate nitrogen loss from New Zealand agriculture to report to the OECD on an annual basis.[45] An OVERSEER nutrient budget models inputs and outputs of an agricultural system and estimates nutrient losses, particularly nitrogen and phosphorus losses. It has been used increasing by Regional Councils as a regulatory tool.[46]

Modelled (using models OVERSEER, Land Use in Rural New Zealand (LURNZ) and Catchment Land Use for Environmental Sustainability (CLUES)) and measured nitrogen and phosphorus leaching from different farming systems indicates that the nutrient losses from dairy farming (and dairy wintering) are significantly higher than those of sheep and beef farms or forestry.[27, 30, 43, 47] Table 2 shows indicative data of the differences in nutrient losses from different land uses.

Table 2. Indicative nutrient losses from different agricultural industries.[47]

Industry	N Leaching (kg/ha)	P Loss Risk (kg/ha)
Dairy	29-49	0.8-2.1
Sheep and Beef	8-18	0.1-0.5
Forestry	2	0.1

Work by Monaghan *et. al.* (2007) in the Bog Burn catchment in Southland modelled the estimated nitrogen losses from five types of agriculture within the catchment and compared the relative contributions of each landuse to nitrogen losses from the catchment.[28] It was found that both dairy wintering and dairy milking platforms contribute to a greater proportion

of the nitrogen load for the catchment than the relative area that these farms occupy. This is in contrast to arable, forestry and dry stock (Figure 2).

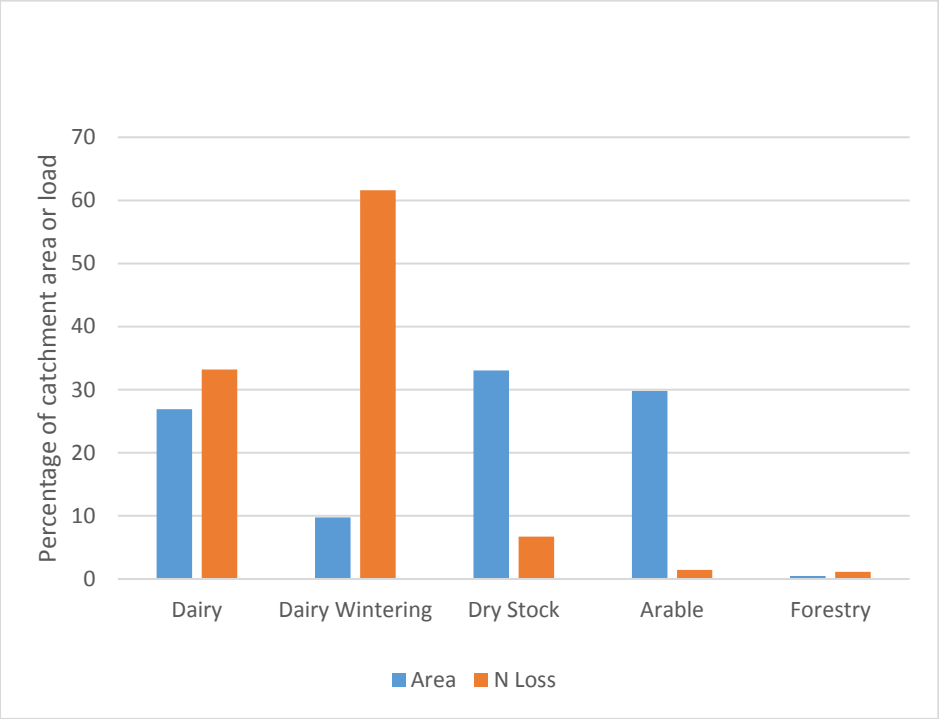

Figure 2. Relative area occupied and predicted contribution to stream N load of the different modelled land uses within the Bog Burn catchment. Page 218 in [28].

Converting land to dairy farming has the biggest increase on nutrient loss, rather than any other land change or intensification of the existing dairy farm.[43] Figure 3 shows the modelled result in nitrogen load increase for the projected increase in dairy farming area between 1996 and 2020.[43] This clearly shows the increase in dairy farming area and resulting increase in nitrogen load predicted to occur in Southland.

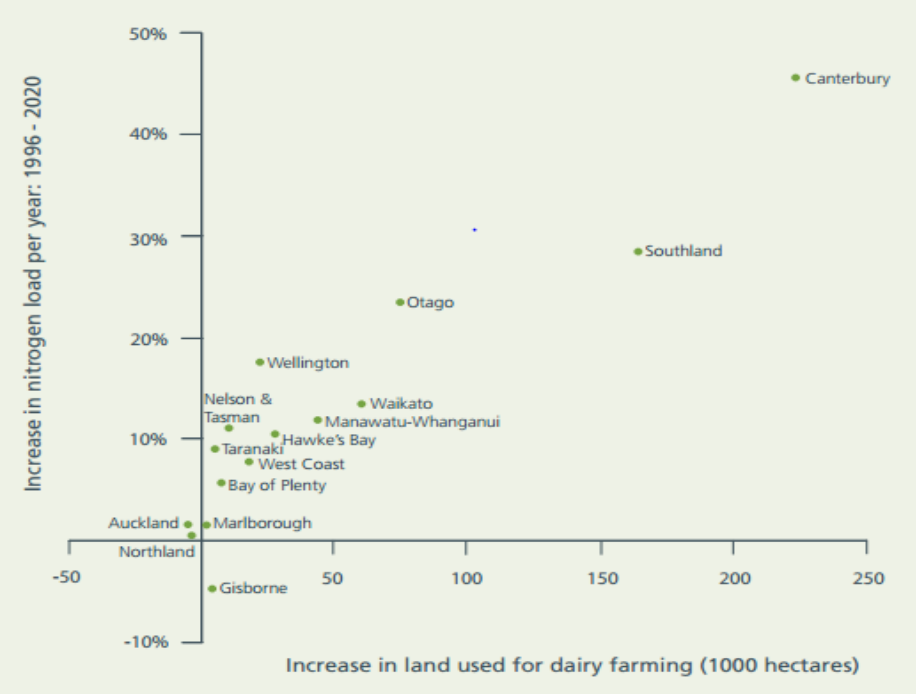

Figure 3 Large-scale land use change to dairy farming leads to an increase in the amount of nitrogen that gets into fresh water. The graph shows the differences between 1996 and 2020. From page 66 in[43]

2.3.3 Sediment Losses

Sediment loss can result from bank sloughing where banks collapse and enter the waterways or from soil being washed into the waterways from surrounding land (runoff). Marine sediment can also enter estuaries via tidal movements.[48] Soil type, drainage and topography have large influences on the risk of sediment run off.[49] Another significant factor is the cover that the soil has, as exposed dirt such as ploughed ground has a much higher risk of runoff. The majority of dairy farming systems in Southland include a cropping rotation, and winter grazing of crops is common practice. Compaction can also contribute to greater runoff and it is estimated that nearly 80 percent of soils under dairy farming in New Zealand are affected by compaction.[17] Good management practises can significantly reduce the amount of sediment lost.[49] Too much sediment in a waterway can cause turbidity which blocks sunlight and affects aquatic life. It can also affect the use of the waterway for recreational activities such as swimming, boating and fishing. Sediment from farms is also likely to contain significant amounts of phosphate due to high Olsen P levels.[28]

2.3.4 Escherichia coli

Escherichia coli (E. coli) is one of several bacteria that is found in faecal matter (both animal and human) that contaminates waterways. It is commonly measured in waterways as an indicator to faecal matter present due to its ability to survive in freshwater for 4-6 weeks.[50] Faecal contamination in waterways is a risk to the health of humans and animals using the water ways. Also, the breakdown of faecal material releases nutrients and consumes oxygen, affecting the aquatic ecosystem. Faecal contamination of waterways from intensive farming including dairy farming, can come from runoff from drainage, farm waste runoff, dairy effluent runoff, irrigation water and direct faecal discharge from farm animals into water ways. Streams that originate in and are wholly within dairy landscapes are at risk of elevated E. coli levels.[51] The Sustainable Dairying: Water Accord requires dairy farmers to fence their waterways so that stock are excluded. By the end of 2014/2015 season, 96% of waterways on dairy farms were fenced to prevent stock access.[52] This will reduce the amount of direct faecal contact on dairy farms. There are also non-agricultural ways of faecal contamination such as septic tanks and urban storm water.[50] The risk of E. coli contamination can also be increased by climatic conditions. ES's freshwater and marine science leader, Nick Ward, reported that the high levels of E. coli found during tests at seven rivers and streams in Southland during January 2016 were influenced by the extended dry period, and the following rainfall which would mobilise material which may elevate the risk of E. coli contamination.[53]

2.4 Water Quality Changes in Southland

2.4.1 Background

There is concern about the water quality in Southland. Increased intensity of agriculture coupled with the poor flushing characteristics of estuaries has led to a decline in water quality for some bodies of water.[54] Since 2010 there has been an increasing focus on the region's water quality in response to well documented regional (ES's State of the Environment report 2010) and localised (Waituna lagoon – refer to 2.7) declines in freshwater quality.[55]

ES monitors 76 water quality sites in Southland, and this data is available on the Land, Air, Water Aotearoa (LAWA) website. [56] Although there are other reports from ES[57, 58] and

other agencies,[59] regarding water quality in the region, the LAWA website publishes the most recent results.[58]

The LAWA dashboard indicator analyses the data collected by the councils and reports the results for nine indicators as state and trend. The state for the region is represented by the median concentration for the parameter across all sites within the region and then compares that value to the quartiles for all monitored sites (945 sites) in New Zealand. The trend analysis uses a Seasonal Kendall Trend Test to ensure that differences between seasons do not influence overall trends. Five results for trend are possible- significant meaningful improvement, significant improvement, no trend, significant degradation and significant meaningful degradation.[56] The Cawthron Institute has worked alongside regional councils to verify the processes and methods used for data collection, laboratory analysis of samples collected and the statistical analysis and interpretation of the results presented on the LAWA website. For the Southland results, the data collection and state of sample criteria have been verified by the Cawthron Institute, but the trend data is not adjusted for flow as national guidelines suggest so trends must be interpreted with caution as they may be affected by variations in flow across sampling occasions.[56]

2.4.2 Nitrogen

LAWA's ten year analysis puts total nitrogen (organic and inorganic) in Southland in the worst 50% of sites with no trend. Total oxidised nitrogen (nitrite and nitrate) is in the worst 50% of sites and has meaningful degradation, while ammoniacal nitrogen (ammonia and ammonium) is in the best 25% of sites and has meaningful improvement.[56] This data agrees with the previously released data from ES, (Figure 4). There is only one site with improving surface water nitrate trends, and only one site with improving ground water nitrate trends.[58] Ledgard (2014) estimated the natural losses (ca. 1840) for the region based on historical land use data and loss estimates from natural state ecosystems. Natural state nitrogen losses were calculated at 11% of current day losses.[10] Although, given the landscape and population change Southland has experienced it would be unrealistic to expect the nitrogen losses to be similar to the natural losses, this gives an indication of the changes experienced.

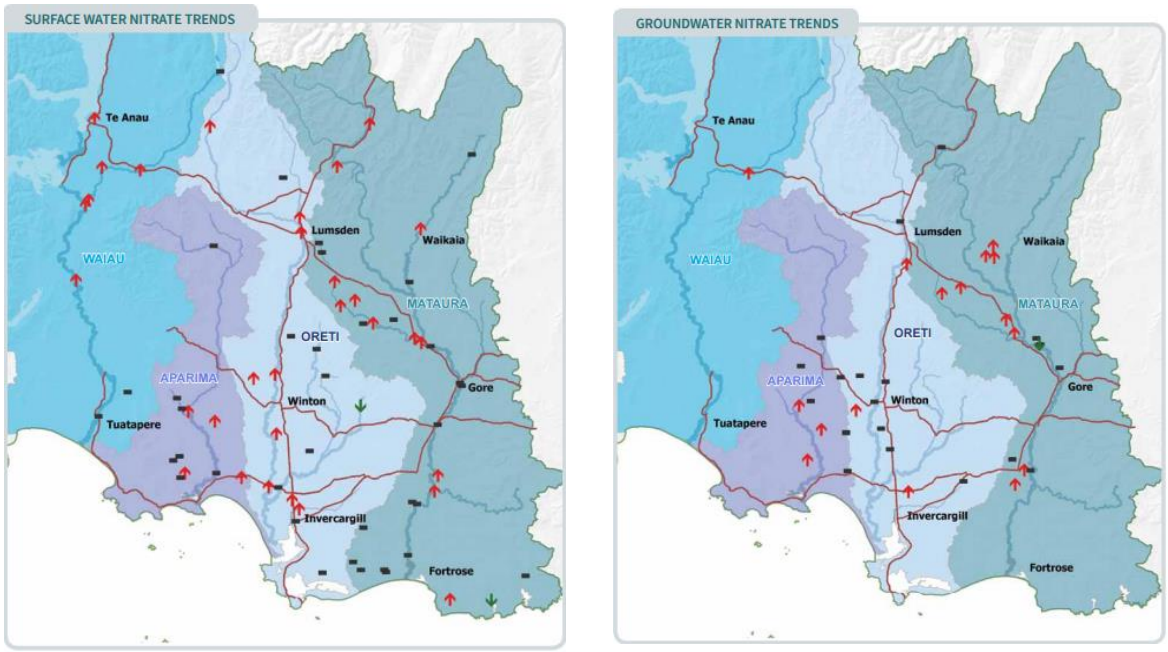

Figure 4. Maps showing nitrate trends in surface water (left) and groundwater (right) across Southland for monitoring sites with 10 years of data (2003 – 2013). Deteriorating trends are shown by the red arrows, improving trends by the green arrows and sites with no significant changes are marked with black dashes.[58]

2.4.3 Phosphorus

LAWA's ten year analysis puts total phosphorus (dissolved and particulate, organic and inorganic) in Southland in the worst 50% of sites with no trend. Dissolved reactive phosphorus (soluble phosphorus) is in the worst 50% of sites and has significant degradation.[56] This is in contrast to ES's published data for trends between 2003 and 2013 (Figure 5), where many sites had improving trends.[58] Investigation into this discrepancy found that in November 2015 LAWA changed their dissolved reactive phosphorus trend data due to a sampling error discovered in one year's data. This significantly changed the ten year trend.[60] In the same study by Ledgard (20140,[10] discussed earlier, natural state phosphorus losses were calculated at 40% of current day losses.

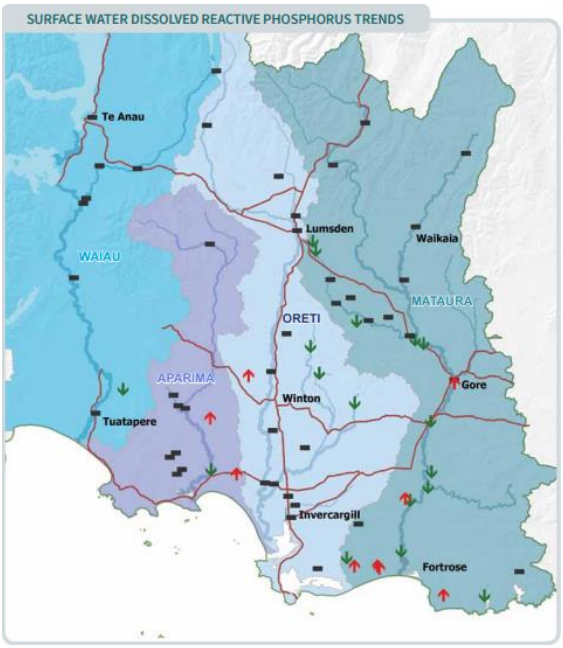

Figure 5.Map showing dissolved reactive phosphorus trends in surface water across Southland for monitoring sites with 10 years of data (2003 – 2013). Deteriorating trends are shown by the red arrows, improving trends by the green arrows and sites with no significant changes are marked with black dashes.[58]

2.4.4 Sediment

Sediment levels are measured through measuring water clarity. For water clarity, LAWA's ten year analysis has Southland in the worst 50% of sites with no trend for both the black disc test and turbidity (both measures of water clarity).[56] Sediment fingerprinting research by DairyNZ and NIWA found that the majority of sediment in the Jacobs River Estuary (near Riverton) originated from coastal sources brought into the estuary by incoming tides.[48] A separate study by AgResearch found that up to 95 percent of sediment in Waituna Creek came from stream banks, with bank collapse and drain cleaning identified as the main causes of this.[48] Although, intensive dairy farming can increase sediment loss it is not the only source.

2.4.5 Escherichia coli

LAWA's ten year analysis has Southland in the worst 50% of sites for E. coli with no trend.[56] ES has reported that there are five sites do not meet the national bottom line for secondary contact of is 1000 E. coli per 100ml. Secondary contact is defined as activities where it is unlikely that your head will go under water such as wading and boating. It may be decided during the WL2020 process, that some sites need to adhere to the national bottom line for

primary contact recreation (such as swimming), which is lower (i.e. harder to achieve) than the secondary contact standard.[58]

2.5 National Policy Statement for Freshwater Management

The Resource Management Act (RMA) (1999) regulates the dairy farming (and other types of agriculture), and its environmental impacts within New Zealand.[61] Sections 9 (restrictions on use of land) and 15 (discharge of contaminants into environment) directly relate to dairy farming. This Act allows regional authorities, such as regional councils, to set policies and plans to manage the natural resources in their regions and to mitigate the environmental impacts of any activities. Many activities, including dairy farming, are controlled through the process of resource consents.[3]

A different approach from central government towards managing fresh water in New Zealand was started in 2009. The stake-holder led Land and Water forum was established to advise government on freshwater reform. This group released its 4th report in November 2015 outlining 60 new consensus recommendations for how New Zealand should improve its management of fresh water as well as urging the Government to adopt all of its recommendations from earlier reports. This latest report made three key points. The first was that integrated catchment management systems are complex, and that maximising the economic benefit of fresh water will require multiple lines of action. Secondly, resolving the issue of iwi rights and interests lies with the Treaty Partners themselves and not this forum. Thirdly, the report made a set of recommendations on stock exclusion from waterbodies and riparian management to address an important gap in current management systems.[62]

Part of this different approach also included the 2011 National Policy Statement for Freshwater Management (NPS-FM) was issued by the government and introduced limits for water quantity and quality. In 2014, NPS-FM amendments introduced the National Objectives Framework and national bottom lines for water quality. The NPS-FM directs regional councils to set objectives for the state their communities want for their water bodies in the future, and to set limits to meet these objectives. [63]

Some of the key requirements of the NPS-FM are to:

- safeguard fresh water's life-supporting capacity, ecosystem processes, and indigenous species
- safeguard the health of people who come into contact with the water through recreation
- maintain or improve the overall quality of fresh water within a region
- protect the significant values of wetlands and outstanding freshwater bodies
- follow a specific process (sometimes referred to as the National Objectives Framework or NOF) for identifying the values that tāngata whenua and communities have for water, and using a specified set of water quality measures to set objectives
- set limits on resource use to meet limits over time and ensure they continue to be met
- determine the appropriate set of methods to meet the objectives and limits
- take an integrated approach to managing land use, fresh water, and coastal water
- involve iwi and hapū in decision-making and management of fresh water. [63]

Although the amended version of the NPS-FM was commended by Dr. Jan Wright (Parliamentary Commissioner for the Environment) as a "big step forward," there were some significant omissions noted. Dr. Wright was concerned by the "unders and overs" approach where regional councils were allowed to degrade some waterways and compensate by improving others. Estuaries were not covered by the policy, although they are "particularly vulnerable because of their location at the bottom of catchments." Dr. Wright also questioned the lack of direction towards a strategic approach by councils. In total six recommendations were made by Dr. Wright. [36, 64] Ongoing reform of the legislation controlling the management of fresh water in New Zealand will continue. The proposed next steps for the government are outlined in a consultation document[65] (excerpt shown in Figure 6) for which submissions closed on April 22nd 2016.

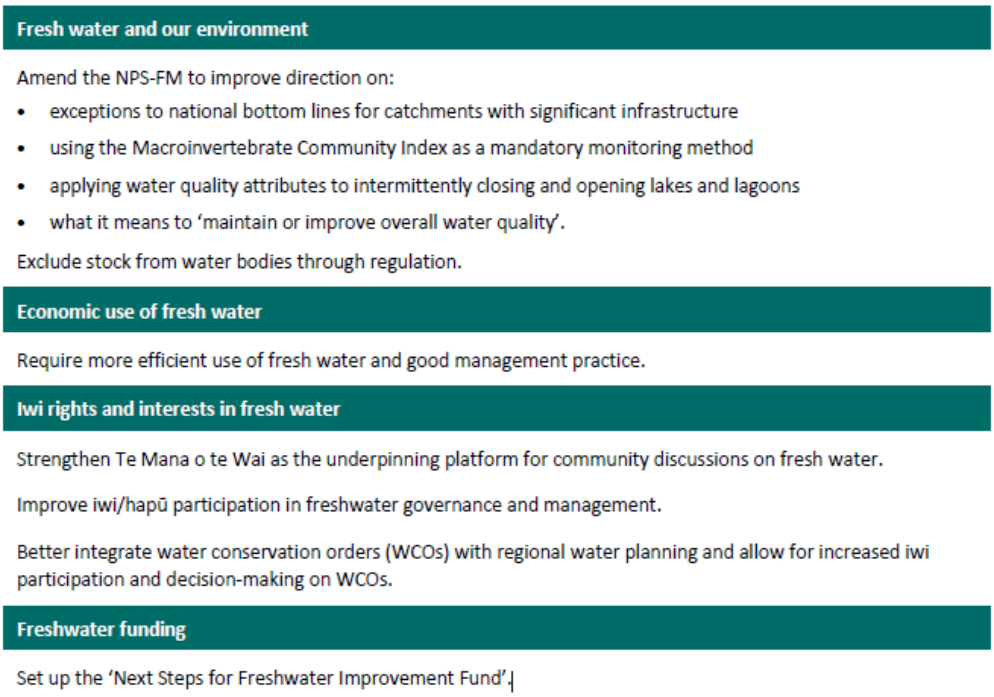

Figure 6. Summary of key proposals for the next steps for the government in fresh water management.[65]

2.6 Water and Land 2020 and Beyond

2.6.1 Background

ES is implementing the NPS-FW through its Water and Land 2020 and Beyond (WL2020) project. This project aims to prevent any further decline in water quality, and to help the Southland community achieve its goals for water. The Water and Land 2020 & Beyond project has three main components. Firstly, 'focus activities' for good management practices. Secondly, forming of the new Water and Land Plan, which will replace the existing Regional Water Plan for Southland. Thirdly, the limit setting process for Southland's catchments. Ngai Tahu ki Murihiku is ES's lead partner for this project, as well as a regional forum of other stakeholders.[66] A summary of the WL2020 process is below (Figure 7).

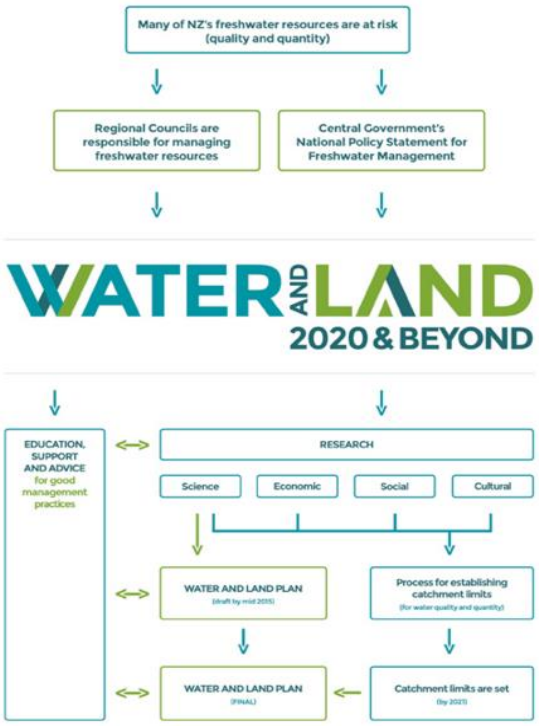

Figure 7. Summary of Environment Southland's Water and Land 2020 and Beyond Project.[66]

2.6.2 Focus Activity Farm Plans

A Focus Activity Farm Plan is an environmental plan developed for a farmer by an ES Land Sustainability Officer. It contains specific good management practice advice and recommendations, particularly focussing on nutrient management, winter grazing and riparian management. The plan aims to identify the environmental risks specific to the farm, help farmers to manage soil, water and nutrient losses and to demonstrate the management practices that have a positive impact on the environment. Farmers who have had a Focus Activity Farm Plan compiled for their property are also able to apply for funding to assist with the implementation of these recommendations.[67] Approximately 200 plans have been completed so far. [68] Currently these plans are voluntary and rely on farmers contacting ES to get one done. There are similarities between these plans and Sustainable Milk Plans (DairyNZ) and Land Environmental Plans (Beef and Lamb).

2.6.3 New Water and Land Plan So Far

The current Regional Water Plan for Southland came into operation on the 18th of January 2010.[69] The second stage of the WL2020 is to review this plan, and also the Regional

Effluent Land Application Plan, to update these to form the new Water and Land Plan.[44] The existing Regional Water Plan for Southland sets out the community's values and goals in relation to water quality and quantity at a regional scale, which ES has indicated will not change in the new plan. At a high level these goals are:

- Water quality that supports community uses and values e.g. drinking water (human and stock), recreation, food gathering, fisheries and ecosystems.
- Sufficient water available for individual, community and ecosystem wellbeing[44]

The review process began in 2015 with a three month public consultation period on the document "Working Draft for Water and Land," that ended on the 31st of October 2015. The public were invited to give feedback on this document which outlined what ES thought were some of the region's water issues, and how the council was thinking of addressing them. Nine key issues were identified:

1. High intensity farming
2. Critical source areas
3. Wintering stock
4. Stock access to water and associated discharges
5. Cultivation on sloping land
6. Discharge from farm tile drains
7. Household onsite wastewater systems
8. Surface and groundwater takes
9. Indigenous biodiversity/wetlands[70]

Southland was also divided into physiographic zones by scientific work that looked at key features relating to the rainfall, geology, soil, water chemistry and how water moves between different parts of the landscape. Based on these details, nine physiographic zones were created that will be used for some of the rules that are included in the Plan. This was instead of treating the Southland region as a whole, so that specific issues in specific zones could be treated separately.[71]

The feedback on this Working Draft was summarised and published by ES.[72] ES also released a shorter engagement document titled "Towards a New Plan." This document was a brief overview of some of the science around water quality in Southland and also of the Working Draft, focussing on the 9 main issues listed above.[70] It provided a form that was able to be used to provide short feedback on each of the nine issues. This feedback was also summarised and published.[73] ES also held ten drop-in sessions with councillors and council staff which public could attend. Two online drop-in sessions were also held via Facebook. Again feedback was collated from these sessions.[74] There is also "Ideas and Comments" albums on ES's Facebook which summarise some of the feedback so far. ES has stated the all of the feedback will be used to the Water and land Plan which was due to notified in May 2016 but has been put back until June 2016.[44] The timing of the review process has been criticised as it coincided with lambing and calving periods for farmers in Southland, which may have impacted farmer's ability to become engaged.[75]

2.6.4 Limit Setting

ES has stated that limit setting is a key requirement of the NPS-FM, and that it is the third main component of the Water and Land 2020 and Beyond project.[76] Limit setting has also been identified as an important long-term approach to looking after water in terms of both quality and quantity.[76] Five steps in the limit setting process have been identified:

1. Establish a baseline – five Freshwater Management Units (as in Table 3) are already defined and the current state of these units is being assessed at present.
2. Set freshwater objectives – by identifying all the values that the community hold for their waterways, measureable characteristics of water that need to be managed to provide for those values will be identified. These measureable characteristics will be used to formulate freshwater objectives that describe the outcome wanted for Southland's waterways.
3. Develop limits – limits will be set that sets the maximum amount of resource that is available for use. For water quality this will define the amount of a contaminant that can enter the water and for water quantity this will define the amount of water that can be taken and the amount that must be left behind.

4. Create scenarios – scenarios will be used to understand the costs, benefits and consequences of management options. Data from the Southland Economic Project and Southland Science Programme will be used to assess the difference outcomes.
5. Choose preferred options – the information from the assessment of different scenarios will be used to decide on the best set of limits and methods that will ensure obligations to the NPS-FM are met. An analysis of economic and environmental impacts and evaluation of the management option selected will be important. As well as analysis of any trade-offs that are needed in choosing between different management options. Input from water users and the community will be important. [76]

The "Progressive Implementation Plan" was adopted by Environment Southland in November 2015.[77] This outlines the proposed timeline for Environment Southland's limit setting process (Table 3).

Table 3. Environment Southland's progressive implementation plan.[78]

Stage	Process	Timeline
Community conversations	Establish process for community conversations about catchment scale limit setting following notification of regional framework in Water and Land Plan for Southland.	By 30 June 2016.
Fiordland and Islands Freshwater Management Unit	Develop catchment limits through a community and council process.	Commence late 2016, with catchment limits to be developed by July 2018.
Mataura-Toetoes Harbour Freshwater Management Unit	Develop catchment limits through a community and council process.	Commence late 2017 with catchment limits to be developed by July 2019.
Aparima and Pourakino -Jacobs River Estuary Freshwater Management Unit	Develop catchment limits through a community and council process.	Commence late 2017 with catchment limits to be developed by July 2019.
Waiau-Waiau Lagoon Freshwater Management Unit	Develop catchment limits through a community and council process.	Commence late 2018 with catchment limits to be developed by July 2020.
Oreti and Waihopai - New River Estuary Freshwater Management Unit.	Develop catchment limits through a community and council process.	Commence late 2018 with catchment limits to be developed by July 2020.
NPS-FM fully implemented	Water and Land Plan for Southland notified.	Plan Change(s) for all Freshwater Management Units to be notified by December 2025

2.6.5 Possible Economic Effects

The possible economic effects of changes in Southland's environmental regulations are an important consideration for both ES and the Southland community. It is likely than any change in environmental regulations that impact agriculture or other industry will have some economic effect on individuals and the community.

The New Zealand Institute of Economic Research (NZIER) investigated the impacts of nutrient caps and mandated farm practices in the Southland region on its economy and environment.[47] This was done through the use of a Multi-Agent Simulation (MAS) model. This work modelled a baseline out to 2037, using 16 model scenarios that are combinations of caps on nitrate leaching (15 – 60 kg/ha) and phosphorus (0.5 – 2 kg/ha) loss applied uniformly across the region. It also analysed four scenarios that include non-uniform nutrient caps, grandparenting of dairy farms, and mandated mitigation practices. The modelling was repeated with the assumption that farmers may use the nitrification inhibitor dicyandiamide (DCD). This product had previously been commercially available for farmers to use, but was withdrawn from the market after traces were found in milk. [47]

The 16 scenarios gave results from no impact on impact on land use or dairy practices up to a 45% reduction in N leaching, a 59% reduction in P loss, and a 7% reduction in E. coli load for a cost of 81% of the value of agricultural production. [47] Non-uniform nutrient caps were found to provide mitigation that is more cost-effective than uniform caps. Grandparenting of existing dairy farms with nutrient caps is less cost-effective than other tools when it limits conversion to dairying. Focusing on farm practices rather than nutrient caps was found to provide a comparatively high level of mitigation, while being more cost-effective than most policies. [47]

Economic modelling is currently by the Southland Economic Project. This is a collaboration between ES, DairyNZ, Beef and Lamb New Zealand, the Ministry for Primary Industries, the Southland Chamber of Commerce, the Department of Conservation and Te Ao Marama. There are three studies included in this project:

1. Economic sectors – gathering information on contaminant discharges to water from multiple sources and the cost of dealing with these.
2. Regional economy – developing an economic model to show possible financial costs to these sectors that could flow through the rest of the economy.
3. Community outcomes – investigating how some of the costs to the economy may have social and cultural impacts on local communities.[79]

41 case study Southland dairy farms are involved in this project which utilises OVERSEER and the farm modelling software Farmax. Preliminary reporting from this project focused nitrogen and phosphorus mitigation and the corresponding change in operating profit. It was found that in general, the higher the reduction in N leaching the higher the impact on operating profit. This is similar to the NZIER study discussed earlier. P loss reduction had a greater impact on operating profit than reduction of N leaching.[79]

Environmental regulations that affect the flexibility of farm systems may cause a disruptive effect on the value of agricultural land. Journeaux (2016) found that environmental constraints in the form of water quality and potentially greenhouses gases can effect land prices in two ways. The first was the increasing of costs and decreasing of profitability of the farming system which affects the productive component of land value. The second was to significantly reduce the ability to intensify either within the same farm system or by land use change. This affects the speculative value of the land.[80] The disruptive effects on land values because of changes in environmental regulations in Southland will depend on what the changes include. However, there is the potential for a large impact, which will be felt by current land owners. Overtime it is likely that any changes in land value would reach an equilibrium.

2.7 Case Study - The Waituna Lagoon

The Waituna Lagoon of Southland warrants special attention as it is a specific example of water quality issues in Southland. The Southland community, including dairy farmers, went through a process with the water quality issues in the Waituna Lagoon, and learnings from this process can be applied to Environment Southland's WL2020 project.

2.7.1 Background

Waituna Lagoon is 1350ha lagoon, which is part of the internationally renowned Awarua Wetland. The area is a designated Ramsar Wetland of International Importance which imparts a commitment to maintain and enhance the ecological health of the wetland. [81] The lagoon is fed by three creeks and drains to the sea through a managed opening. The lagoon and its surrounding wetland are valued for their ecological diversity including a unique macrophyte colony (Rupia). The area is widely used for duck shooting, fishing, boating and walking.[82] The cultural significance to the local Ngai Tahu people was recognised under a Statutory Acknowledgement with the Ngai Tahu claims Settlement Act 1998.[81] The water levels in Waituna Lagoon have been artificially managed since 1908, with temporary openings historically used to improve fish access.[83]

2.7.2 Environmental Issues

In 2011, ES's State of the Environment reporting identified that the environmental state of the Waituna Lagoon had significantly deteriorated and the lagoon was at risk of "flipping."[82, 84] Flipping would see the lagoon change from having clear water that the Ruppia colony thrives in, to having murky, turbid water that is only a suitable environment for algal slime.[41] A significant cause of the deteriorated state was attributed to excessive inputs of nitrogen, phosphorus, and sediment from intensification of landuse in the catchment.[85] The state of Waituna Lagoon made local and national news [86-88] and caused significant disruption in the Southland community (author's personal experience).

2.7.3 The Process Used

The Waituna Lagoon process began before the 2011 announcement by ES. In 2001, members of the Waituna community set up the Waituna Landcare Group in response to changes they were seeing in the catchment and lagoon. This group has held field days raising awareness of good management practices and worked on projects to help improve the water quality in the lagoon.[82] In 2007, funding from the Government, Department of Conservation (DOC), ES's "Living Streams program" and the Arawai Kākāriki Wetland Restoration Programme contributed towards subsidised riparian fencing, culvert alignment and riparian planting on

farms within the catchment. Funding from DOC and ES provided a dedicated Land Sustainability Officer for the Awarua and Waituna catchments to provide direct advice for those within the catchments. After the 2011 announcement from ES, efforts were intensified.[82] One-on-one support was given to famers, and DairyNZ piloted "Sustainable Milk Production Plans (now superseded by Sustainable Milk Plans), with support from ES, Fonterra and Federated Farmers. With support from DairyNZ and other industry partners, the farmers started working through the 584 tasks identified to improve their farms and the lagoon's water quality.[82] Within a year, the estimated investment by the farmers was more than $1 million.[89] Farmers within the Waituna catchment formed "Waituna Farmers United" and developed their own catchment action plan.[90] ES, along with the Waituna community, was successful in their bid to the Ministry for the Environment's "Fresh Start for Fresh Water Clean-up Fund."[91] This provided funding to help with work such as reconstructing stream banks to reduce sediment loss as bank collapse was a major contributor to sediment.[48] In 2013 Fonterra announced a $20 million commitment to wetlands, including the Waituna Lagoon, in a Living Water partnership with the Department of Conservation.[92]

The Department of Conservation, ES, Southland District Council, Te Runanga o Ngāi and Te Rūnanga o Awarua formed the Waituna Partners' Group in August 2013 to show commitment to work as a partnership for the ongoing care and improvement of the Waituna catchment and lagoon. This is a working group made up of staff from these agencies as well as the DOC-Fonterra Living Water partnership and DairyNZ. In 2015 this group, along with local landowners contributed to the release of the "Strategy and Action Plan for Waituna." This plan gives a formal structure for the desired outcomes and actions needed to be taken to achieve these with a timeline, as well on ongoing actions. It was noted that a coordinated approach will achieve a lot more than agencies working separately.[82]

Social and economic modelling was instigated out by DairyNZ. This work modelled the social and economic impacts of possible nutrient loss limits.[93, 94]

2.7.4 Learnings from the Waituna Lagoon

The learning from the Waituna Lagoon process can be utilised by the Southland community, including dairy farmers, during ES's WL2020 process. DairyNZ has summarised some learnings that farmers have had from the Waituna lagoon process:

- Be proactive so that you don't have to act under pressure.
- Define who your community is. Make sure that everyone is represented from an early stage.
- Approach the challenge with in a united way. It pays to have an agreed strategy from the outset.
- Build a network and use the resources of industry organisations.
- Get in front of the decision makers. Tell your story, make it personal so people understand the impacts on your farm, your family and the community
- Use the expertise of individuals in your community who can contribute at different stages of a project. Working as a team makes the journey easier.[41]

These learnings are very similar to the learnings summarised in the Waituna Farmers United's catchment plan:

- A catchment community approach based on openness and trust
- Working directly with the environmental stewards of the land – farmers
- Recognising problems and our responsibilities
- Sharing the responsibility and actions between ourselves and with others
- Moving past emotions and engage with high quality decision making
- Getting support from experts (keeping them on tap not on top)
- Communicate well with each other and with local authorities
- Promote leadership and celebrate success[90]

Key learnings involve the importance of involving the whole community, good communication and involving the decision makers. Leadership and strategy are also important. These themes are directly transferrable to the WL2020 process.

2.8 Science of Behaviour Change and Adoption of Innovation

2.8.1 Research Innovation Diffusion Model

The WL2020 process represents a change in management policy and local government policy. To be able to help dairy farmers adapt to this change, it is important to understand how society adapts to changes and innovations in general. In all sectors of society, people do not adopt to these management changes or innovations simultaneously.[95] The most widely used research innovation diffusion model is one proposed by Rogers (1962) [66] and revised by Rogers and Shoemaker (1971)[96].[97]This model categorises the population based on their attitudes to innovation. In this model, the concept of innovation is defined as any object, idea, technology, or practice that is new. This theory is described as a bell-shaped curve of the population (Figure 8).

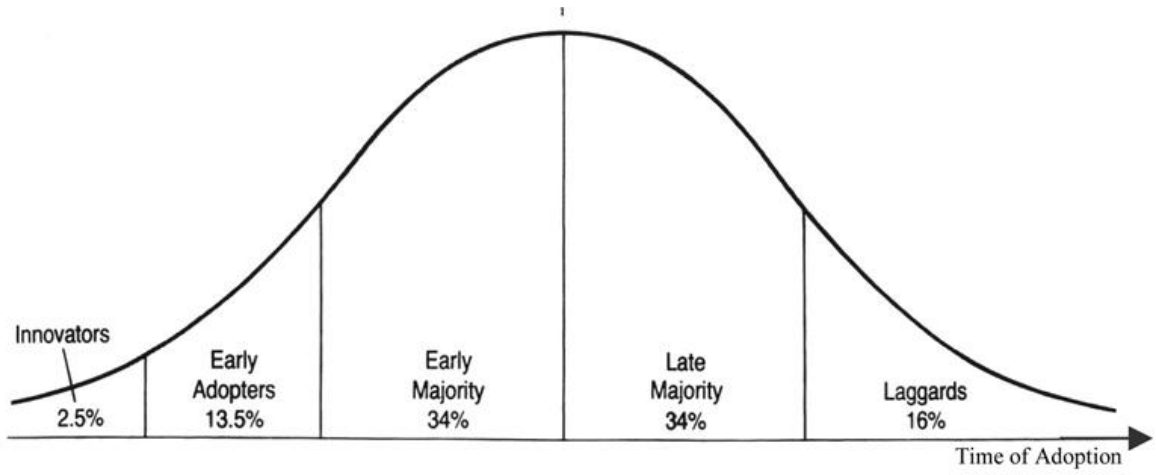

Figure 8 Adopter categorisation on the basis of innovativeness From [98]which has adapted it from Rogers and Shoemaker (1971)

From the bell curve, the top 2.5% of the population are described as innovators. Innovators are eager to try new ideas, willing to take risks and often belong to and communicate with a group of fellow innovators. They have high social status and strong financial liquidity which allows them to absorb losses from adopting innovation that may ultimately fail. Early adopters are the next 13.5% of the population. They tend to be more discrete in adoption choices than the innovators, but show the greatest amount of opinion leadership of any group and are looked to for advice by the remaining groups. This group is pivotal in achieving change within a population. The early majority make up the next 34 % of the population. These people

are more risk averse than the early adopters. They need to see the practice/technology successfully working before adopting it themselves. This group have contact with the early adopters and tend to follow their lead. The late majority of the population also make up 34%. This group adopts innovation after the average participant. They have a high level of scepticism and wait until social norms change to adopt the innovation. The last group (16%) are the laggards. They are the last to adopt an innovation. They are adverse to change and prefer to focus on what has been traditionally done. They are likely to be older than other adopters.[96] In a situation such as environmental regulations, regulations would need to be in place to achieve change from the laggards.[8]

When trying to get uptake of a new innovation or a new practice, it is best to focus on the first two groups (innovators and early adopters).[97] Any barriers that they may face will be experienced by the rest of the population.[99]

There are four factors that affect the diffusion, or uptake, of innovations.[97]

1. The characteristics of the innovation – described as the relative advantage, compatibility, complexity, trialability and observability of an innovation.[96]
2. The characteristics of the individual – factors such as time available, personal and financial circumstances, support networks and relationships with advisors have an influence.[96]
3. The characteristics of the social system - innovative individuals exhibit far less innovative behaviour when living in a traditional society. A modern social society is far more likely to support innovation.[97]
4. Channels of communication – two main routes are mass media and interpersonal.[97] Mass media is important at the “knowledge function level,” while interpersonal channels are more important at the “persuasion function” in the innovation- decision process. Early adopters are more likely to use mass media than later groups.(Rogers and Shoemaker in [97])

Waugh (2011), described an issue of using Rogers’ models in a situation similar to the WL2020. The models have generally been used to describe innovations such as new technologies and/or practices that are expected or perceived to have greater direct benefits

to the adopter.[8] However, in the situation of water quality there is often a perception that practices that are being encouraged may have direct costs to the farmer. Waugh stated that this perception is a difficult barrier to overcome, even if it is incorrect, and may lead to a greater timeframe between the innovators and the laggards. Most, if not all, of the laggards, and potentially a proportion of the late majority are not likely to make these changes without some form of regulation in place.[8]

2.8.2 Social Aspect of Farmer Adoption of Innovation

Traditionally, the social aspect of farmer adoption of innovation has not been a focus, and environmental extension has been a "top down" process. Farmers who did not adopt the innovation were seen to be at fault and not much consideration was given to the farmer's point of view or that their resistance may be based on logic.[100] Vanclay (2004), emphasised the need to understand the social aspect of farmers to achieve adoption of innovation:

"A*griculture has too long been thought of as a technical issue involving the application of science and the transference of science outputs via a top-down process of technology transfer. It is not. Agriculture is farming, and farming is people."*[101]

Vanclay presented 27 "social principles" (Table 4), that need to be understood if agricultural extension is to be effective in dealing in addressing natural management issues,[101] such as water quality. Broadly speaking these covered the importance of understanding farming from a social perspective rather than a pure technical perspective, to assist in the promotion of sustainable farming. These principles have implications as to how to increase farmer adoption of any changes.

Table 4. Vanclay's 27 social principles.[101]

Principle	Description
1	Farming is a socio-cultural practice
2	Farmers are not all the same
3	Adoption is a socio-cultural process
4	Profit is not the main driving force of farmers
5	It is hard to be in the green when you are in the red
6	"Doing the right thing" is a strong motivational factor
7	Farmers don't distinguish environmental issues from other farm management issues
8	There is a strong desire to hand the farm on to one's children
9	Sustainability means staying on the farm
10	Women are an integral part of the farm
11	Stage in the lifecycle of a farming family and family composition are significant factors
12	Non-adoption is not the cause of land degradation, rather practices actively promoted by extension in the past have significantly contributed to degradation
13	Marginal farmers are not marginal because of their management ability but rather because of their structural location
14	Farmers' attitudes are not the problem
15	Farmers construct their own knowledge
16	Effective extension requires more than the transfer of technology, it requires an understanding of the world views of farmers
17	Farmers have legitimate reasons for non-adoption
18	Top-down extension is inappropriate
19	The 80-20 rule is a self-serving delusion
20	Science and extension so not have automatic legitimacy and credibility
21	Representation is not participation
22	Promotion of awareness through the use of dramatic images is counterproductive
23	Put degradation into perspective
24	The best method of extension is multiple methods
25	Group extension is not panacea
26	Extension is likely to have only a small impact
27	Farmers need to feel valued

The client Stocktake Project was undertaken by Dairy Australia to help understand and work more effectively with the diversity of Australian dairy farmers.[102] It involved the development of the Derived Attitudinal Farmer Segments (DAFS) method to identify manageable segments of the farming population to better target technology development, extension and communication.[102] This work identified six groups of farmers (with % of population):

1. Family first (5.5%) – this group is driven by the desire to maintain their farms so that their families can continue its dairy farming way of life
2. Winding down (3.6%) – very risk adverse with low motivation towards sustaining or improving their business

3. Love farming group (17%) – this group is very positive about farming and willing to make changes in their farming businesses to ensure sustainability
4. Established and stable (24.9%) – self-reliant and risk adverse
5. Open to change (21.5%) – motivated to develop a sustainable and successful business
6. Growing for the kids (27.4%) - enjoying running and developing a sustainable dairy business, keeping up the tradition and looking to the future of the family farm

van Reenen (2012), in her summary of the above work, suggested that the segments of dairy farmers could be attributed to the groups identified by Rogers and Shoemaker (1971).[99]

- Family first plus winding down = laggards
- Love farming = early adopters
- Established and stable = late majority
- Open to change = innovators plus early adopters
- Growing for the kids = early majority

van Reenen, based on this summary, concluded that there are a greater percentage of farmers who are more rapid at adopting new technologies and practices than suggested by the Rogers and Shoemaker study.[99] This has positive implications for the rate of uptake of environmental practices by farmers.

A review by Blackstock *et. al.* (2010) identified key areas that are essential when trying to influence farmer behaviour around diffuse pollution.[103]

1. Raising awareness amongst farmers

It was found that well-reasoned and data-based message should be effective to persuade farmers to adopt good management practices, so long as farmers were convinced that there is a problem and that their own actions can contribute to solving it. However, it was found that often topics like diffuse pollution were poorly understood and authorities needed to take time to discuss the issues with farmers.

2. Recognising diversity within farming stakeholders

Not all farmers are the same and not even all farms within a catchment are the same. Advice needs to be tailored to individual farms and farmers and one-on-one advice and farm visits help achieve this.

3. Socially negotiated learning

Knowledge exchange social relationships and local group learning is important. Capability may need improving for this to be effective.

4. A new role for scientists

Farmers will still need to draw on reliable science from experts, but the relationship has changed from exclusively being a knowledge transfer to becoming a knowledge exchange. Farmers need to be working effectively with scientists rather than simply passively learning from them.

2.8.3 A New Zealand Perspective

Social implications on environmental extension in New Zealand have been reported. Historically, a linear transfer of technology and diffusion model of extension was used for extension.[104] However, as New Zealand agriculture has moved through the four phases of land management as described by Bawden (1987) (in[104])), from the pioneering phase, to the production phase, to the productivity/economic phase to the ecological/sustainability phase, there has been increasing appreciation that environmental issues are socially complex and require a more collaborative approach to extension.[104] Journeaux (2009), found that the social component of environmental issues as crucial to the adoption of any extension. It was found that the rate of adoption of environmental best management practices was slow amongst sheep and beef farmers, because of factors including the traditional top down/linear approach to extensions and lack of participatory or collaborative approaches with farmers.[97] Davies (2012), found that a 'one size fits all' approach to improving nutrient management on sheep and beef farms would not work and that a farm specific approach was needed.[105] van Reneen (2012), in the project already discussed, found that increasing environmental practices on sheep and beef farms was a social issue as much as it was an environmental issue.[105]

Recent work on farmers' perspectives on water quality in Canterbury by Duncan, found divergent problem framings between the Canterbury Regional Council and farmers in the Culverden Basin.[106, 107] It was found that, farmers take moderate responsibility for water quality, seeing water quality problems as dependent on a range of variable factors such as weather. In contrast, the regional council frames water quality and farmers responsibility to

it as direct and unimpeded. Duncan concluded that this difference affects the laying down of good management and, beyond that, achieving farmer compliance with the regional plan. As these framings are so divergent, Duncan in her report to the Hurunui-Waiau Zone Committee recommended farming communities work out what water quality meant to them (rather than adopting the regional council's scientific framing of the issue) which could involve building narratives that have little to do with the rivers. This was translated by a zone committee member as the need to move conversations from ''river talk'' to ''farm talk.''[106, 107]

In a news article about the work, Duncan commented: *"the local understanding and local knowledge of farmers and the local scale are very important to consider. It is about how we can increase our chances of engaging with farmers and come up with workable solutions rather than solutions that are unworkable or misdirected. It's not a matter of trying to blame farmers or force messages onto them which seems to be the current approach. While easily dismissed as farmers lack recognition of the effects they have or misunderstanding of science, how farmers frame the water quality problem must be recognised. This is an important starting point for working with them in introducing new policies and rules and good management. Ultimately farmers need to be a large part of the water quality solution. A fundamental step is to increase policy maker understanding of farmers."* [108]

2.9 DairyNZ Sustainable Milk Plans

A DairyNZ Sustainable Milk Plan (SMP) is a farm-specific action plan which outlines the steps to be taken on an individual farm, to contribute towards catchment-scale environmental targets. A SMP identifies current on farm good management practice (GMP) actions as well as further actions which can be implemented for environmental gain.

DairyNZ Sustainable Milk Plans targets four key areas:

- Nutrient management
- Waterway management
- Land management
- Water use efficiency[109]

The Canterbury Land & Water Regional Plan requires farmers to have a farm environment plan (FEP) that demonstrates how they are achieving good management practice on farm. DairyNZ's SMP has been approved by Environment Canterbury to be meet these regulatory requirements.[110]

A SMP involves a consultant with suitable nutrient management and farm systems knowledge visiting a dairy farm. Together, with the farmer/s, the consultant gathers data and inspects the farm. The SMP process is focused on five main management target areas: nutrients, effluent, land and waterways management, and water use efficiency.[111] Major environmental risks are identified for the farm and a farm map is produced. The SMP records good management practices already being carried out as well as farmer agreed actions to complete with a timeframe. At this stage in Southland, as the plans are voluntary, no follow up visit is completed. The author has been contracted to DairyNZ to complete SMPs within Southland.

2.10 Case Study - The Upper Waikato Sustainable Milk Project Summary

2.10.1 Background

The Upper Waikato Sustainable Milk Project is the largest environmental good-practice catchment project ever undertaken by the New Zealand dairy industry. This project involved 642 dairy farms in the Upper Waikato and was co-funded by the Waikato River Authority (WRA), a Primary Growth Partnership (PGP) and DairyNZ.[111]. Between June 2012 and May 2015 all 700 dairy farms in the Upper Waikato catchment were offered the chance to carry out a SMP. A follow up visit 6-10 months was carried out also. By July 2015, 598 farms had completed the full SMP process. A total of 5921 individual actions were recorded across all 642 farms taking part in the study.[111] OVERSEER, as well existing literature, was used to model the effectiveness of different mitigation strategies. Only the actions that could confidently be assessed as having a direct reduction on contaminant loss were included in the analysis. A lot of other actions carried out by farmers as part of the SMP project would be likely to have direct or indirect environmental benefit, but this would not be possible to quantify. [111, 112]

2.10.2 Environmental Improvements

The environmental improvements from the program were modelled. Potential load reductions on individual farms ranged from 0 to 35% for nitrogen, and 0 to 73% for phosphorus. Mean potential reductions in farm nutrient losses following the successful completion of 70% of all intended SMP actions across all farms were estimated to be 5% for N and 12% for P. These values are expected to increase to 8% for N and 21% for P should all actions across all 642 SMP farms be completed. These estimates reflect the potential reduction in farm nutrient losses as calculated from OVERSEER nutrient budget outputs and do not reflect attenuation processes prior to discharge direct to surface waters. However, assuming that attenuation rates are likely to be similar before and after reductions in farm nutrient loading, the final percentage reductions in loadings to waters are likely to be similar to the estimated off-farm reductions.[111, 112]

2.10.3 Influencers of adoption

The reasons that farmers had completed or not completed the agreed actions by the follow up visit were recorded. The SMP visit itself, compliance with Council and dairy industry requirements and self-initiated were the main drivers for change. Time to complete and financial reasons were the time main barriers for not completing the agreed actions, although some will still be completed. Not surprisingly, a decreasing world milk price made a noticeable impact on the barriers to completing actions, especially during the second half of the project as the price further decreased. Talking to other farmers and experts, reading relevant technical information and use of the internet, were readily used forums to aid decision making. It was found that farmers still required support through this process, as often the articles and information were too technical, so they needed one-on-one advice to put it in plain language.[112]

2.10.4 Further Work

DairyNZ generously provided me with this information before the project was completed. A second phase of the study will evaluate the benefits of SMP implementation on reducing sediment and bacteria loads. Loading to surface waters after attenuation will also be further

investigated. The values used to define the effectiveness of individual mitigation measures and the collective impact of consecutive measures will be further tested by a peer-reviewed scientific process. Therefore, all estimates of N and P loss are treated as preliminary until the results of this are published.[111, 112] However, the results of this work show promising nutrient loss reductions that can be achieved by a catchment based SMP project.

3. Methodology

This project had two main aims. The first was to review existing literature to analyse the issue of water quality in New Zealand, particularly in the Southland the focus region of the project. It was important not just to analyse the science aspect of water quality, but also the social science aspect. Secondly, the author wanted to find ways in which DairyNZ could help Southland dairy farmers adapt to the changing environmental rules that will come in the near future. Stakeholders, both dairy farmers and industry representatives were interviewed to develop a practical perspective of ES's WL2020 process. Interviews also aimed to get opinions on what DairyNZ could do to support Southland dairy farmers adapt to the changing environmental regulations that are part of the WL2020 process.

Interview questions were designed to cover the three key sections to this research. Firstly it was important to determine what knowledge Southland dairy farmers had of ES's WL2020 process and their knowledge of the proposed changes. Secondly, the impact of the proposed changes and the awareness of these impacts was investigated. Finally, preparedness of Southland dairy farmers, how this preparedness could be improved and how DairyNZ could contribute was the focus. Background questions were also asked to each interviewee.

Two groups of people were interviewed. The first group were professionals involved with the Southland dairy industry. These people were selected because they have been involved with ES's WL2020 process and also have direct contact with Southland dairy farmers. These people were selected by the author with input from industry leaders. They included representatives from Southland Federated Farmers, Fonterra, DairyNZ, Agribusiness Consultants and ES. The interview asked for their personal opinions, not necessarily the opinions of the organisations that they represented.

The second group were Southland dairy farmers. These farmers were again identified by the author with help from industry leaders, as farmers that were directly engaged in the WL2020 process at an industry level. This sample set was selective but this approach was chosen over a more random sample because these farmers are likely to belong to the innovators and early adopters groups of Rogers's theory.[95] Any issues that were facing these groups would likely

face the rest of the population. The engagement shown by these farmers is what this project aims to replicate through a greater proportion of the Southland dairy farmer population.

A total of 13 semi-structured interviews were conducted in person (except for one where in person was not possible) by the author, with a near equal split between dairy farmers and industry representatives. Before each interview a background of the project and its aim to provide positive and practical ideas on how DairyNZ could support Southland dairy farmers with changing environmental regulations was given. Confidentiality of responses was guaranteed, and assurance that no specific answers would be attributed to individuals was also provided. This ensured that the answers and ideas given were completely genuine and were given without fear of being directly quoted. Given the often controversial nature of water quality issues in the media, this was important. The choice to do in person interviews was deliberate also. These were more time consuming than other methods, but the rapport that was developed between the author and the interviewees was far greater than what would have been if phone interviews or digital surveys were used. There is no doubt that this contributed to the honesty of the responses. The interviews lasted between one hour and two and a half hours.

The interview questions that were asked are included in Appendix 1 and Appendix2. Slightly different questions were asked to the industry representatives and the dairy farmers given their different backgrounds, although the intent of the questions was the same. The data from each interview was summarised so that the opinions of each interviewee could be analysed separately before being collated.

As well as the formal interviews the author did further background research by attending three meetings over the course of this project that provided further background information. These were a Hedgehope catchment group meeting, a DairyNZ Southland Dairy Leader meeting and the Southland Federated Farmers annual general meeting where there was a plenary session focussing on water quality. A number of other Southland dairy farmers and industry members were talked to gain further insights.

4. Results and Discussion

4.1 Background of Interviewees

The Southland dairy farmers that were interviewed had a range of ownership structures and management structures on their farms. There were equity partnerships, sole owners and leased farms. Management structures included managers, contract milkers, sharemilkers and owner operators. The farm sizes ranged from 90 hectares to 550 hectares. All of the dairy farmers interviewed had been engaged in some way with the WL2020 process. This engagement included activities such as attending ES drop in meetings, attending other industry meetings, belonging to and/or leading catchment groups, writing feedback and/or submissions on the draft plan and being part of the stakeholder group that has direct contact with ES. Some were also part of the DairyNZ Southland Dairy Leader Advisory group.

The industry representatives that were interviewed had been in their role for between two and 11 years. All of the representatives had direct contact with farmers in the Southland region, including dairy farmers. All of the representatives had engagement with the WL2020 process also. This included holding community meetings, helping farmers to prepare feedback and/or submissions on the draft plan, preparing formal submissions from their industry on the draft plan and being involved in collaborative research with ES. Two Land Sustainability Officers from ES were amongst the industry representatives interviewed.

4.2 The Water and Land 2020 and Beyond Process

4.2.1 Background

All interviewees were asked to describe the ES WL2020 Process. The purpose of this was to assess understanding of the process, where we are now and what is yet to come. All interviewees were able to accurately describe the process (which was confirmed by the ES staff), which was expected as they had been selected due to their known engagement in the process.

Some interviewees raised concerns that the general Southland public, including dairy farmers, were confused regarding the process. They thought that a significant part of the Southland community didn't realise that the new Water and Land plan due to be notified in June was

not the end of the process, and that limit setting was still to come. There were also doubts that the Southland community realised that ES had been required to go through a process like this due to central government policies. There were also a significant proportion of the Southland community that didn't accept that there was a water quality issue. These points are significant because if dairy farmers or other community members don't understand the context or the framing of the issue, this is likely to restrict their engagement with the process, This is similar to what Duncan (2016) reported.[107]

4.2.2 Strengths and Weaknesses of the Process

There were both similarities and differences amongst the responses describing the strengths and weaknesses of the process. A key strength identified was that ES had taken their time with this process and not "rushed out" like other regions such as Horizons, Otago and Canterbury. This was appreciated by the interviewees and built respect for ES. Most interviewees also acknowledged the amount of feedback sessions and meetings (both ES and other industry organisations), as giving plenty of opportunity for the public to give feedback if they wanted. There was the impression that ES was trying to base any rules and changes on science also which was a positive. The experiences that had been taken from the Waituna Lagoon process were also seen as a positive, as unlike for many other regions, Southland had already gone through a water quality issue process, and learnings could be taken from this.

The major weakness identified was the timing of the release of the Working Draft Plan and the end of the feedback process on this on the 31st of October 2015. This timeframe clashed with the high workload of the calving season for dairy farmers (and also the lambing season for sheep farmers), and this would have impacted on the proportion of farmers that were engaged in this process. Other weaknesses identified included ES staff and councillors not having enough farm systems knowledge and not getting onto farms enough. Most of the farmer interviewees as well as some of the industry members, felt that both ES staff and councillors needed to have more knowledge of the practical implications of their suggested rules and changes. There was also an opinion that ES was relying on the pure science too much and not utilising enough economic modelling during the process. Although economic modelling work is being carried out, it was felt that this should be a major factor from the start of the process and the results should be more visible. It was also felt that there had not

been much effort trying to get the urban community involved, and as a result the water quality issues was still seen in the Southland community as a "dairy farmers' issue." It was suggested that the "proactive-ness" of farming agencies such as DairyNZ and Federated Farmers in holding farmer meetings during the consultation on the Working Draft and providing feedback and submissions on behalf of farmers, can contribute to the non-farming community labelling water quality as an agricultural problem. Also, the tendency for local media to report farmers' views on the process,[75] was thought to contribute to this.

Something that was identified as both a strength and a weakness by different interviewees was the aim of ES to use a collaborative process. The attempts by ES to involve the community and to seek feedback from as many of them as possible was seen as a positive. There was also agreement around the importance of ES collaborating with agencies such as DairyNZ on the science and economic modelling. However, there were interviewees that questioned whether the collaborative process used with the Southland public was instead a consultation process. To analyse this the difference between collaboration and consultation must be defined. Kieny (2012) defines collaboration as "working together to achieve a goal…a recursive process where two or more people or organizations work together to realize shared goals." Whereas the definition of consultation is "more reactive, based on providing advice from time to time or reacting to something that has already been decided or created. It's more project-specific or shorter-term in nature."[113] Some interviewees felt ES was genuine in wanting collaboration and would take into account the feedback of the public for the next steps of the process. It was pointed out that ES could have just released the notified plan and didn't have to go through the Working Draft process. Others thought that ES had already decided what they wanted to achieve, were asking leading questions and would "cherry pick" the responses that they listened to and ignore the rest, indicating a more consultative approach. There were comments around ES being "tellers" and not "facilitators." Once the Plan is notified in June and the changes from the Working Draft are apparent, it will help evaluate whether this part of process was more collaborative or consultative in nature.

Another aspect that was identified as both a strength and a weakness was the step-wise process itself. Some felt that this process gave the public time to build their understanding and knowledge. In contrast, some felt that people could be left behind and others felt that

there was confusion and that not everyone knew where the end point was. There was a fear that the process was seen as a “big cloud” and was not defined enough.

The level of information provided to the public was largely deemed to be either somewhat appropriate or appropriate by the interviewees, although there were some comments relating it its uptake. Although a lot of information is available on the ES website, there were questions at how effective this was at reaching farmers and that “information overload” could occur. Also the quality of broadband coverage in Southland could hinder the uptake. The importance of one-on-one information transfer between farmers was discussed, and many interviewees felt that this was not occurring enough. Farmers are more likely to listen to their peers than anyone else and this was seen as a key information exchange mechanism that needed encouraging.

4.2.3 Engagement of Southland Dairy Farmers in the Process

Understanding the current level of engagement of Southland dairy farmers in the WL2020 process is critical to this project, as to improve the level of engagement one must first understand what that level is beforehand. Engagement is defined as the action of participating or being involved in.[114] In this project, it was defined as the farmers having had something to do with the process in an active way, for example attended a meeting (ES or industry), spoken to an advisor, given feedback or prepared a submission.

The estimate of Southland dairy farmers engaged in the process was estimated to be between 10 and 20% by most interviewees. Some commented that this was similar to most other processes in life, and likened it to Rogers’s bell curve. The engaged dairy farmers were seen as being comparable to the innovators and early adopters. They were the part of the population that were easy to get engaged and were likely to be the leaders. There were comments that there had been strong engagement from the dairy industry agency bodies such as DairyNZ, Federated Farmers and Fonterra, and that these agencies engaged on behalf of all Southland dairy farmers, not just those that had been engaged individually.

Questions were then asked on how to improve the proportion of engagement. A key theme of how engagement could be improved going forward was that more one-on-one meetings

or small group “woolshed” meetings were needed. Dairy farmers, like reported by Duncan (2016), had to understand and accept that there was a water quality problem before they could be engaged.[107] Farmers listened to other farmers more than anyone else, so key farmers needed to be identified who could directly contact farmers who were not engaged. As stated by Vanclay (2004) “group extension is not a panacea,”[101] rather one-on-one interaction was also important. This form of peer pressure or “socially negotiated learning” was seen as essential by by Blackstock *et. al.* (2010).[103] Other suggestions were that the information had to be made specific for individual farmers so that they could relate the big picture to their own circumstances. As reported by Vanclay (2014), farmers are not all the same and this meant that there were no single problems or single solutions,[101] and personalising the issue and not treating all farmers the same was found to be important by Blackstock *et. al.* (2010).[103] However, it was discussed that the “bell curve would not change, just the axis would move,” i.e. there would always a significant proportion of the population less engaged than others. It was also commented that for topics such as environmental issues the bell curve was likely to start shifted slightly towards the left hand or less engaged side and this is why regulation would always be needed to change the behaviours of the laggards.

The attitudes of dairy farmers was seen as significant to very significant in their willingness to be engaged. Dairy farmers that wanted to be engaged were, and those who did not want to be were not. The dairy farmers that didn’t want to be engaged had put the process in the “too hard basket” and had shown apathy. The key to having any change on these attitudes was identified as needing to focus on one-on-one engagement, or “inter-personal communication” as described by Journeaux (2009),[97] with these farmers. These farmers would not respond to the mass media approach, invites to meetings or information on the internet. It was unlikely that they would go out of their way to become engaged. It was also seen as important to individualise the possible costs to dairy farmer’s businesses of the proposed rules and changes, as this would encourage dairy farmers to become engaged in the process. They would be able to personalise the possible outcomes which would carry more weight, than talking about the outcomes for Southland as a whole.

One interviewee described the process as correlating to the Kübler-Ross five stages of grief model. This model has been used to describe some of the stages many people go through when dealing with grief.[115] The steps are denial, anger, bargaining, depression and acceptance. When the dairy farmer or other community member first heard about any environmental changes they may go through this process. Firstly they may deny anything is happening or needs to happen, and then they may become angry. Bargaining and depression may occur before acceptance is reached. This is a simplistic way of interpreting the model that itself has been questioned,[116] but may describe how some people react to changes in environmental regulation. Once the acceptance stage is reached, and the individual had accepted there are water quality issues and that the changing environmental regulations were going to happen, they were willing to become engaged with the process.

The impact of the low dairy payout was seen by most interviewees as having a negative impact on dairy farmers' ability to become engaged. Dairy farmers have had to significantly reduce on farm costs, including reducing staffing levels, and have gone into "survival mode." This has meant that their focus has become more "on farm" and they have less time and energy to spend on issues perceived to be "outside their farm gate," such as the Plan and the WL2020 process. In contrast, it was suggested by some interviewees that the low payout "reduced the production focus" of dairy farmers, and gave them the opportunity to look at their farming business as a whole, which included analysing their environmental footprint. The low payout turned dairy farmers' attention to the sustainability of their businesses and this included environmental sustainability. Dairy farmers who had farmed through the "B.C. and A.D." periods of subsidy removal also appreciated the disruptive nature that environmental regulations could have on agricultural. The low payout was seen as "cyclical" and "not here forever," whereas environmental changes were "forever," and were likely to have larger impacts in the long term than the current low payout conditions. Therefore, it was felt that it was vital that despite the low payout, Southland dairy farmers were engaged.

4.3 Knowledge of Proposed Rules and Changes

The knowledge of the proposed rules and changes is the next step for dairy farmers after engagement. It is not enough to be engaged in the process, but it is important for Southland dairy farmers to know and understand the proposed rules and changes. Interviewees were

asked to estimate the proportion of Southland dairy farmers that had a near complete knowledge of the proposed rules and changes, what proportion would have some understanding, and what proportion would have very little or no understanding. Although there was some variation in the actual proportions provided the overall trend was that the majority of Southland dairy farmers had very little or no understanding (between 50 and 70%), the next biggest group was those that had some understanding (between 20 and 40%), followed by a small group of Southland dairy farmers that had a near complete understanding (from less than 5% to 10%). There percentages were not surprising to the author, but are concerning especially the large proportion of Southland dairy farmers with very little or no understanding of the proposed rules and changes. ES has taken a stepwise approach in their WL2020 process which has given the Southland community time to gain knowledge of their proposed rules and changes, but the majority of Southland dairy farmers still have very little or no understanding of these.

The effectiveness of farm environmental plans (such as DairyNZ's SMPs) to improve the knowledge of the proposed rules and changes was rated at either somewhat significant to very significant. It was commented by some interviewees that the main aim of a SMP was not to improve awareness, which was confirmed by DairyNZ. However, by going through the SMP (or other farm environmental plan) process the knowledge of the proposed rules and changes was increased by the discussion that was had one-on-one between the consultant and the dairy farmer/s. Farmers that had been through the SMP process generally felt that they were more confident in their knowledge of good management processes, and how these can contribute to better water quality. It took good management practices from being a concept that had been talked about a lot, to something that was practical and applicable to their individual farm. It took some of the fear out also, as it allowed farmers to see that a significant amount of good management practices had little or no financial cost to their business, and some even had a positive effect to the overall financial position.

A criticism of the farm environmental plans was that there was duplication in the three plans available to Southland farmers (DairyNZ's SMP, Beef and Lamb's Land Environmental Plan and ES's Farm Focus Plan). Some interviewees felt that this confused farmers, but by contrast others thought that by doing all three plans (if the dairy farmer was also a sheep and beef

farmer than it would be possible for them to complete all three plans, otherwise dairy farmers could do a SMP plus a Farm Focus Plan if they wanted) they could use the "best bits" of each plan and that it was better to have "too many plans than not enough."

There were similarities between the answers of the interviews regarding the major limitations of Southland dairy farmers having a knowledge of the proposed rules and changes. Lack of time and competing demands were seen as major limitations. Also fear of what the changes may mean was seen as a possible limitation. Some interviewees felt that there dairy farmers that were embarrassed to be dairy farmers when talking about environmental issues. The "dirty dairying" type of campaigns had villainised them. This prevented them becoming involved in environmental discussions.

As well as limiting dairy farmer's ability to become engage, the low payout was seen as a major limitation to dairy farmers increasing their knowledge of the proposed changes and rules for the same reasons as discussed earlier. Again, dairy farmer's attitudes were seen as important but often dairy farmers that had chosen to be engaged were willing to increase their knowledge.

There were also similarities between responses from the dairy farmers and the industry members on how these limitations could be overcome. Some responses from industry members felt that the knowledge of the proposed rules and changes could be improved by more accessible information (science) and better education. Responses from the farmers took this further. Farmers had to be helping to spread the knowledge within their community. It was important that all of the community was involved and that people were talking to their neighbours, whether they were dairy farmers or not. This would help not only help the spread of knowledge, but also foster relationship building within the community that would be essential for the limit setting process that is to come. Interviewees felt that dairy farmers should show leadership within their communities and bring their community up to speed. It was discussed that the unknown factor of the Plan doesn't help this process. The knowledge of the proposed rules and changes is likely rise exponentially once the Plan is notified in June. This will give a "burning platform," and a sense of urgency which will increase engagement which will ultimately increase the knowledge of the rules and changes.

4.4 Impact of Proposed Rules and Changes

Although the Plan will not be notified until June 2016, the Working Draft indicated some proposed rules and changes covering nine key themes that may be included, and the limit setting process has been publicised. The next step for Southland dairy farmers, as seen by the author, after engagement and knowledge, is knowing what the impact of the proposed rules and changes for themselves as individual dairy farmers, and for the Southland community in general.

The estimated impact of the proposed rules and changes was ranked from little or no impact right up to large impact, with the majority of interviewees selecting large impact. In general, the dairy farmers were more likely to select large impact than the industry representatives which is likely to be because of them having dairy farming businesses that will be directly affected. The time frame for any of the rules and changes was seen as having an important effect on the impact. If the timeframe was short and not practical, then the impact would be higher. The timeframe also affected "who pays" for the rules and changes and the impacts that they cause. The longer the timeframe, the less the individual pays and the more the community pays. In Duncan's (2016) work, similar results were found regarding timeframe. "None [of the farmers] objected to limits being set by the regional plan so long as they were fair and reasonable, did not affect economic viability and profitability and were carried out with sufficient transition times."[108]

The estimated impacts were also seen to be different for different physiographic zones, as some of the proposed rules were different for each zone. Some interviewees feared that this would make for "haves and have nots" or "winners and losers" within farming communities, and the Southland community in general. It may have disruptive impacts on land prices at both ends of the scale. This division was seen as a probable hurdle to the community having productive and inclusive conversations at the beginning of the limit setting process. It was seen likely that for some physiographic zones, good management processes would not go far enough and significant changes to farm systems may be needed, whereas farms in other physiographic zones would manage with smaller changes.

4.4.1 Awareness of the Impacts of the Proposed Rules and Changes

The awareness of the impacts by Southland dairy farmers was somewhat correlated to that of the knowledge of the proposed rules and changes and those who were engaged. Out of the dairy farmers that are engaged, most had knowledge of the proposed rules and changes and some were aware of the impacts of these.

Improving the awareness of the rules can be achieved by increasing the proportion of Southland dairy farmers that were engaged. If only 10-20% of Southland dairy farmers are engaged in the WL2020 process, then it would be impossible to get more than this number aware of the impacts of the proposed rules and changes. By "shifting the axis" on the bell curve to get more dairy farmers engaged, then by default the awareness of the rules and changes and their impacts would increase.

4.5 Farmer Involvement in the Process

Generally the interviewees felt that dairy farmers had little or no awareness that their involvement in the submission process after the Plan was notified could have an impact on the final outcome of the Plan. Apathy or the "someone else will do it" attitude was seen as a constraint. Dairy farmers put it in the "too hard basket" or didn't think that they had the required skills to do it. Dairy farmers are rate payers and contribute to the income of ES, so need to ensure that their views are heard as part of the Southland community.

The interviewees felt that the submission process is quite foreign for most dairy farmers, although they probably have more awareness than sheep farming, due to the consented nature of dairy farming. It is something that is not really taught. Also the good job done by groups such as DairyNZ and Federated Farmers made dairy farmers feel that they did not have to do their own submissions. Getting dairy farmers to do personal submissions was seen as one of the most difficult parts of this process to achieve. Most interviewees thought that specific attention would have to be given to initiatives, such as submission workshops to get dairy farmers to do personal submissions.

4.6 Preparedness for Changes and Rules

Most interviewees thought that Southland dairy farmers were somewhat prepared for the proposed changes and rules that the Plan would bring, but the fact that the Plan would not be notified until June made it difficult to fully assess this. This was surprising given that much less than the majority of them had been engaged, had knowledge of the proposed rules and changes or their impacts. However, the indication by ES that good management practices are likely be a significant part of the new Plan meant that dairy farmers already following these were somewhat prepared if these are included in the new Plan. A significant amount of work had been done around the education of dairy farmers about good management practices by both ES and DairyNZ. Areas such as winter grazing management had been a focus for dairy farmers (and other farmers) and as such a lot of dairy farmers were employing good management as standard already. Also, the use of farm environmental plans such as SMPs was helping preparedness. However, the effectiveness of this "preparedness by default" was questioned by some interviewees, and it was still seen as vital to engage dairy farmers in the WL2020 process.

Although Southland dairy farmers were somewhat prepared for the possible rules and changes that might be included in the new Plan, there was much less confidence from the interviewees around the preparedness for the limit setting process, and ultimately the limits. They also felt that there are a significant amount of dairy farmers, and members of the community in general, that don't realise that the Plan is not the final step.

4.7 How can DairyNZ Help Southland Dairy Farmers Adapt to the Changing Environmental Regulations?

Through the interview process, the author was able to form an understanding of how Southland dairy farmers had been involved in the WL2020 process so far, and possible ways of improving this level of involvement. Dairy farmers are part of the Southland community and must adapt to the changes that are part of the WL2020 process. The last section of the interviews focussed on finding ways that DairyNZ could help Southland dairy farmers to adapt to the changing environmental regulations. Adapt is defined as to become adjusted to new conditions.[114] However, the author was looking at ways at which Southland dairy farmers

could ultimately go further than just adjusting to new conditions. Ultimately how can Southland dairy farmers contribute to a successful outcome for themselves and for the Southland community, how can they thrive and what help from DairyNZ do they need to do this?

4.7.1 Current DairyNZ Southland Dairy Engagement Model

Before analysing the interviewees' suggestions as how DairyNZ could help, it is first important to be aware of the current DairyNZ Southland Dairy Engagement Model as some of the ideas bought up are already being carried out by DairyNZ. This model is described pictorially in Figure 9. The model contains different tiers of engagement and a variety of "ownership" models. Most of this model is in place already. Not included in this picture, but previously discussed are SMPs which have been identified as an important part of DairyNZ's contribution.

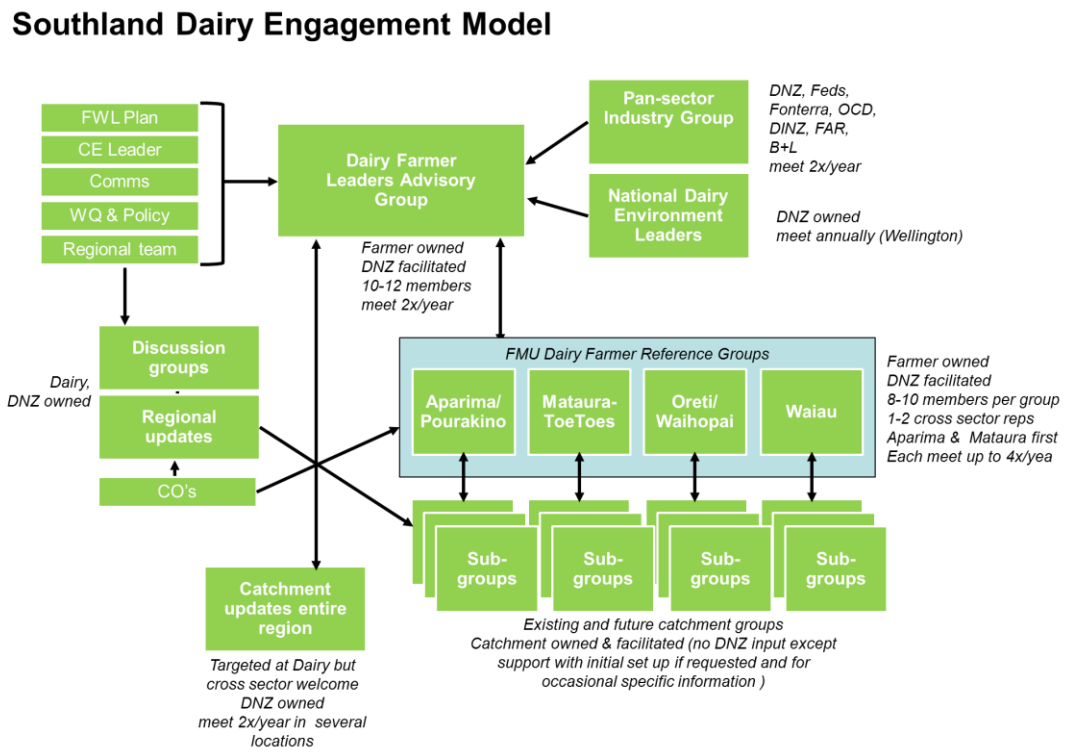

Figure 9. DairyNZ's Southland Dairy Engagement Model

4.7.2 Sustainable Milk Plans

DairyNZ SMPs are one of three farm environmental plans currently available to Southland farmers. Interviewees largely agreed that environmental plans are very effective in helping dairy farmers prepared for any of the proposed environmental changes. The one-on-one approach of the plans helps individual farmers correlate water quality issues to their own properties and own actions. It also allows them find practical ways that they can help improve water quality, and it defines good management practices for their own farms. It also helps dairy farmers to realise that they are contributing to water quality issues, and that changes they make to their own actions can help improve water quality. A problem identified by some of the dairy farmer interviewees was that they could guarantee that all dairy farmers who have been engaged would accept to some degree that there was a water quality issue within Southland, but most would think that others were causing the problems and that they were already doing the best that they could. This similar to what Duncan (2016) found "when [farmers were] asked what their contribution to nutrients in rivers was, they consistently said "minimal.""[108] While, Vanclay (2004) stated that farmers wanted to "do the right thing."[101] The SMP process allowed for an independent consultant to assess the environmental impacts of an individual farm with the farmer. This allowed the farmer an impartial look at the environmental impacts of their own farm and get personalised advice on how to "do the right thing" on their own farm. Personalising the issue in environmental extension, was also found to be important by Blackstock *et. al.* (2010).[103]

Another strength of the SMP process was identified as the fact that the consultant came to the dairy farm. This meant that there was an opportunity for both partners (if the farmers were a couple) to be present. This was seen as a strength because at off farm meetings, often only one of the couple would be able to make it if there were children to look after. Vanclay (2004) identified that women are an integral part of any farm.[101] Therefore, it is important to involve women in environmental extension and with the SMP process this was achievable.

The impact of the low payout on completing any of the recommendations that were included in a farm environmental plan was seen as high for the "high cost" recommendations such as infrastructure. Vanclay's (2004) fifth social principle for agriculture extension is "it is hard to be green when you are in the red,"[101] which has greater implications when dairy farmers

are being paid less than the cost of production as they are currently. This was also similar to what was found in the Upper Waikato SMP Project, as the payout decreased, the number of recommendations completed decreased.[112] However, many SMP recommendations are low cost such as lane cut-outs or have financial benefits such as mining Olsen P levels, so interviewees thought that these would still be completed regardless of the payout.

The preliminary outcomes from the Upper Waikato catchment show the effectiveness of completing SMPs at a catchment level.[111, 112] It is possible that similar results could be achieved in Southland catchments.

To make SMPs more effective, most interviewees felt that they needed a follow up visit and some sort of auditing process. The ideal was seen as an "industry audited, self-managed" system. Part of the strength of the SMP process was that it was currently voluntary and that the agreed recommendations were not compulsory. Interviewees felt that this meant better farmer "buy in," and more open mindfulness when discussing process on farm improvements. If these plans became compulsory, interviewees felt that they may lose some of their effectiveness and may even become a "box-ticking" exercise. It would be important to ensure that farmers saw the value in the plans and that there was follow up support. It was also important, that if the plans became compulsory, that an industry that was able to charge significant amounts of money for the plans was not created. Some interviewees bought up the recent health and safety legislation, and the industry of health and safety plan creators that had evolved. They didn't want SMPs or any sort of farm environmental plan industry to end up like this, and be able to charge significant amounts of money because farmers had fear about the possible outcomes if they did not have a plan. If farm environmental plans such as SMPs do not become an ES requirement, interviewees thought that they were still a valuable process to go through, and as discussed earlier the voluntary status may actually increase their effectiveness.

4.7.3 Building on the Current DairyNZ Southland Engagement Model

There were many other ways apart from SMPs, identified by the interviewees, in which DairyNZ could help Southland dairy farmers adapt to the changing regulations. Some were

things that DairyNZ is currently doing within its Southland engagement model, as well as building on what they are currently doing.

Science was seen as a key way in which DairyNZ could help, and where DairyNZ is already playing a vital part. Interviewees in general, felt that science needs to be one step ahead of rules. It also needs to help interpret the outcomes that are desired by ES and the community. It needs to be able to explain how does things work or don't work in dairy farming systems. Solutions needed to be practical and able to fit in a whole farm system. Science needs to be directly relevant to Southland, so it was important to have local research conducted such as DairyNZ's Southern Wintering Systems project. It was seen that science was important to ensure that rules do not stifle innovation and that "we don't look at tomorrow's problems with today's technology."

Communicating science to dairy farmers (and the entire community) in an easy to understand and practical way was also seen as vital. As shown by Duncan's (2016) work, the issue of diffuse nutrient pollution is not easily understood but this understanding is important for farmers to realise what the water quality problem is, and that this had the potential to hinder the uptake of good management practices and farmer compliance.[106, 107] Interviewees thought that one-on-one communication on individual farms or in small groups such as woolshed meetings were important. Here, dairy farmers would not feel embarrassed to ask questions. Vanclay (2004) reported that group extension was not a solution to every problem and that one-to-one extension is important.[101] Journeaux (2009) found mass media extension, such as field days, monitor farms and printed media good at raising awareness of innovations, but that the greatest level of adoption follows one-to-one interaction between a farmer and an advisor.[97] Some interviewees thought that more science could be communicated as part of the SMP visit as this would give the consultant the opportunity to thoroughly explain and answer any questions the farmer may have.

Direct communication between DairyNZ and ES needed to continue as this relationship was seen as important. This needed both parties to be open minded and to build trust. Obviously agreement on all issues is going to be unlikely, but the relationship was still seen as important. It was also seen as important that individual dairy farmers themselves developed a relationship with ES, and DairyNZ may be able to coordinate this. Strong relationships

between dairy farmers and ES staff (including scientists) and councillors were seen as important now, and as the Southland community moves towards limit setting. These relationships personalise dairy farming and the effects that any rules and changes may have on dairy farmers. They also provide a way for dairy farmers to provide constructive feedback to ES. This would help the process become an information exchange rather than an information transfer.[103] This is similar to what was found in the Waituna Lagoon process. "*Get in front of the decision makers. Tell your story, make it personal so people understand the impacts on your farm, your family and the community.*"[41] "*Communicate well with each other and with local authorities.*"[90]

DairyNZ's involvement was seen as critical in starting and supporting catchment groups. Southland was identified, by an interviewee, as being the only region that had catchment groups before the limit setting process started. This was seen as a big strength to the Southland community, and had attracted attention from the Ministry of Primary Industries and environmental NGOs. Southland DairyNZ was seen as being a large part of this success of these groups so far and this will continue. These groups have to involve the whole community, not just dairy farmers, but DairyNZ's support is very important.

The Southland Dairy Engagement Model shows the use of discussion group as ways to get message through to more dairy farmers. This idea was bought up by some of the interviewees. Waugh (2011), suggested that innovators, early adopters and the early majority attend discussion groups, although the early majority tend to sit in the background.[8] By delivering information about the changing environmental regulations through the existing discussion group model, the message will reach people that may not come to meetings specifically about these changes. Another idea bought up by an interviewee was to have joint farmer discussion groups across different sectors of agriculture. These didn't have to be solely about the environment, but could be used to foster relationships between different farmers as well as transferring knowledge. Joint field days such as the DairyNZ and Beef and Lamb winter grazing days were seen as a start, but needed to be increased to reduce the "us" and "them" mentality. This type of meeting was seen as a better quality type of meeting, "we don't need more meetings, just better meetings."

Further collaboration was needed with other primary industry organisations. DairyNZ was identified as appearing "much further down the track" than other agricultural industry groups in Southland, but it is needed to ensure that the other industry organisations were not left behind. A pan-sector industry group is identified in the Southland engagement model, but interviewees felt that there needed to be more "on the ground collaboration."

Good news stories in mainstream media were seen as important to helping rid the "dirty dairying" message and to prevent dairy farmers feeling embarrassed to be dairy farmers. This mentality was preventing them from being involved in the WL2020 process. Interviewees didn't want stories that were just dairy farmers achieving compliance, they wanted stories that were about best practice and well above compliance. There was already a lot of good news stories in dairy specific publications like Inside Dairy (April 2016 edition) and the Dairy Exporter (February 2016 edition), but it is important to reach mainstream media. This was something DairyNZ is already working on in Southland.[117] It was important to celebrate successes and to spread the good news about dairy farmers, not just in the environmental space. The importance of celebrating success was identified in the Waituna Lagoon process.[90]

The use of social media was seen as important way to get these messages out there. Most dairy farmers were aware of how quickly stories can spread through social media in light of the recent bobby calf campaign by SAFE. One interviewee bought up the concept of "thought germs" – an idea as to how messages spread so quickly on social media. This can also work for good news stories as well as it does for bad news stories.

4.7.4 Other Ways that DairyNZ can help Southland Dairy Farmers Adapt

There were some ideas identified by the interviewees that DairyNZ could adopt to help Southland dairy farmers adapt to the changing regulations that were not specifically covered in the Southland engagement model. One of the fundamental issues identified by the interviewees was that there was a large proportion of Southland dairy farmers and the Southland community that didn't understand the WL2020 process and didn't understand why ES was going through this process. This needs to be rectified, although this is not directly DairyNZ's responsibility and as pointed out by one interviewee, "DairyNZ shouldn't be

delivering the bad message." Duncan's (2016) work has shown that not understanding the problem can hinder engagement.[107] Therefore, DairyNZ needs to work with ES to ensure that the framing of the WL2020 process is improved so that there is much more understanding. There was suggestion that ES should design a WL2020 App to clearly communicate the process itself. This would ideally include a timeline for the process, background information and upcoming events. This linked back to the idea of using social media more.

The importance of dairy farmers spreading the message to other dairy farmers and members of the community was a reoccurring theme throughout the interviews. It was suggested the DairyNZ staff in Southland should identify potential leaders, like they have when starting catchment groups, but will the focus on these leaders personally contacting other dairy farmers, other farmers and non-farming members of their communities. These identified leaders would need some support to build capability but this was seen as less resource hungry than having DairyNZ staff perform similar roles. Vanclay (2004) found "*adoption takes place in a social context, with farmers discussing their ideas with other farmers.*"[101]

The ability for individual farmers to do cost benefit analysis of any of the proposed changes and rules on their own farming systems was seen as important. Given the modelling needed, it would be unlikely that a simple cost benefit analysis tool that could be used easily by individual farmers could be developed. Instead, it might be something that is better used by professionals in small meetings, where model farms based on input from the individual groups of farmers at the meetings could be modelled. Although this wouldn't achieve the cost benefit analysis for individual farms, it would be a more practical way of delivering this type of information while still allowing input from individual farmers.

It was commented by some interviewees that a lot of people on the dairy farms in Southland were not the owners. There were a lot of absentee owners and also corporate owners. It was felt that specific strategies to engage these owners were needed as local advertising or visits to the farms would not reach these owners.

The ability for dairy farmers and other community members to do personal submissions to the Plan was seen as an important but difficult goal to achieve. Specific workshops designed

to help attendees understand the submission process were seen as a way of helping people do their own submissions.

The use of technology for information transfer was discussed by several of the interviewees as an effective way of information transfer. DairyNZ already does utilise technology with examples such as its national facebook page, regional emails and texts. However, some interviewees felt that this use needed to be increased. Increased use of social media, as discussed earlier, was seen as an essential way to reach more dairy farmers and also other community members. The development of a "Southland DairyNZ App" and/or "Southland DairyNZ facebook page" was suggested. This App or facebook page could be used not just for environment work, but to notify dairy farmer and other community members of upcoming events, recent science and good news stories.

The Cawthrone Institute's habitat assessment was suggested as a practical tool that dairy farmers could use on their own farms. This protocol[118] involves a practical assessment for streams and rivers, and could be used by dairy farmers (and other farmers) on a regular basis to assess the quality of the streams and rivers within their farms. It was suggested that DairyNZ could use this tool or an adaption of it as a resource for dairy farmers to use on their own farms. It could even be developed into an App. This would help to personalise the issue of water quality.

4.7.5 Southland Dairy Farmers' Responsibility

Although DairyNZ is the levy organisation supporting dairy farmers, it was clear from the dairy farmer interviewees that they thought that a large part of the onus on getting the dairy farming community, as well as the general Southland community, involved in the process and adapting to the changing environmental regulations, was on dairy farmers themselves. While they were very appreciative of DairyNZ's support and felt that is was necessary, dairy farmers themselves needed to take responsibility also.

The importance of leadership was seen as vital. As members of the Southland community, dairy farmers have the responsibility to "stand up and lead." The learnings from the Waituna Lagoon process had found that while DairyNZ and other industry support was important,

working as a team with your community and taking leadership was important. "*Define who your community is. Make sure that everyone is represented from an early stage.*"[41] Community members had to understand their fellow community members. It was seen important that everyone was invited to their catchment group meetings and that these invites were personal. A flier or an advertisement isn't going to encourage those who are not engaged to attend, but a personal invite might.

There are definitely examples of this happening already. One dairy farm interviewee told of their plan to carry out catchment-wide planting plans. This involved everyone within their catchment, not just dairy farmers and is an example of how dairy farmers as leaders can achieve a lot within the community.

4.7.6 Capability of DairyNZ

There was general consensus amongst the interviewees that DairyNZ was doing well with the resources that it had, but as the WL2020 project progressed further, the demand on resources would increase rapidly. Interviewees were realistic however, that the amount of resources was unlikely to increase significantly. With the likelihood of a third consecutive year of low pay outs for dairy farmers, it was probable that the levy collected by DairyNZ would be reduced because of reduced production from dairy farmers. This meant that DairyNZ was looking to achieve more from less in general.[119] Instead of increasing resources, DairyNZ could increase capability by increasing collaboration with other industry groups, using technology more and working with identified dairy farmers leaders within the community. Journeaux (2009) reported a lack of human capability in the environmental extension industry as a major issue, due in part to a lack in numbers of actual advisors.[97] If SMPs or other farm environmental plans became compulsory or were completed in higher numbers even while voluntary, it identified by some interviewees that was there would need to be more people with the capability to carry them out.

The science capability of DairyNZ is seen as very high compared to other industry groups. The work done by DairyNZ scientists and that done by scientists who were partially funded by DairyNZ was seen as world class.

4.8 Best Possible Outcome for the Water and Land 2020 and Beyond Process

The description of the best possible outcome for the WL2020 process provided the most unanimous responses of the whole survey from the interviewees. Amongst the best outcomes described there were several themes. Environmental sustainability was not surprisingly a popular theme. Interviewees wanted to see actual improvements in water quality, that were quantified by science and that were visible. Most realised that this would take time and because of the biological nature of water movement, water quality was likely to decline before it got better. However, the ultimate aim for the future was for better water quality for Southland. Some spoke about their children and grandchildren being able to swim and fish in places that they had while they were growing up. The importance of handing the land to the next generation in a better state was also spoken about. This is echoed in Vanclays's (2004) work. Most farmers want to pass their farm on to their children in a better state than they received it.[101]

Economic sustainability was also a key message. A prosperous and productive Southland community is necessary if the aim to have 10,000 more people living in the region by 2025 is to be reached.[120] There were comments around the effect that the current dairy down turn is having on the region's economy both directly and indirectly, and this was seen as an example of what it might be like if there were significant constraints on the productivity of dairy farming because of the WL2020 process. Also it was important that timeframes of any change or rules were realistic so that no dairy farmer was "driven out of business," without a chance make any necessary changes and the support required.

From a social perspective, an united community was important and not an "us" versus "them" mentality. It was hoped that all parties would have a better understanding of each other's views, and that a truly collaborative approach with all parties starting with an open book was used for the limit setting process.

One of the most significant messages from all of the interviewees was something that wasn't said by any of them. No one argued that something had to be done. All of the interviewees had been engaged in the WL2020 process, and all realised that something had to be done to improve water quality in Southland.

4.9 Further Comments

Further comments by the interviewees were largely described by two themes. Praise for DairyNZ, and further ideas that could help Southland dairy farmers and the Southland community adapt to the changing environmental regulations.

The amount of praise given for DairyNZ, particularly the Southland staff, was evidence that both dairy farmers and industry members appreciated what was being done. Many comments focussed on “how lucky dairy farmers were” to have the support of DairyNZ, and that the community would be “many steps behind our current position” in the WL2020 process without them. It was felt that DairyNZ was doing a lot with the limited resources that they had and that they had the right people working for them. The Southland DairyNZ staff had shaped the engagement of Southland dairy farmers and that this was far better than in other regions. DairyNZ funding SMPs for dairy farmers was also appreciated.

Further ideas from interviewees around helping Southland dairy farmers and the Southland community adapt to the changing environmental regulations without direct help from DairyNZ were quite inspiring to the author. The plans the dairy farmer interviewees had for their catchment groups ranged from everyone having a farm environmental plan to charitable trusts being set up for catchment groups. There was definitely the feeling that these groups were going to keep growing and evolving even after the final stages of the WL2020 project had been completed.

5. Recommendations

The question as to how DairyNZ can support Southland dairy farmers to adapt to changing environmental regulations is complex. Water quality issues, and the community's response to them involves both science and social science. It is not as simple as providing the scientific proof to dairy farmers and assuming that this will lead to improvements in water quality. It is also complex because dairy farmers are part of the wider community. For dairy farmers to adapt to changing regulations, the communities that they are part of must also adapt.

5.1 Water Quality is Also a Social Issue

Southland dairy farmers must first understand what the water quality issue is, accept that there is an issue and understand how their actions affect it, before they can adapt to any changes in regulation. More one-on-one work and small group work with dairy farmers is necessary. The issue must be personalised to their own farms, rather than just talking in general terms. Dairy farmers are practical people and need practical solutions. They need to be able to give feedback to the scientists and "rule setters," so that an information exchange occurs rather than an information transfer. Therefore, a key focus for ES and also DairyNZ should be to make sure water quality is understood by dairy farmers and the community.

5.2 DairyNZ should build on what it is doing in Southland

DairyNZ has contributed significantly to the progress that the Southland dairy farmers and the Southland community has made in the WL2020 process, but this can be built on. Science and communicating this science in a way that dairy farmers, and the rest of the community understands was seen as important. Ongoing innovation is also important. Spreading the message through discussion groups will help and will reach dairy farmers who may not be reached at specific environment groups. One-on-one work with dairy farmers was still very necessary, and tools such as the Cawthorne habitat assessment and cost benefit analysis that personalised the issues have large potential. Specific issues such as getting dairy farmers to submissions and communicating with absentee land owners should be addressed. Greater use of technology is also needed to reach more dairy farmers, and to also spread good news stories about dairy farming.

5.3 Engagement is the First Step

If dairy farmers were not engaged in the WL2020 process, then they will not have knowledge of the proposed changes and rules, the impacts of these and they will not be prepared for these. Again more one-on-one and small group meetings were needed, and personalising the problems at a farmer level is seen as the best way to get dairy farmers engaged. Dairy farmers were seen as the best people to contact dairy farmers and peer pressure is important. A formal scheme supported by DairyNZ could see selected dairy farmers personally contacting other dairy farmers who are not engaged. This would not need a lot of resource from DairyNZ but could work very effectively. By focussing on engagement, the "axis would be shifted," which would lead to a higher proportions of Southland dairy farmers being engaged in the WL2020 process, having knowledge of the proposed rules and changes, their impacts and being prepared for these. Ultimately, this would help more Southland dairy farmers adapt to the changing regulations.

5.4 Sustainable Milk Plans are Effective but Need Follow Up

SMPs (as well as other farm environmental plans) are effective at both increasing the knowledge of the proposed rules and changes, and helping dairy farmers prepare for these changes. Increasing the capacity to complete more of these plans in Southland was seen as a key way for DairyNZ to help. These plans gave an one-on-one meeting with dairy farmers which was important for both engagement and understanding water quality issues. However, a follow up visit and some sort of "industry audited, self-managed" system is needed. It is important that these plans did not simply become a "box ticking" exercise, but add real value to dairy farmers. It is also important that these didn't become a "gravy train" for consultants if they had to be charged for.

5.5 Relationships and Leadership are Key

Southland dairy farmers are part of the Southland community. It is important dairy farmers themselves ensure that all members of the community are engaged in the WL2020 process. Dairy farmers need to talk to their neighbours and form relationships that will be vital for the

whole WL2020 process, but particularly for the limit setting process. Dairy farmers themselves need to be responsible for forming these relationships.

The relationship between ES and DairyNZ is also vital, as is the relationship between ES and individual dairy farmers. Work must continue from both sides to keep these relationships as strong as possible.

Southland dairy farmers must show leadership within the community. It is not DairyNZ's responsibility "push" Southland dairy farmers through the WL2020 process, but more their job to support. By becoming leaders themselves, this will help to ensure that Southland dairy farmers and their community not only adapt to the changing environmental regulations, but thrive within them.

6. Further Work

Given the timeframe of this project, it was important to keep the investigation focussed. However, if time was no obstacle, there would be some further work that would contribute to this project:

- As a focus of this project was to find ways to encourage more engagement with the WL2020 process, the dairy farm interviewees were identified as dairy farmers who were already very engaged in this process. It would be worthwhile to interview dairy farmers who have had no engagement whatsoever in the WL2020 process, to investigate what was holding them back from being engaged and to compare this to what the dairy farmers that were interviewed have suggested.
- One of the findings of this work was that a community approach had to be taken to get the best results, rather than just focussing on dairy farmers. Given this, speaking to non-dairy farmer community members may give further insights.
- The timeframe and wanting to do face to face interviewees limited the distance from where interviewees could be from. If there was longer, it would have been worthwhile interviewing dairy farmers and industry members from regions such as Canterbury and Horizons, who have gone through a similar process as the WL2020 process in their own regions.

7. Conclusion

The author, coming from a pure science background, mistakenly considered the water quality issue and the WL2020 process as primarily a science issue. If there is good science then dairy farmers will see this and make the required changes. DairyNZ's role would be to make sure that this science was carried out and available to dairy farmers. However, throughout this project, it has become very clear that this is far from the case. Social science plays a very important role, and this is as much a "people issue" as it is a "water issue."

The Southland community is fortunate to have DairyNZ working within it. Their work, including SMPs, has contributed to the involvement of Southland dairy farmers and also the Southland community in the WL2020 process. Their work has meant that Southland, unlike other regions, has had catchment groups well before the limit setting process has started. Building on the work that they are currently doing will further help Southland dairy farmers, and the Southland community, adapt to the changing environmental regulations.

Engagement in the WL2020 process is the first step for Southland dairy farmers, and other community members, to ultimately adapt to the changing regulations. To increase engagement it was found that personalising the issue was important.

The social aspect of water quality means that it doesn't matter as to how good the science is, if it is not understood by members of the community then it is not going to be effective at causing a change in behaviour. International[101, 103] and New Zealand[107] research, has highlighted the importance of this. Relationships and leadership are also important. The whole community must be involved, and it is important not to have "them" and "us." For this to occur, people must be prepared to be leaders and relationships must be formed. Southland dairy farmers must be prepared to be leaders within their community.

The Southland community is mid-way through the WL2020 process. Significant changes are still ahead, and there is no doubt that there will be further challenges for the Southland community to come. At this stage, parts of this process are unknown. What is known is, as summed up by one dairy farmer interviewee, echoing the academic research, is that "water quality isn't the issue….. the issue is people."

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Appendix 1. Interview Questions for Dairy Farmers

Introductory questions:

1. Role (owner/sharemilker/manager etc):
2. Length on current farm:
3. Size of current farm:
4. Involvement with Environment Southland Water and Land 2020 process:

Water and Land 2020 and Beyond Process:

5. Describe the process (Water and Land 2020 and Beyond) that Environment Southland has used so far.
6. What are the major strengths and weaknesses of the process that Environment Southland has used?
7. How appropriate has the level of information provided to farmers been? Why?

Not appropriate/somewhat appropriate/very appropriate

8. In your opinion, what has been the attitude of dairy farmers to this process?
9. What is your estimate of the proportion of Southland dairy farmers that were engaged?
10. How could it have been more engaging? What could be changed going forward?
11. How do the attitudes of dairy farmers affect their willingness to become engaged? Why?

Not significant/somewhat significant/very significant

12. How can these attitudes be changed?
13. How much of an impact has the low payout (less than $5/kgMS) had on dairy farmers' willingness to become engaged?

Not significant/somewhat significant/very significant

14. What are the next steps in this process (Water and Land 2020)?

Knowledge of proposed rules/changes:

15. What proportion of dairy farmers would you estimate have a near complete and in depth understanding of the proposed rules (new plan plus limit setting in the Water and Land 2020 process)? What proportion of dairy farmers would have some understanding of the

proposed rules? What proportion of dairy farmers would have very little or no understanding of the proposed rules?

16. How effective are farm environmental plans (such as DairyNZ's Sustainable Milk Plans) in increasing the knowledge of the proposed rules/changes? Why?

Not effective/somewhat effective/very effective

17. What do you think limits Southland dairy farmers from having a knowledge of the proposed changes? How can this be improved?

Impact of proposed changes and rules:

18. Although the draft water and land plan has not yet been notified and the catchment limit process hasn't started, what impact do you think that the proposed changes may have on Southland dairy farmers? Why?

Little or no impact/moderate impact/large impact

19. How aware are farmers of these impacts?

Little or no awareness/moderate awareness/full awareness

20. How could this awareness be improved?

21. How aware are dairy farmers that their involvement in the process could affect the proposed rules?

Little or no awareness/moderate awareness/full awareness

22. How could this awareness be improved?

Preparedness for rules:

23. How prepared do you think Southland dairy farmers are to be part of the process e.g. submissions to the draft plan?

Not prepared/somewhat prepared/very prepared

24. How prepared do you think Southland dairy farmers are for any of the proposed changes?

Not prepared/somewhat prepared/very prepared

Improving preparedness:

25. How effective do you think farm environmental plans are (e.g. Sustainable Milk Plans) in helping dairy farmers prepare for any of the proposed changes? Why?

Not effective/somewhat effective/very effective

26. Even if these do not become a requirement are they still relevant? How could their effectiveness be improved?

27. How would a low payout (less than $5/kgMS) affect a farmer's ability and willingness to action the recommendations in a farm environmental plan?

28. Apart from farm environmental plans, what other ways could DairyNZ help Southland dairy farmers become more prepared for the proposed changes?

29. How could DairyNZ help dairy farmers become more prepared to be part of the consultation process?

30. In your opinion what are the major limitations to dairy farmers becoming more prepared? How could these be reduced?

31. What is the capability of DairyNZ to help prepare dairy farmers? How can this be improved?

32. What is the capability of DairyNZ to help dairy farmers deal with any changes? How can this be improved?

Outcome:

33. What do you see as the best possible outcome for the Water and Land 2020 process?

34. How can DairyNZ help dairy farmers to become part of this outcome?

Any further comments?

Appendix 2. Interview Questions for Industry Members

Introductory questions:

1. Title of role:
2. Time in role:
3. Description of role:
4. Involvement with Environment Southland Water and Land 2020 process:

Water and Land 2020 and Beyond Process:

5. Describe the process (Water and Land 2020 and Beyond) that Environment Southland has used so far.
6. What are the major strengths and weaknesses of the process that Environment Southland has used?
7. How appropriate has the level of information provided to farmers been? Why?

Not appropriate/somewhat appropriate/very appropriate

8. In your opinion, what has been the attitude of dairy farmers to this process?
9. What is your estimate of the proportion of Southland dairy farmers that were engaged?
10. How could it have been more engaging? What could be changed going forward?
11. How do the attitudes of dairy farmers affect their willingness to become engaged? Why?

Not significant/somewhat significant/very significant

12. How can these attitudes be changed?
13. What processes has your organisation (for DairyNZ, Fonterra, Agribusiness Consultants and Federated Farmers only) used to engage and inform Southland dairy farmers of the Water and Land 2020 and Beyond process?
14. How successful do you feel these were? Why?

Not successful/somewhat successful/very successful

15. What is your estimate of the proportion of Southland dairy farmers that you engaged with? How could you have engaged with more Southland dairy farmers?
16. What are the next steps for your organisation in this process?

Knowledge of proposed rules/changes:

17. What proportion of dairy farmers would you estimate have a near complete and in depth understanding of the proposed rules (new plan plus limit setting in the Water and Land 2020 process)? What proportion of dairy farmers would have some understanding of the proposed rules? What proportion of dairy farmers would have very little or no understanding of the proposed rules?

18. How effective are farm environmental plans (such as DairyNZ's Sustainable Milk Plans) in increasing the knowledge of the proposed rules/changes? Why?

Not effective/somewhat effective/very effective

19. What do you think limits Southland dairy farmers from having a knowledge of the proposed changes? How can this be improved?

Impact of proposed rules:

20. Although the draft land and water plan has not yet been notified and the catchment limit process hasn't started, what impact do you think that the proposed changes may have on Southland dairy farmers? Why?

Little or no impact/moderate impact/large impact

21. How aware are farmers of these impacts?

Little or no awareness/moderate awareness/full awareness

22. How could this awareness be improved?

23. How aware are dairy farmers that their involvement in the process could affect the proposed rules?

Little or no awareness/moderate awareness/full awareness

24. How could this awareness be improved?

Preparedness for rules:

25. How prepared do you think Southland dairy farmers are to be part of the process e.g. submissions to the draft plan?

Not prepared/somewhat prepared/very prepared

26. How prepared do you think Southland dairy farmers are for any of the proposed changes?

Not prepared/somewhat prepared/very prepared

Improving preparedness:

27. How effective do you think farm environmental plans are (e.g. Sustainable Milk Plans) in helping dairy farmers prepare for any of the proposed changes? Why?

Not effective/somewhat effective/very effective

28. Even if these do not become a requirement are they still relevant? How could their effectiveness be improved?

29. Apart from farm environmental plans, what other ways could DairyNZ help Southland dairy farmers become more prepared for the proposed changes? How could DairyNZ help dairy farmers become more prepared to be part of the consultation process?

30. In your opinion what are the major limitations to dairy farmers becoming more prepared? How could these be reduced?

31. What is the capability of DairyNZ to help prepare dairy farmers? How can this be improved?

32. What is the capability of DairyNZ to help dairy farmers deal with any changes? How can this be improved?

Outcome:

33. What do you see as the best possible outcome for the Land and Water 2020 process?

34. How can DairyNZ help dairy farmers to become part of this outcome?

Any further comments?