

**BEFORE THE INDEPENDENT COMMISSIONERS**

**IN THE MATTER** of the Resource Management Act  
1991

**AND**

**IN THE MATTER** of the  
Proposed Canterbury Land and  
Water Regional Plan

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**EVIDENCE IN CHIEF OF DAN MARSH ON BEHALF OF  
NELSON/MARLBOROUGH, NORTH CANTERBURY AND CENTRAL  
SOUTH ISLAND FISH AND GAME COUNCILS  
2 APRIL 2013**

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# Contents

|  |           |
|--|-----------|
| <b>SCOPE OF EVIDENCE .....</b>   | <b>3</b>  |
| <b>EXECUTIVE SUMMARY .....</b>   | <b>4</b>  |
| <b>ASSESSMENT OF ECAN AND FISH AND GAME APPROACHES TO MANAGING THE EFFECT OF LAND USE ON WATER QUALITY .....</b> | <b>15</b> |
| THE APPROACH PROPOSED BY CANTERBURY REGIONAL COUNCIL.....  | 15        |
| THE APPROACH PROPOSED BY FISH AND GAME .....   | 16        |
| JUSTIFICATION FOR RULES (FARMING) PROPOSED BY FISH AND GAME .....  | 18        |
| USE OF A CAP AND TRADE ECONOMIC INSTRUMENT TO ACHIEVE LWRP OBJECTIVES .....                                      | 20        |
| THE COST OF REDUCING NUTRIENT LEACHING .....   | 22        |
| <b>THE REQUIREMENT TO UNDERTAKE COST BENEFIT ANALYSIS .....</b>  | <b>28</b> |
| SECTION 32 AND ASSESSMENT OF COSTS AND BENEFITS.....   | 28        |
| MY ASSESSMENT OF ECAN’S SECTION 32 ANALYSIS OF NUTRIENT MANAGEMENT POLICIES.....                                 | 31        |
| ASSESSMENT OF ‘THE PREFERRED APPROACH’ .....   | 31        |
| ASSESSMENT OF REGIONAL AND NATIONAL IMPACT .....   | 35        |
| CONCLUSION ON REGIONAL AND NATIONAL IMPACT OF PROPOSED CLWRP .....   | 39        |
| <b>ECONOMIC CONSIDERATION OF ENVIRONMENTAL BENEFITS OF WATER QUALITY .....</b>                                   | <b>41</b> |
| THE ECONOMIC APPROACH TO ASSESSING THE VALUE OF WATER QUALITY BASED ON EXCERPTS FROM SHARP AND KERR (2005) .     | 41        |
| THE NEW ZEALAND AND INTERNATIONAL LITERATURE ON THE VALUE OF BETTER WATER QUALITY.....                           | 44        |
| THE EFFECT OF PROPERTY RIGHTS ON ECONOMIC CONSIDERATION OF BENEFITS.....   | 45        |
| VALUE OF MAINTAINING WATER QUALITY IN THE HURUNUI .....  | 47        |
| OTHER NEW ZEALAND FINDINGS ON VALUATION OF WATER QUALITY: – THE WAITAKI REPORT .....                             | 49        |
| VALUATION OF WATER QUALITY IMPROVEMENTS SINCE THE WAITAKI REPORT (1995) .....                                    | 51        |
| CONCLUSIONS ON THE BENEFITS OF BETTER WATER QUALITY .....  | 54        |
| <b>ASSESSMENT OF COSTS AND BENEFITS OF PROPOSED POLICY OPTIONS .....</b>   | <b>56</b> |
| COST OF PROPOSED POLICIES.....   | 58        |
| ASSESSMENT OF POLICY PROPOSED BY FISH AND GAME.....  | 59        |
| ASSESSMENT OF POLICY PROPOSED BY ENVIRONMENT CANTERBURY .....  | 60        |
| <b>COMMENT ON S42A REPORT HEARING GROUP 2 BY MATTHEW MCCALLUM-CLARK, MARCH 2013 .....</b>                        | <b>62</b> |
| <b>COMMENT ON BNZ SUBMISSION ON PCLWRP BY GUY ENSOR .....</b>  | <b>64</b> |
| <b>APPENDIX 1: DETAILED ASSESSMENT OF ECAN’S SECTION 32 ANALYSIS OF NUTRIENT MANAGEMENT POLICIES .....</b>       | <b>68</b> |

## QUALIFICATIONS AND EXPERIENCE

- 1 My full name is Dr Daniel Kenneth Vawdrey Marsh. I was the chairperson of the Department of Economics at the University of Waikato from 2010 to February 2013. I hold a Master of Agricultural and Forest Sciences (MA Oxon, 1979) from the University of Oxford, UK and a MSc in Agricultural Economics from the University of Reading (1980), UK. I also hold a PhD in Economics from the University of Waikato (2004).
- 2 I have more than thirty years' experience as an economist specialising in agricultural and environmental issues, with a particular emphasis on water resources economics. Within New Zealand I have specialised over the last seven years in the assessment of the costs and benefits of alternative environmental policies and in valuation of the effect of changes in water quality.
- 3 I am a recent past president of the New Zealand Agricultural and Resource Economics Society (NZARES) and a member of the Australian Agricultural and Resource Economics Society (AARES) and the European Association of Environmental and Resource Economists (EAERE). I have been President of NZARES twice (most recently 2010/11) and have served on the Council of AARES. I regularly attend and present papers at NZARES, AARES and EAERE conferences in order to keep up to date with the latest developments.
- 4 I led the University of Waikato component of a large externally funded Research Programme from 2007-11, (Delivering Tools for Improved Environmental Performance - PROJ-12559-PASTORAL-AGR) funded by the Foundation for Science Research and Technology and Pastoral 21 partners Dairy New Zealand, Meat and Wool New Zealand and Fonterra.
- 5 Under this this programme, I participated in the Land and Water Quality Project in the Hurunui catchment which led to the development of a preferred approach for the management of the cumulative impacts of land use on water quality in the catchment (I. Brown et al., 2011; Wedderburn et al., 2011).

- 6 In May 2011 I conducted a quantitative survey, completed by 505 households, in order to describe and quantify the preferences of Canterbury Region residents with respect to existing conditions (the status quo) and potential future land use and water quality scenarios for the Hurunui catchment (Marsh & Phillips, 2012a, 2012b). It was envisaged that this quantitative information on the value of maintaining and enhancing water quality would be used by policy makers at the same time as they considered the outcomes of the stakeholder deliberative process.
- 7 I gave evidence in the Environment Court on the Horizons One Plan appeal including a detailed assessment of the costs that would fall on farmers, the benefits of avoiding a decline in water quality and an assessment of the efficiency and effectiveness of alternative policies.
- 8 I was Chairperson of the Department of Economics at the University of Waikato from February 2010 to February 2012. I have been employed by the University of Waikato as Lecturer, then Senior Lecturer since 1995. Currently I am conducting research on nutrient allocation and trading mechanisms on sabbatical and am on secondment to Dairy New Zealand.
- 9 In preparing this evidence I have reviewed: the reports and statements of evidence of other experts giving evidence relevant to my area of expertise, including: Geoffrey Butcher, Guy Ensor, Alison Dewes, Jim Cooke and Phillip Percy as well as all documents listed in the References at the end of this document and all documents referred to in footnotes.
- 10 I have read the Code of Conduct for Expert Witnesses in the Environment Court Practice Note. This evidence has been prepared in accordance with it and I agree to comply with it. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

## **SCOPE OF EVIDENCE**

- 11 I have been asked by Fish and Game to prepare evidence in relation to the Land and Water Regional Plan that has been proposed by Environment Canterbury. This includes:
- a. Comparison of the ECan and Fish and Game approaches to managing the effect of land use on water quality.
  - b. Assessment of the Section 32 analysis undertaken by Environment Canterbury
  - c. Assessment of mechanisms to enable achievement of LWRP objectives
  - d. Economic consideration of environmental benefits (including the value of freshwater to the community and the nation and the effect of property rights);
  - e. Assessment of costs and benefits of alternative policy options
  - f. Comment on section 42a ECan officer reports due 18 January and 15 March
  - g. Comment on BNZ economic analysis

## EXECUTIVE SUMMARY

### Assessment of ECan and Fish and Game approaches

- 12 The approach to managing the effect of land use on water quality proposed by ECan will (by its own admission) be likely to allow further deterioration in water quality in the Canterbury Region.
- 13 The section 32 analysis provided by ECan is incomplete since fundamental parts of their approach will not be established for several years (after a plan change). It is unreliable because it is not possible to assess the efficiency and effectiveness of a policy that has not been defined.
- 14 I support the set of rules proposed by Fish and Game in order to prevent N leaching from increasing in over allocated catchments. These rules have been designed to be practicable, taking account of existing constraints. They provide a foundation which can be built on as sub regional chapters go through the plan change process.
- 15 A key element of the proposed rules is that existing farming is a controlled activity if the sustainable leaching standard (20 kg/ha) is met and is a restricted discretionary activity if it leaches above 20 kg/ha but meets minimum practice standards, and achieves N Leaching reduction standards from (2011/12) leaching rates. Reductions can be achieved by trading.
- 16 The proposed rules allow farmers to continue with current practices within certain limits. This has the effect of minimising adverse effects on the farming sector.
- 17 Our approach also has the advantage that it allows the contentious issue of allocation of nitrogen discharge allowances to be addressed through the proposed consultation process. The proposed rules are efficient and effective (compared to alternative rules) for the following reasons:-
  - a. Landowners are provided with a clear N leaching target which they are required to meet.

- b. This will provide a clear incentive to improve environmental management and also to find the most cost effective way of achieving the target.
- c. The cost of achieving N leaching reductions will be lower than with a policy where all land owners are required to achieve the same reductions or to implement the same practices. This is because those with high leaching levels who are required to make larger reductions can generally do this at lower cost compared to those with lower leaching levels.
- d. Trade or exchange of "N leaching reduction" is allowed. This also has the effect of reducing the overall cost of N leaching reduction since those who can achieve N leaching reduction at lower cost will have the incentive to do so. Those who would face a high cost to reduce N leaching have the option of trading or exchanging with those who can achieve N leaching reduction at lower cost.

#### **Use of cap and trade to achieve LWRP objectives**

- 18 I contend that most practical way to improve water quality on farm is to provide *appropriate incentives* for farmers to adopt cost effective practices.
- 19 Well-designed economic instruments can be much more cost effective than some regulatory approaches. For example a ground-breaking analysis by Tom Tietenberg (1985) compared "command and control" including technology based effluent standards with least-cost programs for pollution control. The ratio of command and control to least cost ranged from 1 to 22 e.g. in the worst case the command and control policy was 22 times as expensive as the least cost policy.
- 20 Work by Graeme Doole et al., (2013) on the Karapiro catchment in the Waikato suggests that the cost of reducing N leaching varies depending on the policy instrument used (Table 1). A cap and trade system was found to allow N leaching to be reduced at a cost that was significantly lower than the other policies that were assessed.

### **The cost of reducing nitrogen leaching**

- 21 I am familiar with the New Zealand and international literature on the cost of reducing nutrient leaching by farmers. This includes work by Ross Monaghan, Graeme Doole, Stuart Ford and others (G. Doole et al., 2013; Graeme J Doole, 2012; Graeme J. Doole & Pannell, 2012; Monaghan, 2009).
- 22 Alison Dewes (in her evidence for Fish and Game), provides detailed evidence on changes to farm level practice that can enable some farms to reduce leaching and improve profitability. I support her detailed analysis of the potential for reducing N leaching in Canterbury.
- 23 Motu Economics and Policy, in a recent summary of research in this area found that “best practice land management will not be sufficient to meet the environmental target set by the Bay of Plenty Regional Council.
- 24 I consider that N Leaching at catchment level can be reduced at moderate cost. My position is supported by a Dairy NZ report in which Howard, Romera & Doole (2013) show that a 32% reduction in N leaching across the Selwyn Catchment would reduce profits by 5.6%.
- 25 Dairy farmers are well used to adapting to changing prices for inputs and outputs. The profit reductions estimated above are small compared to the effect of change in milk price (and a variable climate) which farmers have to manage every year.
- 26 This DairyNZ report also provides a revealing insight into the overall profitability of dairy farming in the Selwyn District. Based on the set of assumptions used, it is estimated that around one third of dairy farms are unprofitable.

### **The requirement to undertake cost benefit analysis**

- 27 Section 32 of the Resource Management Act 1991 requires councils to prepare an evaluation which demonstrates they have considered the costs, benefits and alternatives of a proposed policy.



- 28 The Treasury issued an updated guidance note to assist government departments to make proper use of cost benefit analysis in 2005. The note includes the following statement: *“there are often cases where a market does not exist or market prices are not directly observable or easy to estimate. In such cases, it may be difficult to estimate costs and benefits ... Wider social and environmental costs and benefits commonly fall into this category, but should not be ignored simply because they cannot easily be costed. (p. 21)”*.
- 29 The importance of a broad based approach to assessing the impact of policy – that takes account of *“much more than just income or GDP”* continues to be stressed by the Treasury. This approach was underlined by publication of a Treasury Paper *“Working towards higher living Standards for New Zealanders”* on 4 September 2012.
- 30 Working Towards Higher Living Standards for New Zealanders describes how Treasury thinks about and works towards its vision of *“higher living standards for New Zealanders”*. Treasury's understanding of the term living standards goes beyond the narrow material definition - often proxied by GDP - to incorporate a broad range of material and non-material factors such as trust, education, health and environmental quality.

### **My assessment of ECan’s preferred approach**

- 31 On page 5 of Appendix 1 (A1 S32 PCLWRP) it is reported that *“The overall policy direction to manage the effects of land use on water quality in the region is based on the results of a pilot study in the Hurunui catchment, known as the preferred approach”*. This appendix also includes an assessment of alternative policy options (p. 39). I have personal knowledge of this research, having participated in two of the catchment level workshops held as part of the pilot study.
- 32 Given the prominence that ECan give to this preferred approach I have made a detailed assessment (included as Appendix 1), while noting that it is not formally part of the proposed plan and so cannot be subject to section 32 analysis.
- 33 Some of my key findings that I explain in detail in this Appendix include the following:-

- a. The interim approach proposed by ECan is contrary to the outcome of the limit setting phase of the consultation process and contrary to the strongly held desires of the community (for maintenance or improvement in water quality).
- b. The proposed “process for managing to these limits” has not been subject to appropriate analysis and is not based on thorough consultation with stakeholders. This process is based on the concept of audited self-management.
- c. One of my key concerns with this (audited self-management) approach is that it places too much reliance on the voluntary adoption of ‘good management practices’. This will not stem the current decline in water quality. This approach has also recently been rejected in the Environment Court (Horizons One Plan).

#### **Assessment of regional and national impact**

- 34 An assessment of the effect of pCLWRP on regional development should take account of the effect of the proposed plan on future development and the benefits and costs that would be experienced by the people of the region.
- 35 A common view on these matters is put forward in the statement of Guy Ensor (submission for BNZ dated 5 October 2012, paragraph 34) who writes that *“measures that enhance the environmental qualities of the Canterbury region ... must be done in a way that maintains people’s livelihoods and contributes to the economic growth of the region”*
- 36 I contend that the benefits of agricultural intensification and increased use of irrigation may well be lower than has been suggested and in some cases are negative (see evidence by Geoff Kerr, Alison Dewes and Howard, Romera and Doole, for example).
- 37 Some of the benefits of agricultural intensification will not be captured by current residents of Canterbury Region since many of the extra jobs in dairying will be provided by migrant workers. In contrast the cost of declining water quality is of great concern to most Canterbury region residents.

- 38 To the extent that these regional effects of nutrient management policies can be properly measured using aggregate measures such as GDP, the effect of environmental regulation will be small. For example Rae and Strutt found that national level dairy regulations to reduce nitrogen leaching by around 30% would have very little effect on national income as measured by GDP.
- 39 A full analysis of regional impact should follow the advice of New Zealand Treasury and include environmental effects. I contend that the cost of reducing N leaching is moderate (paragraph 114) and smaller than the benefits that will arise from making sure that water quality is maintained or enhanced (paragraph 234). As a result, policies that ensure that water quality is maintained and enhanced will result in a net economic benefit to the Canterbury region.

#### **Economic consideration of environmental benefits of water quality**

- 40 There is a large body of international literature that reports on the benefits of improving water quality by reducing agricultural pollution. For example, Pretty et al. (2003) estimate the damage cost of freshwater eutrophication in England and Wales to be \$105-\$160 million per year, while Viscusi et al. (2008) provide estimates for increasing the percentage of lakes and rivers in US regions with water quality rated as “good”. Valuation of market and non-market environmental costs and benefits is a well-established part of the public policy making process in many countries.
- 41 In New Zealand we have access to a rapidly growing database of information on this topic. Stated preference studies have been used to assess willingness to pay for improved water quality and can take account of both use and non-use values.
- 42 I also present evidence from revealed preference studies. These studies provide estimates of the amount that consumers would be willing to pay for improved environmental quality based on their actual behaviour in purchasing houses and in selecting angling destinations.
- 43 We found that a one metre improvement in lake water clarity resulted in an average increase in house sale price of around 7 per cent. So for example a typical house on

Lake Rotoiti, worth \$300,000, would increase in value by around \$70,000 if water clarity improved by 3 metres.

- 44 Similar work on the behaviour of anglers using the Rotorua Lakes indicates that a modest (one metre) improvement in water quality could produce direct benefits for anglers in excess of \$1 million per year.
- 45 Where property rights are clearly defined, Willingness to Accept (WTA) provides the correct measure of compensation for a loss in environmental quality. This is because WTA, by definition, leaves an individual indifferent between the status quo and a loss in environmental quality plus compensation. Such individuals will feel that they have not been fully compensated if compensation is based on WTP.
- 46 I contend that the policy proposed by Fish and Game will prevent future deterioration of water quality [see evidence of Jim Cooke on behalf of Fish and Game], whereas the Canterbury Regional Council report that the approach that they propose is likely to results in water quality deteriorating. In this case the size of the benefit depends on the assumption made regarding property rights. Assuming that the citizens of the region have the right to water quality that is not declining, the correct measure of benefit is willingness to accept (WTA).

### **Value of maintaining water quality in the Hurunui**

- 47 In 2011, I conducted a survey in the Canterbury Region to understand the preferences of Canterbury Region residents with respect to existing conditions (the status quo) and potential future land use and water quality scenarios for the Hurunui catchment. Our survey provides new information (for New Zealand) in that we estimated values for WTA e.g. how much compensation would residents require to accept policies that would lead to deteriorating water quality.
- 48 Early results, based on analysis with my co-author, Yvonne Phillips were presented to Environment Canterbury and Lincoln University in September 2011. Following peer review, the full results were presented at the 2013 conference of the Australian Agricultural and Resource Economics Society Conference and in a Department of

Economics Working Paper (Marsh & Phillips, 2012a, 2012b).

49 We found that Canterbury households would need to be compensated for loss in quality of:-

- |    |   |                           |
|----|---|---------------------------|
| a. | Suitability for recreation (satisfactory to not satisfactory) | \$315 per h'hold per year |
| b. | Ecological health (satisfactory to not satisfactory)          | \$254                     |
| c. | Salmon and trout (satisfactory to not satisfactory)           | \$244                     |
| d. | Tributary water quality (not satisfactory to poor)            | \$224                     |

50 It should be noted that the values reported above are mean values.

51 A particular objective of the study was to find out whether residents were equally concerned about the quality of the main river and the tributaries. One of the key findings was that preferences for water quality improvement of tributaries were almost as strong as for the main river.

### **Assessment of Costs and Benefits of Proposed Policy Options**

52 The purpose of this section is to provide an overview of the costs and benefits of the proposed policies now under consideration, namely: the pCLWRP current approach and the approach proposed by Fish and Game. In addition a 'business as usual scenario' has been included to provide a baseline against which the benefits of the different alternatives can be compared.

53 Costs and benefits are assessed based on the following expected outcomes:-

- a. Business as Usual. Intensification is likely to continue and there will not be any widespread uptake of currently recommended mitigation practices because these tend to increase costs and reduce profit. I assume that water quality will continue to deteriorate in all catchments.
- b. Proposed CLWRP. Water quality will get worse in all catchments for at least the

next five years. Given that Schedule 8 is blank, it is not possible to assess what will happen to water quality after a possible future plan change.

- c. Rules proposed by Fish and Game. Water quality will improve in over-allocated catchments and will at least be maintained in other catchments.

54 In assessing the likely cost of the policy proposed by Fish and Game I make use of analysis by Howard, Romera & Doole (2013) for Dairy New Zealand on the cost different N leaching targets under different allocation mechanisms.

55 This should be regarded as an upper limit for likely cost of mitigation. Reasons for this (see evidence by Alison Dewes) include the fact that precision irrigation was not considered and the benefits of some mitigations may not have been fully accounted for.

56 According to this analysis by Dairy New Zealand, the cost of a 32% reduction would be around \$170 per hectare (based on Table 17 in Howard et al.,). Based also on the data provided in this report the per hectare cost for dairy farmers of reducing N leaching by 16% appears to be around \$70 per hectare.

57 Appendix 1 of the Section 32 report provides data on the area of dairy farms leaching at different levels. Using this data and mitigation costs from Howard, Romera, Doole, I estimate an upper bound for the direct cost of N leaching reductions to be of the order of \$21 million per year.

### **Assessment of policy proposed by Fish and Game**

58 Under the policies proposed by Fish and Game water quality is expected to slowly improve in over allocated catchments and is at least maintained in other catchments.

59 The 'benefit' of this approach is that water quality slowly improves whereas it deteriorates under the 'Business as Usual' scenario.

60 In Para 49 above, I refer to my finding that the benefit for Canterbury Region residents of avoiding deterioration in water quality in the Hurunui amounts to \$244 to \$315 per household per year.

- 61 This estimate of \$244 to \$315 refers to a single river. Given diminishing marginal utility and scope effects (Desvousges, Mathews, & Train, 2012), this value cannot be simply multiplied by the number of significant rivers in the Canterbury region to estimate a regional benefit from protecting multiple rivers. Rather I take the very conservative approach of using this estimate for a single river (the Hurunui) to estimate a minimum value for the Region as a whole.
- 62 Statistics NZ estimated the population of Canterbury Region in 2012 to be 558,800, up from 540,000 in 2006. Results from the 2006 census indicate 142,059 households in private occupied dwellings. Based on 142,000 households and a value of \$250 per household, the benefit of avoiding deterioration in water quality exceeds \$35 million per year.
- 63 The willingness to pay/accept of anglers, tourists and other recreational users from outside the region is very substantial and should be added to estimates detailed above.
- 64 Given that residents of Canterbury Region have the right to water quality that is not deteriorating, the benefit of maintaining water quality has a value well in excess of \$35 million per year. This value is well in excess of an estimated upper bound for the cost of reducing N leaching \$21 million per year.
- 65 The benefits of the Fish and Game proposals are likely to greatly exceed the cost of a set of appropriately designed policies that will deliver improved water quality. Implementation of these proposals should result in a net improvement in welfare for the residents of the Canterbury Region and New Zealand as a whole.

## **Assessment of policy proposed by Environment Canterbury**

- 66 Under the policy proposed by Environment Canterbury, water quality will get worse in all catchments for at least the next five years (this point is covered in the evidence of Dr Jim Cooke, on behalf of Fish and Game). Given that Schedule 8 is blank, it is not possible to assess what will happen to water quality after a possible future plan change.
- 67 Using the same approach as detailed above, deterioration in water quality would cause a net loss of at least \$35 million per year. On the other hand the cost (for farmers) of the policies proposed by Environment Canterbury may be substantially lower than the upper bound of \$21 million per year estimated above for the policy proposed by Fish and Game.
- 68 Overall, the cost (net loss of at least \$35 million per year) of the pCLWRP approach exceeds the benefit (a reduction in the cost of up to \$21 million, that would otherwise fall on farmers).
- 69 The costs of the ECan proposal (falling water quality) are likely to greatly exceed the benefits (lower costs for farmers). Implementation of these proposals is likely to result in a net loss in welfare for the residents of Canterbury Region and New Zealand as a whole.



## **ASSESSMENT OF ECAN AND FISH AND GAME APPROACHES TO MANAGING THE EFFECT OF LAND USE ON WATER QUALITY**

### **The Approach Proposed by Canterbury Regional Council**

70 My understanding of the key elements of the approach proposed by ECan in the plan as notified to managing the effect of land use on water quality is as follows:-

#### **Until 2017**

- a. Existing land uses can increase leaching from current levels by up to 10%, or change land use where a water permit has been granted which specifies the allowed level of N leaching. In this case the activity is permitted subject to requirements to model N leaching using OVERSEER, and in some cases to prepare and implement a Farm Environment Plan.
- b. There are no specified limits on the level of N leaching which can be allowed. ECan will not have authority to audit input files or discuss OVERSEER modelling assumptions with landowners.
- c. New Land uses for any farming activity are proposed to be regulated through either restricted discretionary, discretionary or non complying rules depending on zone allocation state.
- d. The regulatory framework applies to all 'use of land for any farming activity'.

#### **Region wide rules post 2017 and sub regional rules**

- e. The above framework applies until sub regional chapters go through their own plan changes and/or 2017 or later, when "Schedule 8" containing industry derived good practice leaching rates will be imposed as one of the triggers for resource consent (rule 5.46) on a region wide basis.

### **My Main Concerns with this approach**

71 We cannot assess whether the sub regional chapters, nor the imposition of Schedule

8, will be either effective at achieving water quality objectives, or efficient in terms of costs and benefits to farmers, the region and the nation. ECan's own section 32 report acknowledges that the rule regime they have proposed will lead to “likely further decline in ground and surface water quality<sup>1</sup>”.

- 72 The section 32 analysis provided by ECan is incomplete since fundamental parts of it will not be established for several years (after a plan change). It is unreliable because it is not possible to assess the efficiency and effectiveness of a policy that has not been defined.
- 73 Based on evidence presented by experts for Fish and Game and Environment Canterbury’s own assessment (above), the approach proposed by ECan does not:
- a. maintain the quality of freshwater
  - b. improve the quality of freshwater where it has been degraded by human activities
- 74 Further details of our understanding of the rules proposed by ECan will be provided in the planning evidence of Philip Percy.

### **The Approach Proposed by Fish and Game**

- 75 Fish and Game propose a set of rules, which will prevent N leaching from increasing in over allocated catchments. These rules have been designed to be practicable, taking account of existing constraints. They provide a foundation which can be built on as sub regional chapters go through the plan change process.
- 76 Key aspects of the rules (farming) proposed by Fish and Game are detailed below:-

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<sup>1</sup> Proposed CLWRP Section 32 Summary, page 67

### **Red and Orange Catchments**

- i. Existing farming is a controlled activity if the sustainable leaching standard is met along with minimum practice standards specified in the rule
- ii. Existing farming is a restricted discretionary activity if it meets the minimum practice standards, and achieves N Leaching reduction standards from (2011/12) leaching rates, Reductions can be achieved by trading.
- iii. Existing farming in catchments that do not comply with standards terms and conditions of the above rules are non-complying
- iv. New farming in red catchments are non-complying
- v. New farming in orange catchments are a controlled activity if leaching at or below the sustainable leaching standard, and if minimum practice standards specified within the rule are met.
- vi. New farming in orange catchments that cannot meet the sustainable leaching rate are a restricted discretionary activity if minimum practice standards specified within the rule are met. This rule facilitates trading such that the total N leaching of all farms does not exceed the cumulative amount for all farms participating in the trade set by the sustainable leaching standard.
- vii. New farming in orange catchments that does not comply with standards terms and conditions of the above rules are non-complying

### **Blue and green catchments**

- viii. New and existing farming are a controlled activity if leaching at or below the sustainable leaching rate and minimum practice standards specified in the rule are met.
- ix. New and existing farming that cannot achieve the sustainable leaching standard is a restricted discretionary activity if the minimum practice standards specified in the rule are met. Matters of discretion include the maximum amount that can leached from the property and measures to implement best management practices and reduce phosphorus, sediment, and faecal contaminant losses from the property.
- x. New and existing farming is non complying if the standards and conditions of the two rules above are not met.

### **Sustainable leaching standard – 20kg/ha/yr**

#### **Rules for existing farming to come into effect on a staged basis:**

Red catchments 2014

Orange catchments 2016

Blue and green catchments – 2017/2018.

- 77 Further details of the rules proposed by Fish and Game will be provided in the planning evidence of Mr Phillip Percy on behalf of Fish and Game.
- 78 I provide an assessment of the efficiency (paragraph 3794 to 100) and effectiveness of the rules proposed by Fish and Game (paragraph 220 onwards).

### **Justification for Rules (Farming) proposed by Fish and Game**

- 79 This justification will focus on the rules proposed by Fish and Game in order to prevent nutrient leaching from increasing in over allocated catchments. Key aspects of the rules proposed by Fish and Game are detailed in the Box above.
- 80 Some of the main factors taken account of in proposing this revised set of rules are as follows:-
- 81 Water quality in over allocated catchments is declining and will continue to decline until effective rules are put in place and land owners have a clear incentive to change their behaviour.
- 82 Ideally, a process would already have been carried out at catchment level whereby
- a. “A nutrient discharge allowance (NDA), linked to the catchment nutrient load limit, would be set for each property in a zone. The NDA would state the maximum amount of nitrogen (kg/ha/year) that may be discharged from a property. The catchment nutrient load limits and NDA would be added by a variation or change to the sub-regional sections of the LWRP<sup>2</sup>”.
  - b. The catchment nutrient load limit would have been set at a level consistent with achieving the objectives of the National Policy Statement on Freshwater.
- 83 ECan have not set catchment nutrient load limits in the proposed pCLWRP. They have made a start on the catchment level consultation process in Hurunui and Selwyn.
- 84 The allocation of catchment nutrient load limits to individual properties will affect equity (there will be winners and losers under any system) and efficiency (overall net

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<sup>2</sup> Environment Canterbury (2012) Appendix 1 to the Section 32 report for the pCLWRP, page 5.

benefits and costs) and is likely to be contentious.

- 85 There are many valid views on the fair sharing of costs [and the appropriate initial allocation of nutrient discharge allowances]. This is not a technical question (Marsh, 2012, quoting Motu). What is equitable (or fair) is often defined as ‘whatever the relevant community thinks is fair’ (Marsh, 2012).
- 86 For these reasons (points 84 to 85 above), community consultation will be an essential prerequisite to the establishment of an efficient and equitable allocation system.
- 87 Nonetheless, water quality has been declining for many years and immediate action is required to prevent further deterioration.
- 88 I am not aware of any adequate justification for ECan’s proposal to allow water quality to deteriorate for the next five years or so, while it attempts to progress the catchment level nutrient limit process.
- 89 Fish and Game proposes a set of rules which will prevent nutrient leaching from increasing in over allocated catchments from 2014 onwards.
- 90 These rules have been designed to be practicable, taking account of the factors detailed above. They provide a foundation which can be built on as sub regional chapters go through the plan change process.
- 91 The proposed rules take account of the concept of a nitrogen leaching level threshold of 20 kg/ha as proposed by Environment Canterbury<sup>3</sup>.
- 92 The proposed rules allow farmers to continue with current practices within certain limits. This has the effect of minimising adverse effects on the farming sector. This approach (taking account of current practice) is supported by most authorities on allocation systems including the recent DairyNZ report on Selwyn by Howard, Doole and Romera (2013)<sup>4</sup>.

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<sup>3</sup> Environment Canterbury (2012) Appendix 1 to the Section 32 report for the pCLWRP, page 5.

<sup>4</sup> They found that “significantly more farms ... are unable to meet their costs and drawings under equal allocation than under good management practice”, page 4. Note – the ‘good management practice’ allocation analysed in this report is essentially the same as the allocation system proposed by Fish and Game.

- 93 The proposed rules take account of the widely held view (Marsh, 2012a), that the costs of reducing N leaching should fall more heavily on those who are leaching at high levels – compared to those who are already practicing more efficient environmental management or who are leaching at lower levels.
- 94 The proposed rules are efficient and effective (compared to alternative rules) for the following reasons:-
- a. Landowners are provided with a clear N leaching target which they are required to meet.
  - b. This will provide a clear incentive to improve environmental management and also to find the most cost effective way of achieving the target.
  - c. The cost of achieving N leaching reductions will be lower than a policy where all land owners are required to achieve the same reductions or to implement the same practices. This is because those with high leaching levels who are required to make larger reductions can generally do this at lower cost compared to those with lower leaching levels.
  - d. Trade or exchange of “N leaching reduction” is allowed. This also has the effect of reducing the overall cost of N leaching reduction since those who can achieve N leaching reduction at lower cost will have the incentive to do so. Those who would face a high cost to reduce N leaching have the option of trading or exchanging with those who can achieve N leaching reduction at lower cost.

#### **Use of a cap and trade economic instrument to achieve LWRP objectives**

- 95 I contend that most practical way to improve water quality on farm is *to provide appropriate incentives*<sup>5</sup> for farmers to adopt appropriate, cost effective practices. The current ‘state of the art’ was summarised in a special issue of the American Journal of Agricultural Economics: ‘environmental economics: how agricultural economists helped advance the field’. This paper lists the top ten contributions with contribution #1 being: “Agricultural economists have developed the theory underlying innovative

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<sup>5</sup> This paragraph is the same as paragraph 145.

incentive-based policies to control environmental externalities for both point and nonpoint source pollution” (Kling, Segerson, & Shogren, 2010).

- 96 At present, nutrient leaching is (using economics terminology) a ‘negative externality’. It is a cost which is imposed on others (those who value the environment) but which is not borne by the decision maker (the land owner) and hence does not influence his or her actions.
- 97 The ‘problem’ (nutrient leaching) is caused by the fact that people do not have to take account of the cost of pollution that they impose on others. The most efficient and effective mechanism for dealing with this problem is through the use of an economic instrument in order to ‘internalise the externality’. Use of an appropriate economic instrument (e.g. via a cap and trade system) puts a price on people’s use of the natural environment and provides an incentive for land owners to act in the best interest of society as a whole by taking account of nutrient leaching in their management decisions.
- 98 Well-designed economic instruments have the potential to be much more cost effective than some regulatory approaches. For example a ground-breaking analysis by Tom Tietenberg<sup>6</sup> (1985) compared “command and control” including technology based effluent standards with least-cost programs for pollution control. The ratio of command and control to least cost ranged from 1 to 22 e.g. in the worst case the command and control policy was 22 times as expensive as the least cost policy.
- 99 Similar results are reported in (Daigneault et al., 2012) Appendix G on the cost effectiveness of alternative nutrient mitigations strategies for Lake Rotorua. For example the cost per kg (of reduction in nitrogen entering the lake) varies from \$4/kg to \$460/kg.
- 100 Similar results are also reported elsewhere in Daigneault et al., (2012). In the summary of findings for the Hurunui Waiau: page (xiv) *“of the policy options modelled, a catchment-wide trading programme with a grandparenting allocation proved to be the*

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<sup>6</sup> Tietenberg, T. (1985). Emissions Trading: An Exercise in Reforming Pollution Control: Resources for the Future, Washington DC.

*most cost-effective for landowners to maintain 2010 catchment nutrient loads with the irrigation scheme implemented."*

- 101 Work by Graeme Doole et al., (2013) on the Karapiro catchment in the Waikato suggests that the cost of reducing N leaching varies depending on the policy instrument used (Table 1). His modelling suggests that costs are higher when all farms face a uniform cap – with no trading allowed. For example, reducing average leaching across the catchment from 31 to 30 kg/ha would cost around \$23/ha under a uniform cap ***but less than \$1 with trading***. Under the uniform cap all farms have to meet the cap irrespective of the cost, whereas with trading abatement is carried out by those farms who can do so at lowest cost. **Cap and trade allows reduction in N leaching at least cost.**

**Table 1: Abatement quantity and cost for simulated policies**

|                                       |           |           |           |
|---------------------------------------|-----------|-----------|-----------|
| <i>Leaching target (kg/ha)</i>        | <i>30</i> | <i>26</i> | <i>22</i> |
| <i>Abatement quantity (kg/ha)</i>     | <i>1</i>  | <i>5</i>  | <i>9</i>  |
| Cap emissions - no trade (cost \$/ha) | 22.9      | 49.47     | 96.6      |
| Cap emissions – trade (cost \$/ha)    | 0.69      | 14.79     | 54.39     |

Source: Doole, Marsh, Panell & Ramilan (2013). Note: Farmers are assumed to make use of Currently Recommended Mitigation Practices (CRMPs)

### **The cost of reducing nutrient leaching**

- 102 I am familiar with the New Zealand and international literature on the cost of reducing nutrient leaching by farmers. This includes work by Ross Monaghan, Graeme Doole, Stuart Ford and others (G. Doole et al., 2013; Graeme J Doole, 2012; Graeme J. Doole & Pannell, 2012; Monaghan, 2009).
- 103 Various authors have investigated and/or analysed the cost of reducing nutrient leaching in Canterbury. Key sources of information include:-
- Evidence of Alison Dewes for Fish and Game.



- b. Selwyn Te Waihora Nutrient Benchmarking (2012), AgriBusiness Group, December.
- c. Howard S, Romera A & Doole G (2013) Selwyn-Waihora Nitrogen Loss Reductions and Allocation Systems, Dairy New Zealand February.
- d. Brown I, Norton N, Wedderburn L, Monaghan R, Harris S, Hayward S & Ford R (2011) Nutrient Management in Hurunui: A Case Study in Identifying Options and Opportunities, Environment Canterbury, November.

- 104 Expert opinion on the cost of reducing leaching can be described as falling broadly under three overlapping perspectives; a) leaching can be reduced while increasing profitability; b) leaching can be reduced at moderate cost; c) reduction in leaching can only be achieved at high cost. I will review each of these three perspectives.
- 105 Some experts suggest that *Nitrogen leaching can be reduced significantly while increasing profitability*. Experts in this group suggest that mitigation options are available which will reduce nitrogen losses and improve profitability. An example is provided by Smeaton who gave evidence<sup>7</sup> that farmers in the catchment of Lake Rotorua could reduce N leaching by 5-25% with a minor negative to slightly beneficial effect on profit.
- 106 Alison Dewes provides detailed evidence on changes to farm level practice that can enable some farms to reduce leaching and improve profitability. I support her detailed analysis of the potential for reducing N leaching in Canterbury.
- 107 Practices to reduce N leaching often require high managerial ability and are most likely to be adopted by leading farmers, especially when supported by suitable technical back up. Such changes will not be voluntarily implemented by the majority of farmers because of various constraints (see below).
- 108 Doole et al., (2013) modelled the cost of mitigation in the Karapiro catchment and found that none of the commonly listed mitigation strategies would be adopted under current policy settings because they do not increase profitability. Similarly, Motu in a

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<sup>7</sup> In the case of the Proposed One Plan – Horizons Regional Council

recent summary of research in this area<sup>8</sup> found that *“best practice land management will not be sufficient to meet the environmental target set by the Bay of Plenty Regional Council”*.

- 109 The key point I adopt is that **best practice land management will not be sufficient to meet the environmental targets.**
- 110 Many farmers will not be able to achieve N reduction without an increase in costs. Overall, at a catchment or regional level, reduction in nitrogen leaching is likely to require a moderate increase in costs and will have a (probably small) negative impact on profits.
- 111 *I consider that N Leaching at catchment level can be reduced at moderate cost.* My position is supported by Howard, Romera & Doole (2013) who found that a 32% reduction in N leaching across the Selwyn Catchment would reduce profits by 5.6%. They also report that *“a 10 per cent reduction in N loss in the catchment [equivalent to a 16% reduction by dairy farms] is not likely to have major implications for farm viability ...”* The key point I rely on is that **DairyNZ research shows that a 32% reduction in N leaching across the Selwyn Catchment would reduce profits by 5.6%.**
- 112 Similar results were reported for the Waikato by Doole & Pannell (2012) who found that *“under optimal management, the costs [of mitigation] are generally modest ... with differentiated emissions standards”*. They found that a 4 per cent reduction in profit was required to achieve a 30 per cent N reduction at catchment level, or a 14 per cent reduction in profit to achieve a 50 per cent N reduction.
- 113 Howard, Romera & Doole (2013) carried out research for Dairy New Zealand in order to investigate the effect of different N leaching targets under different allocation mechanisms. They conducted interviews with key informants and other experts and a phone survey covering 80 of the approximately 200 dairy herds in the Selwyn District. This information was used for cluster analysis in order to create a set of simulated farms representing the main farm types in the district. Nitrogen loss mitigation costs were estimated using the using the Grazing Systems Limited (GSL) linear programming

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<sup>8</sup> Motu (2012) Designing Policy to Protect New Zealand’s Water Quality

model. Catchment level mitigation costs were estimated using a linear programming model of the zone built by Graeme Doole.

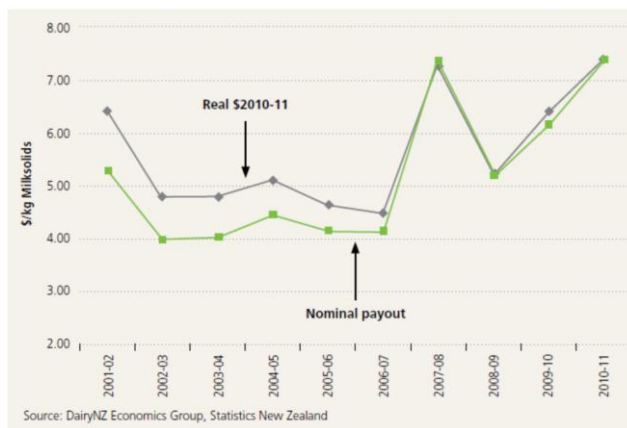
- 114 According to this analysis by Dairy New Zealand, the cost of reducing N leaching by 10% across the whole catchment would be around \$3 million – equivalent to a 1% reduction in total catchment profit (\$273 m falls to \$270 m). Similarly a 20% N decrease would reduce profit by \$9.3 million (a 3% reduction in total catchment profit). Most of this reduction is faced by the dairy sector where catchment profit would be reduced by 5.6% for a 32% N decrease (Table 17). Catchment level results are extracted from Table 8 which is reproduced below.

Table 8. Catchment and general dairy farm output for different levels of N restriction before the implementation of the CPW scheme. The equal allocation solution is profit-maximising solution with fully effective N trading and N restriction.

|                              | Units     | GMP baseline | Equal allocation with trading |                   |                   |
|------------------------------|-----------|--------------|-------------------------------|-------------------|-------------------|
|                              |           |              | 0%<br>N decrease              | 10% N<br>decrease | 20% N<br>decrease |
| Median return <sup>32</sup>  | \$/ha     | 241          | 169                           | 46                | -53               |
| Mean return <sup>32</sup>    | \$/ha     | -87          | -143                          | -255              | -366              |
| Total catchment profit       | \$m       | 273.06       | 273.06                        | 270               | 263.78            |
| % change                     | %         | -            | -                             | -1                | -3                |
| Total N leached in catchment | t N       | 4,695        | 4,695                         | 4,225             | 3,756             |
| % change                     | %         | -            | -                             | -10               | -20               |
| Dairy cows                   | Head      | 152,838      | 152,838                       | 144,028           | 133,484           |
| % change                     | %         | -            | -                             | -6                | -13               |
| Milk production              | t MS      | 64,989       | 64,989                        | 61,297            | 56,627            |
| % change                     | %         | -            | -                             | -6                | -13               |
| N fertiliser                 | t         | 6,830        | 6,830                         | 4,581             | 2,685             |
| % change                     | %         | -            | -                             | -23               | -61               |
| Supplement                   | t         | 70,007       | 70,007                        | 46,110            | 16,008            |
| % change                     | %         | -            | -                             | -34               | -77               |
| Equal allocation             | kg N/ha/y | -            | 24.4                          | 21.96             | 19.52             |
| N price in market            | \$/kg N   | -            | 2.58                          | 11.38             | 16.45             |

- 115 Dairy farmers are well used to adapting to changing prices for inputs and outputs. The profit reductions estimated above are small compared to the effect of change in milk price or climatic variation which farmers have to manage every year. The milk price received by farmers can vary by over 50% from one year to the next – see Table 4.2 below (reproduced from the DairyNZ Economic Survey 2010-11).

Figure 4.2: \$ Received per kg MS Sold (Nominal and Real)



- 116 The DairyNZ report by Howard, Romera & Doole (2013) also provides valuable information on the effect of alternative systems that might be used to allocate farm level nitrogen discharge allowances. They find that an equal allocation system heavily penalises higher leaching land uses and increases the proportion of farms that would experience negative returns. They find that these adverse effects are reduced under a system of modified grand parenting (which they refer to as ‘good management practice’).
- 117 The report also provides a revealing insight into the overall profitability of dairy farming in the Selwyn District. Based on the set of assumptions used, it is estimated that around one third of dairy farms are unprofitable<sup>9</sup>.
- 118 The third group – put forward the view that *reduction in N leaching can only be achieved at high cost*. I do not agree with this view. Analysis supporting this perspective tends to be based on individual farm case studies and a prescriptive approach whereby it is assumed that farmers must adopt various capital items or reduce stocking rate in order to achieve the required level of mitigation. An example of this approach is provided in Appendix 1 of the BNZ submission on the PCLWRP, in which a set of assumptions around a single ‘model’ farm are used to suggest that EBITDA (Earnings Before Interest, Taxes, Depreciation and Amortization) could fall by 33% and land prices by 35%<sup>10</sup>.

<sup>9</sup> See Table 10. 38% of farms have negative returns (baseline), with drawings considered as a cost.

<sup>10</sup> I have rounded the BNZ estimates 33.45 and 34.58 in order to avoid the spurious impression of accuracy.

- 119 Cost levels reported under this approach may be biased upwards because they do not take account of farmers' ability to find lower cost ways of achieving any given mitigation target and also because they may not take account of variation in the cost of mitigation for different farms across a catchment or region.

### **Other Analysis on the Cost of Nutrient Mitigation in Canterbury**

- 120 The 2011 report by Brown et al., on nutrient management in the Hurunui includes estimated costs for alternative N mitigation strategies. These appear to be based on a 2007 NIWA client report on diffuse pollution attenuation tools for New Zealand<sup>11</sup>. Given the lack of Canterbury specific analysis, this report does not provide any new information on the scale of mitigation costs that would be faced by dairy farmers in Canterbury.
- 121 MPI Technical Paper 2012/46 provides an analysis of various policy options that would enable the achievement of nutrient management targets in the Hurunui-Waiau catchment. In principle the analysis summarised in Table 23 (page 60) might provide some indication of the cost of alternative nutrient management policies.
- 122 I contend that this Technical Paper and current NZFARM methodology should not be used to assess the cost of nutrient management policies in Canterbury. My reasons are detailed in a paper written by Associate Professor Graeme Doole and I, which was provided as evidence in the Horizons case (Graeme J Doole & Marsh, 2013).
- 123 Our key concerns centre on the use of positive mathematical programming (PMP) for calibration and a lack of validation. We explain in the paper referred to above how the use of PMP produces arbitrary results in modelling future outcomes and provide specific examples of such results in the Manawatu catchment. We contend in the paper that significant development will be required before NZFARM outputs can be used with any certainty to inform future policy development.

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<sup>11</sup> See footnote on page 29. McKergrow et al., (2007) Stock take of diffuse pollution attenuation tools for New Zealand pastoral farming systems. NIWA Client Report HAM2007-161.

## THE REQUIREMENT TO UNDERTAKE COST BENEFIT ANALYSIS

### Section 32 and assessment of costs and benefits

- 124 Section 32 of the Resource Management Act 1991 requires councils to prepare an evaluation which demonstrates they have considered the costs, benefits and alternatives of a proposed policy. The evaluation must examine the extent to which each objective is the most appropriate way to achieve the purpose of the Act and whether, having regard to efficiency and effectiveness, the policies, rules, and other methods are the most appropriate for achieving the objectives. The evaluation of efficiency and effectiveness of provisions must take into account the benefits and costs of policies, rules, or other methods and the risk of acting or not acting if there is uncertain or insufficient information about the subject matter of the policies, rules, or other methods.
- 125 The Ministry for the Environment (MfE) established the Quality Planning Website ([www.qualityplanning.org.nz](http://www.qualityplanning.org.nz) in 2004) to assist councils in developing the expertise needed to follow RMA requirements. The website provides guidelines for conducting a Section 32 analysis including a definition of the two key terms, efficiency and effectiveness, used in Section 32 to determine whether a proposed plan is the most appropriate.
- 126 *“**Effectiveness** means how successful a particular option is/will be in achieving the stated objective... **efficiency** means where the benefits will outweigh the costs, either immediately or over time. The most efficient policy or method will achieve the stated objective with the greatest benefit and at the least cost (costs and benefits may be quantitative, semi-quantitative and/or qualitative)”.*<sup>12</sup>
- 127 *Economic Consideration of Benefits in Policy Analysis.* Economic consideration of [environmental] benefits e.g. water quality is most useful in contexts where decision makers are required to weigh up the costs and benefits of better water quality as part of the policy development process. Cost benefit analysis has long had a central role in

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<sup>12</sup> <http://www.qualityplanning.org.nz/index.php/plan-steps/section-32/key-terms>

policy analysis in many government agencies. The Treasury issued an updated guidance note to assist government departments to make proper use of cost benefit analysis in 2005 (New Zealand Treasury, 2005). Some relevant extracts follow:- *“This primer seeks to improve the quality of policy and spending proposals by providing guidance on the issues that should be considered and how proposals will be assessed by the Treasury. It is intended for public sector policy and financial analysts and provides simple, accessible and practical assistance. The Primer presents an overview of Cost Benefit Analysis in a New Zealand public sector context, with particular emphasis on the basic questions that are likely to arise (p. 3)...*

*There are often cases where a market does not exist or market prices are not directly observable or easy to estimate. In such cases, it may be difficult to estimate costs and benefits ... **Wider social and environmental costs and benefits commonly fall into this category, but should not be ignored simply because they cannot easily be costed.** (p. 21)”.*

- 128 The importance of a broad based approach to assessing the impact of policy – that takes account of “much more than just income or GDP” continues to be stressed by the Treasury. This approach was underlined by publication of a Treasury Paper “Working towards higher living Standards for New Zealanders” on 4 September 2012 (Gleisner, Llewellyn-Fowler, & McAlister, 2012). I had the opportunity to discuss this approach with the Treasury Chief Economist, Girol Karacaoglu when he visited the Department of Economics at the University of Waikato in August 2012. The abstract for this paper is reproduced below.

*Working Towards Higher Living Standards for New Zealanders describes how Treasury thinks about and works towards its vision of "higher living standards for New Zealanders". Treasury's understanding of the term living standards goes beyond the narrow material definition - often proxied by GDP - to incorporate a broad range of material and non-material factors such as trust, education, health and environmental quality... Stiglitz, Sen and Fitoussi's 2009 report for President Sarkozy's commission into Measuring Social and Economic Progress highlights the gap between "the information contained in aggregate GDP data and what counts for common people's*

wellbeing".

- 129 *Treasury's understanding of living standards is encapsulated in its 'Living Standards Framework'. The Framework is centred on four main capital stocks - financial/physical, human, social, and natural - from which we derive flows of material and non-material goods and services which enhance living standards. The Framework describes the interrelationships among the stocks and flows, and highlights the need for responsible management in order to improve the living standards of both current and future New Zealanders. It also emphasises the importance of the way living standards are distributed across society, and argues that considering the distributional impacts of policy choices should be a core part of policy advice.*
- 130 *While the Framework is not intended to provide the final word on what matters most for living standards, it does highlight the trade-offs that are often necessary between various stocks and flows, and in doing so aims to generate debate about what matters for New Zealanders.*
- 131 My understanding is that **Treasury's higher living standards approach tries to close the gap between GDP data and what counts for common people's well being.**
- 132 In my evidence I will contribute to an improved Section 32 analysis by:
- a. following the approach promoted by the New Zealand Treasury to demonstrate how a broader range of costs and benefits can be considered in order to assess how policies proposed under pCLWRP will affect the overall living standards of people living in the Canterbury Region and New Zealand as a whole;
  - b. summarising recent findings that suggest that substantial reductions in N leaching can be achieved at relatively low cost;
  - c. summarising recent findings that enable us to quantify some of the benefits of improved water quality for residents of the Canterbury region; and
  - d. by assessing the costs and benefits of the ECan and Fish and Game approaches to nutrient management.



## **My assessment of ECan's Section 32 analysis of nutrient management policies**

- 133 The Section 32 report for the proposed CLWRP summarises the evaluation of the provisions of the Proposed Canterbury Land and Water Regional Plan (the pLWRP) undertaken by the Canterbury Regional Council as required by section 32 of the Resource Management Act 1991 (RMA). A synopsis is provided on pages 64 to 68 of the main Section 32 report while the full assessment is provided in Appendix 1 to the section 32 assessment.
- 134 I cannot assess whether the sub regional chapters, nor the imposition of Schedule 8, will be either effective at achieving water quality objectives, or efficient in terms of costs and benefits to farmers, the region and the nation. ECan's own section 32 report acknowledges that the rule regime they have proposed will lead to "likely further decline in ground and surface water quality".
- 135 The section 32 analysis provided by ECan is incomplete since fundamental parts of it will not be established for several years (after plan changes). It is unreliable because it is not possible to assess the efficiency and effectiveness of a policy or rule that has not been specified.

## **Assessment of 'the preferred approach'**

- 136 On page 5 of Appendix 1 (A1 S32 PCLWRP) it is reported that "*The overall policy direction to manage the effects of land use on water quality in the region is based on the results of a pilot study in the Hurunui catchment, known as the preferred approach*"... This appendix also describes the evaluation of alternative policy options (p. 39).
- 137 Results of this pilot study are written up in Brown, et al. ., (2011). I also have personal knowledge of this research, having participated in the development of this approach and in two of the catchment level workshops under PROJ-12559-PASTORAL-AGR funded by the Foundation for Science Research and Technology and Pastoral 21 partners - Dairy New Zealand, Meat and Wool New Zealand and Fonterra.

138 Given the prominence that ECan give to this preferred approach I have made a detailed assessment (included as Appendix 1), while noting that it is not formally part of the proposed plan and so cannot be subject to section 32 analysis.

139 Some of my key findings that I explain in detail in this Appendix include the following:-

140 In the case of the Hurunui pilot study, the outcome of the “non-statutory community-led phase for establishing the limits” was based on extensive consultation and detailed analysis.

141 The interim approach proposed by ECan is contrary to the outcome of the limit setting phase of the consultation process and contrary to the strongly held desires of the community (for maintenance or improvement in water quality).

142 The proposed “process for managing to these limits” has not been subject to appropriate analysis and is not based on thorough consultation with stakeholders. On page 5 of Appendix 1 (A1 S32 PCLWRP) it is reported that the preferred process for managing to these limits involves:

*Landowners working with industry organisations or dischargers would take primary responsibility for reducing nutrient losses, within the catchment limits and the framework established by the LWRP. The preferred approach is based on the concept of audited self-management, using a “whole of farm” approach, e.g. farm plans, industry certification schemes, or irrigation schemes, to manage nutrient losses. The performance of an audited self-management scheme would be assessed by an independent auditor...*

143 My key concerns with this approach are as follows:-

- a. Reliance on the voluntary adoption of ‘good management practices’ alone will not stem the current decline in water quality. This approach has recently been rejected in the Environment Court (Horizons One Plan)<sup>13</sup>. There are opportunities for many farms to reduce leaching without a significant reduction in profitability (see evidence of Alison Dewes), however an appropriate set of

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<sup>13</sup> *Day et al v Manawatu–Wanganui Regional Council Decision No. [2012] NZEnvC 182. See Paras 5-9, 5-133.*

rules will be required to provide sufficient incentive for most farmers to make these changes.

- b. There is no direct mechanism to ensure that FEPs in aggregate achieve catchment level objectives;
- c. Incentives to adopt actions that will improve water quality have not yet been addressed;
- d. The different incentives facing different farmers in a catchment have not yet been addressed (e.g. existing drystock farm vs proposed dairy conversion);
- e. Use of “mechanisms such as financial incentives, easing the consenting pathway and longer consent durations” (as proposed by Brown and Mulcock) may cause inequity and distortion as well as being expensive and ineffective.

144 Brown and Mulcock (page 12) suggest that “the most practical way to improve water quality on-farm is for individual enterprises to adopt ‘good management practices’”. This suggestion seems to take little account of the established literature on technology adoption in agriculture (Chavas, Chambers, & Pope, 2010).

145 I contend that most practical way to improve water quality on farm is *to provide appropriate incentives* for farmers to adopt appropriate, cost effective practices

146 The proposed approach of identifying and promoting ‘good management practices’ is similar to the Decision version of the Horizons One Plan. This was rejected at appeal by Judge Thompson who wrote that the “*phrase reasonably practicable farm management practices* (or variations on the theme) should not appear in the surface water quality objectives, policies or the rules of the One Plan”<sup>14</sup>.

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<sup>14</sup> Day et al, para 5-181

147 One of the key elements missing from the approach which Brown and Mulcock refer to as an Audited Self-Management (ASM) system is a clear explanation as to how the proposed ASM of farm level plans will ensure that regulatory requirements are met. For example:

- a. Farms engaging in permitted activities are not required to undertake Farm Environment Plans (FEPs). How will they be engaged in this process?
- b. Even if most farms in a catchment are engaged with the FEP process, how will this ensure that catchment level targets are achieved?
- c. Actions – beyond [voluntary] implementation of ‘good management practices’ may be required, to achieve catchment level targets, how will this be achieved?
- d. Stakeholders investing in new irrigation may need to persuade existing irrigators to invest in expensive technology (e.g. precision irrigation) in order to allow new development within catchment level targets. How will this be achieved?

## Assessment of Regional and National Impact

- 148 Appropriate estimation of farm level costs is a prerequisite for estimation of regional impact. Care needs to be taken in interpreting estimates of regional impact based on input output coefficients. Computable General Equilibrium (CGE) analysis provides a rigorous method for assessing these impacts. Unfortunately, regional data that would enable regional CGE analysis is often not available in New Zealand.
- 149 I understand that ECan have commissioned a report from NZIER that will use CGE modelling to assess “the economic impact of setting and managing to limits. Specifically, the study will need to consider the changes in regional GDP and shifts in employment generated by water quality limits where this may have placed restrictions on growth<sup>15</sup>”.
- 150 It is unfortunate that this report has not been completed, as it should have been considered in the Section 32 analysis.
- 151 Assessments of regional and national impact should take account of the secondary (‘knock on’) effects of regulation. For example, if dairy farming is more tightly regulated, this may lead to some displacement into other land uses – for example dairy grazing. Likewise, if intensive farming is regulated more tightly in the Canterbury Region compared to other regions then there will be some displacement of intensification to other regions.
- 152 Any displacement of intensification to other regions will signal that national level impact may be less than the regional level impact. On the other hand, regulations introduced in the Canterbury Region may pave the way for similar regulations in other regions. In this case, national level impact will be greater – but still less than would be suggested by a farm level approach. This is because some landowners may switch from intensive dairy farming to the next most profitable land use activity.
- 153 A research project has recently been concluded by the University of Waikato (C10X0603 funded by the Foundation for Research Science and Technology, Dairy New

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<sup>15</sup> Extracted from NZIER proposal for Environment Canterbury (2012).

Zealand, Meat and Wool New Zealand and Fonterra) looking at the national impact of regulating the New Zealand dairy industry (Rae & Strutt, 2011). This project included assessment of the impact of environmental regulation (that would reduce N leaching to more sustainable levels) on New Zealand's international competitiveness, including changes in total export volumes and returns for dairy products and meats, and changes in New Zealand's share of major foreign markets for these products. This project was based on the GTAP-ENZ model, further refined, to address nitrogen and GHG reduction options for New Zealand pastoral agriculture.

- 154 The authors estimated that **national level dairy regulations to reduce nitrogen leaching by around 30% would have very little effect on national income as measured by GDP**. They estimated a reduction of 0.03% - 3/100 of one per cent; note, these results for GDP are not included in the report but are available from the authors on request.
- 155 Rae and Strutt did not attempt to model the effect of any change in international consumer demand towards sustainable dairy products. The slightly negative effect noted above could easily be overshadowed by even a slight increase in demand for sustainable dairy products in world markets. Such a change in demand might allow a price premium on sustainable dairy products or might lead to a fall in demand for products associated with adverse environmental effects – such as declining water quality.

### **The Contribution of Irrigation Development to Regional Welfare**

- 156 One of the key messages promoted by some stakeholders is that agricultural intensification and increased use of irrigation will be good for the region .... and that *“measures that enhance the environmental qualities of the Canterbury region ... must be done in a way that maintains people's livelihoods and contributes to the economic growth of the region<sup>16</sup>”*
- 157 In the 2012 report by Environment Canterbury *Canterbury Water Management Strategy Targets Draft Progress Report*, June 2012 pages 70-71. It is claimed that the

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<sup>16</sup> Submission on CLWRP by Guy Ensor, National Manager Water and Irrigation, BNZ.

contribution that water makes to the regional economy “could be expressed as” Total amount of water allocated/Total Regional GDP or Total amount of water used/Total irrigated output. This is incorrect since it implies that the contribution of all other inputs (capital, labour, technology, other natural resources etc.) is zero.

- 158 Economists often focus on marginal analysis and this provides a more useful way of thinking about this issue. So for example: if the irrigated area in Canterbury is increased by 10%, to what extent would Regional GDP increase and how much of this increase would be attributable to irrigation (as opposed to other inputs)?
- 159 I note that expert witnesses are concerned that some of the new irrigation developments that have been proposed may not produce net benefits for the region. For example, Associate Professor Geoff Kerr, providing evidence before the Hearing Panel appointed by the Canterbury Regional Council on the application by the Hurunui Irrigation Project Limited to dam and take water from the Waitohi River<sup>17</sup> wrote:-

*“My analysis of the economic assessment reported in the AEE leads me to conclude that the proposed irrigation scheme will not be economically viable should any of a number of critical parameters differ significantly from the levels used in in Mr Harris’ analysis. There appears to be a reasonably strong likelihood that such circumstances may occur. Whilst Mr Harris reports an expected net present value in the order of +\$200 million of benefits to irrigators, there is likely to be great variability in this result and plausible scenarios result in negative net present value for irrigators.*

*Mr Harris’ economic analysis purposely did not address external costs of the proposed irrigation project. That is appropriate for financial analysis, but raises the question of the magnitude of costs imposed on other people and the environment. The AEE identifies a number of external costs of the project. However, there has been no attempt to identify the significance of those costs relative to the scale of irrigators’ net benefits”.*

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<sup>17</sup> IN THE MATTER OF Applications CRC120687, CRC120695, CRC120696 and CRC120691 to take and divert water; CRC120694 and CRC122547 to discharge water; CRC120692 to dam water; CRC120675 to take and use water; and CRC130467 to store water.

- 160 Geoffrey Butcher in his statement of evidence for Fonterra in the group one hearings on the pCLWRP provided his assessment of the current contribution of dairying to the Canterbury economy. However he did not analyse the following effects – which need to be considered in an economic assessment of pCLWRP:
- a. the likely effect of pCLWRP (as currently drafted) on the future contribution of dairying to the Canterbury economy;
  - b. the likely effect of provisions that would ensure water quality is maintained; and
  - c. the likely effect of future irrigation development on the contribution of dairying to the Canterbury economy (while noting the concerns raised by Geoff Kerr above).
- 161 Gross Domestic Product (GDP) is a measure of value added *by domestic residents*. Because of labour shortages and the unwillingness of many New Zealand workers to work in the agriculture sector it is likely that a high proportion of extra jobs resulting from irrigation development will go to overseas workers. As such a significant portion of the benefits of extra irrigation may be captured by people who are currently not domestic residents (and so would be excluded by the measure of GDP). ***The contribution of irrigation development to GDP may be reduced by employment of overseas workers.***
- 162 The proportion of total agricultural employees in the dairy industry in Canterbury increased by 22% from 2001-2008, but this was offset by a decrease in the sheep, beef cattle and grain farming sector of 21% (Manhire 2010) resulting in a net increase of 1% within the agriculture, forestry and fishing sector. Within the dairy sector much of the increase was provided by migrant workers.
- 163 Evidence for the increasing reliance of the dairy sector on overseas workers is provided below.
- 164 Dynes, Burggraaf, Goulter and Dalley (2010) report that *“it is a common local complaint that it is difficult to recruit, train and retain good quality staff. The number*



*of immigrant workers in the Canterbury region has increased greatly in the last decade to cover the shortfall in agricultural employment*

- 165 In November 2012, Tipples, Trafford and Callister (2012) presented a paper at the conference on labour, employment and work at Victoria University of Wellington. They write *“Over the past decade, the dairy industry has grown in land area, number of cows, milk production and dairy exports to the point where it is New Zealand’s premier exporter. Growth has been accompanied by significant structural changes to the industry. In particular, many small, family owned and managed farms, that were characterised by high levels of self-employment, have been replaced by large scale ‘factory’ style, irrigated farms that depend on nonfamily, often casualized and seasonal workers, who work very long hours. Staffing these farms has been problematic and recruitment and retention have been regularly highlighted issues ...*

*Federated Farmers and recruitment agencies estimate there is a shortage of at least 2,000 skilled dairy Labour, Employment and Work Conference 2010 workers (Career Services Rapuara, 2010). With the industry in expansion mode, labour shortages are likely to compound, especially for the large herds in the South Island where expansion has been concentrated. Possibly 12,000 more are needed (Human Rights Commission, 2009:59 cited in Williams, 2009)”...*

### **Conclusion on regional and national impact of proposed CLWRP**

- 166 An assessment of the effect of pCLWRP on regional development should take account of the effect of the proposed plan on future development and the benefits and costs that would be experienced by the people of the region.
- 167 A common view on these matters is put forward in the evidence of Guy Ensor who writes that *“measures that enhance the environmental qualities of the Canterbury region ... must be done in a way that maintains people’s livelihoods and contributes to the economic growth of the region<sup>18</sup>”*.

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<sup>18</sup> Submission on CLWRP by Guy Ensor, National Manager Water and Irrigation, BNZ.

- 168 I contend that the benefits of agricultural intensification and increased use of irrigation may well be lower than has been suggested and in some cases are negative (see evidence by Geoff Kerr, Alison Dewes and Howard, Romera and Doole, for example).
- 169 Some of the benefits of agricultural intensification will not be captured by current residents of Canterbury Region since many of the extra jobs in dairying will be provided by migrant workers. In contrast the cost of declining water quality is of great concern to most Canterbury region residents.
- 170 To the extent that these effects can be properly measured using aggregate measures such as GDP, the effect of environmental regulation will be small. For example Rae and Strutt found that national level dairy regulations to reduce nitrogen leaching by around 30% would have very little effect on national income as measured by GDP.
- 171 A full analysis of regional impact should follow the advice of New Zealand Treasury and include environmental effects. I contend that the cost of reducing N leaching is moderate (paragraph 114) and smaller than the benefits that will arise from making sure that water quality is maintained or enhanced (paragraph 234). As a result, policies that ensure that water quality is maintained and enhanced will result in a net economic<sup>19</sup> benefit to the Canterbury region.

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<sup>19</sup> I use the term economic to describe overall change in welfare including environmental costs and benefits, this is in keeping with the approach promoted by the New Zealand Treasury in 'Working towards higher living Standards for New Zealanders' (2012).

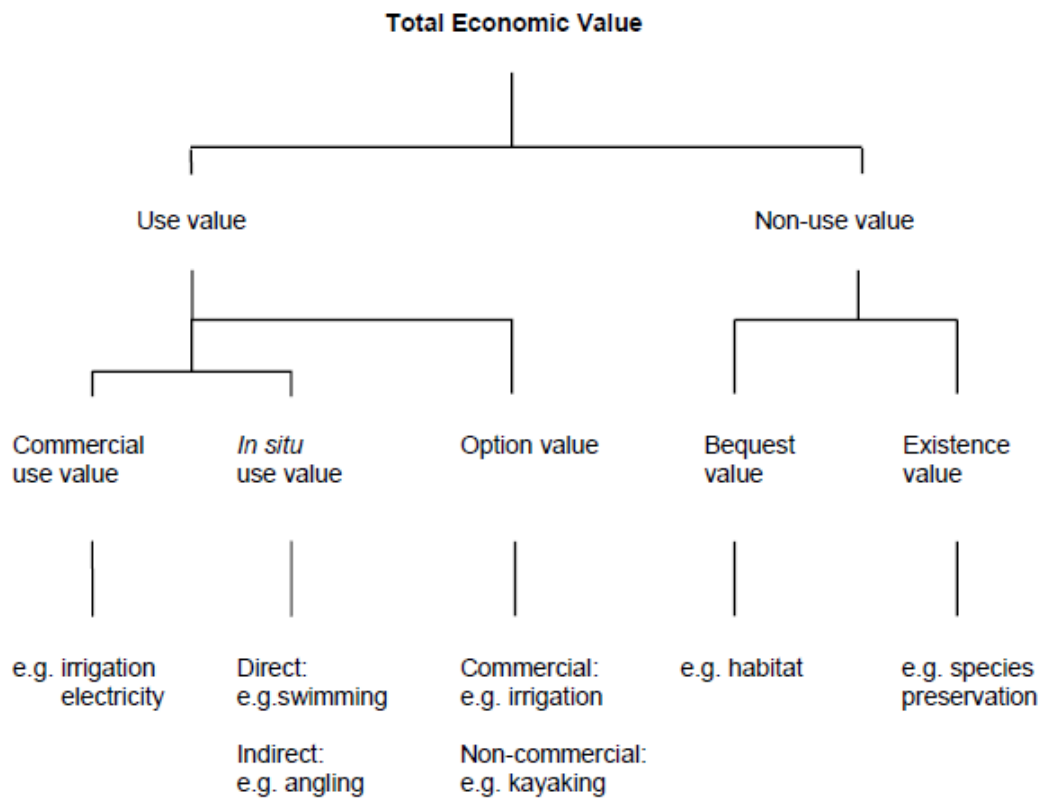
## ECONOMIC CONSIDERATION OF ENVIRONMENTAL BENEFITS OF WATER QUALITY

### The economic approach to assessing the value of water quality based on excerpts from Sharp and Kerr (2005)

- 172 Basil Sharp and Geoff Kerr were commissioned by the Ministry for the Environment to report on the option and existence value of the Waitaki Catchment (Sharp & Kerr, 2005). Their report thoroughly documents economic approaches to valuation so I will introduce the economic approach to assessing the value of improved water quality by quoting from this report. Paras 173 to 178 (below) are extracted from this report, with minor modification indicated in [square brackets] to clarify relevance to the proposed CLWRP.
- 173 *In economics, value is based on the preferences an individual attaches to the flow of services associated with a water resource. Addressing the change in the flow of services is of particular importance. The maximum amount an individual is willing to pay (WTP) for obtaining a benefit or avoiding a loss reflects the individual's preferences for the gain or loss. The minimum willingness to accept (WTA) measures the compensation necessary for the individual experiencing a loss.*
- 174 [Rivers and other water bodies provide] “... a wide array of services, some of which are currently being used. For example, land, labour and capital (market-priced factors of production) combine with an energy gradient .. to produce electricity. Similarly, land, labour and capital combine with water to produce agricultural products. Both of these outputs are market-priced and measuring the benefits and costs associated with alternative water use is relatively straightforward. However, expenditure to derive benefits from ... [rivers] is not limited to the production of market valued outputs. For example, anglers spend money on the annual licence required for fishing, along with gear, travel and so on, in order to fish in the river. Similarly, individuals spend money on gear to enjoy white water kayaking. The output (utility enjoyed by individuals and families) is not valued in the market. We refer to these as ‘use values’.

- 175 *However, some people may place a value on ... [rivers] that is independent of their present use. For example, people may gain utility from the knowledge that the river system is preserved even though they may never visit the site... Natural resource values that are independent of individual's present use of the resource are variously termed 'existence' and 'non-use' values (Freeman, 1993). These values arise from a desire to bequeath environmental resources to one's heirs, a sense of stewardship and a desire to preserve options for the future... If non-use values are large then ignoring them could result in a misallocation of resources".*
- 176 *Total economic value, as illustrated in Figure 1, provides a convenient framework for organising the different classes of value that might be associated with ... [changes in water quality in the Canterbury Region].*
- 177 *Use values: Use value derives from actual use of the water resource. For example, water as an input into dairy production; the energy potential in water to generate electricity; angling and hunting; and so on. As noted earlier, use value necessarily involves the combination of other factors of production with the resource. Use values can be further broken down into:*
- a. Commercial value, where water is combined with other factors of production and the output sold (eg, milk and electricity).*
  - b. In situ use value, where the services of the water resource are directly (eg swimming) or indirectly (eg hunting) used, but the output (utility in this case) is not marketed.*
  - c. Option value, where, although individuals/firms are not currently using the resource, they might be prepared to pay for the right to use the services of the resource at some later date (Weisbrod, 1964; Freeman, 1993). Option value is not related to current use and is typically used to measure the value attached to future use opportunities. For example ... anglers not currently fishing the Waitaki River might be willing to pay for a future opportunity to fish in [that] ... River...*

**Figure 1: Total Economic Value**



Reproduced from Sharp and Kerr (2005)

178 *Non-use values: These are independent of the individual's present use of the resource and are variously described as "existence value", the value from knowing that a particular environmental assets exists (eg endangered species); and "bequest value", the value arising from the desire to bequeath certain resources to one's heirs or future generations (eg habitat preservation).*

## The New Zealand and International Literature on the Value of Better Water Quality

- 179 There is a large international literature that reports on the benefits of improving water quality by reducing agricultural pollution. For example, Pretty et al. (2003) estimate the damage cost of freshwater eutrophication in England and Wales to be \$105-\$160 million per year, while Viscusi et al. (2008) provide estimates for increasing the percentage of lakes and rivers in US regions with water quality rated as “good”.
- 180 Within the environmental economics discipline a common approach is to focus on the cost or benefit of a change in water quality. This approach is also most useful in assessing the benefits of alternative policies that may be implemented by Canterbury Regional Council. This is also the approach generally taken internationally in countries where use of non-market valuation methods to assess environmental benefits and costs has been widely incorporated into the policy making process e.g. USA and Europe (see below).
- 181 **Valuation of market and non-market environmental costs and benefits is a well-established part of the public policy making process in many countries.** In the United States the Environmental Protection Agency’s Guidelines for Preparing Economic Analyses (United States Environmental Protection Agency, 2000)... “establish a sound scientific framework for performing economic analyses of environmental regulations and policies. ...”Environmental valuation is also well developed and accepted in Europe and many other OECD countries. The Water Framework Directive has provided a major impetus for non-market valuation of the benefits of better water quality in Europe.
- 182 The situation in Europe has some parallels with New Zealand in that there is a requirement for policy makers to take account of the costs and benefits of policy measures. This has led to a rapid growth in non-market valuation and use of choice analysis to allow the assessment of costs and benefits.
- 183 In New Zealand, choice analysis has been used to estimate the value that residents attached to the condition of streams in the Auckland region (Kerr & Sharp, 2003) and the amenity value of spring fed streams and rivers in the Canterbury region (Kerr &

Swaffield, 2007). Sharp and Kerr (2005) discuss non market values for the Waitaki catchment as part of a national cost benefit analysis of proposals to take water from that river. They also provide a comprehensive review of all New Zealand studies in this area, including several unpublished papers that address the existence values associated with proposed changes directly affecting rivers.

- 184 Discrete choice experiments (*choice analysis*) have gained widespread recognition since their early application by Louviere & Hensher (1982) and Louviere & Woodworth (1983) and their earliest application to environmental valuation by Boxall et al (1996). Choice analysis is an attribute-based technique in which respondents are presented with different alternatives defined in terms of environmental attributes and cost. They are then asked to select their preferred one. The tradeoffs that they reveal during this exercise between the cost of the proposed options and their environmental attributes are used to derive implicit estimates of monetary value under a set of well qualified assumptions.

### **The Effect of Property Rights on Economic Consideration of Benefits**

- 185 There are in the economics discipline, two measures of the economic benefit (or cost) of environmental improvement (or deterioration). Such benefits or costs can be assessed using the measure of willingness to pay (WTP) for an improvement in provision of the good or willingness to accept compensation (WTA) to forgo such improvements (or to accept deterioration).
- 186 While early economic theorists predicted that WTP for a unit gain and WTA for a unit loss are approximately equal (Hicks, 1939; Randall & Stoll, 1980), empirical evidence reveals that WTA is almost always significantly higher. This can be explained with a simple example as follows: households might be asked how much they would be willing to pay to increase the length of river in a region that is safe for swimming by 20%. Assuming median WTP is \$100 per year, standard theory suggests that the same households would be willing to accept a reduction in swimmable rivers by 20% if they were offered compensation of around \$100. In practice however, we would find that the median value for WTA would be much higher.

- 187 Most studies conducted in experimental or survey settings for both marketed and non-marketed environmental goods have reported higher WTA than WTP values (Anderson, Vadnjal, & Uhlin, 2000; Hanemann, 1991; Rowe, D'arge, & Brookshire, 1980; Willig, 1976). Furthermore, disparities between WTP and WTA tend to be higher for public goods than private goods (Horowitz & McConnell, 2002).
- 188 The difference between WTA and WTP is mainly attributed to income and substitution effects. The amount of disposable income available to an individual constrains how much of a good can be demanded in terms of WTP, while the demand for compensation is not limited by income. Some authors contend that if WTA is used as a measure of value, individuals may demand higher compensation than the actual value of the resource and as a result the benefits of a proposed policy may be overvalued.
- 189 On the other hand, higher WTA values are justified on the following grounds. Close substitutes may not be available for most public goods. Consequently, once the quality of such goods deteriorates, it is not possible to compensate individuals for the losses and hence individuals may reject being bought off to allow pollution by demanding high WTA values (Rowe et al., 1980).
- 190 Property rights for environmental goods although crucial for economic valuation, are often not clearly defined (T. C. Brown & Gregory, 1999; Lienhoop & MacMillan, 2007). This lack of clearly defined property rights has also partly contributed to the continued reliance on the use of WTP even in cases of environmental damage where WTA should be more appropriate. However, as noted by Brown & Gregory (1999) use of WTP leads to the undervaluation of benefits and so may result in sub-optimal policy outcomes.
- 191 This is because WTA, by definition, leaves an individual indifferent between the status quo and a loss in environmental quality plus compensation. Such individuals will feel that they have not been fully compensated if compensation is based on WTP.
- 192 ***Where property rights are clearly defined, WTA provides the correct measure of compensation for a loss in environmental quality.***



- 193 I contend that the policy proposed by Fish and Game will prevent future deterioration of water quality [see evidence of Jim Cooke on behalf of Fish and Game], whereas the Canterbury Regional Council report that the approach that they propose is likely to results in water quality deteriorating [also illustrated in Jim Cooke's evidence]. In this case the size of the benefit depends on the assumption made regarding property rights. Assuming that the citizens of the region have the right to water quality that is not declining, the correct measure of benefit is willingness to accept (WTA).
- 194 In simple terms, WTA should be estimated by reminding the citizens of the region that they have the right to sustainable management of natural resources including water that is not deteriorating in quality. They would then be asked what amount of compensation would induce them to accept a reduction in water quality. An estimate of benefit based on this measure of compensation would have a much higher value than the WTP estimates referred to above.

#### **Value of Maintaining Water Quality in the Hurunui**

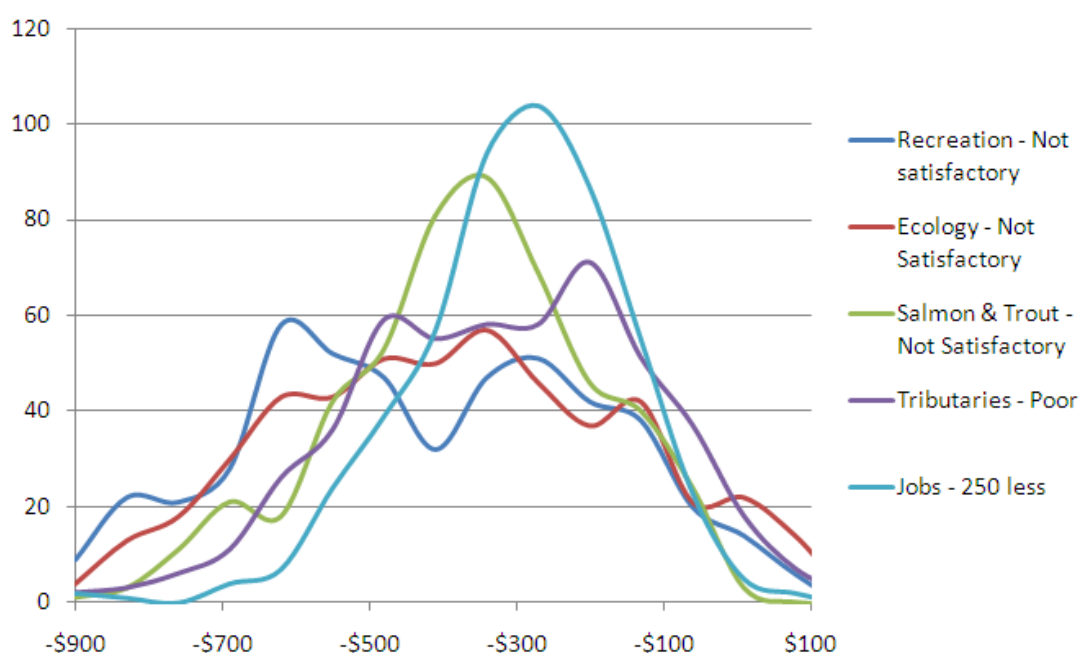
- 195 I participated in the Land and Water Quality Project in the Hurunui catchment which led to the development of a preferred approach for the management of the cumulative impacts of land use on water quality in the catchment (I. Brown et al., 2011; Wedderburn et al., 2011).
- 196 In 2011, I conducted a survey in the Canterbury Region to understand the preferences of Canterbury Region residents with respect to existing conditions (the status quo) and potential future land use and water quality scenarios for the Hurunui catchment. Our survey provides new information (for New Zealand) in that we estimated values for WTA e.g. how much compensation would residents require to accept policies that would lead to deteriorating water quality. Early results, based on analysis with my co-author, Yvonne Phillips were presented to Environment Canterbury and Lincoln University in September 2011. Following peer review, the full results were presented at the 2013 conference of the Australian Agricultural and Resource Economics Society Conference and in a Department of Economics Working Paper (Marsh & Phillips, 2012a, 2012b).

197 We found that Canterbury households would need to be compensated for loss in quality of:-

|  |                           |
|--|---------------------------|
| Suitability for recreation ( <i>satisfactory to not satisfactory</i> ) | \$315 per h'hold per year |
| Ecological health ( <i>satisfactory to not satisfactory</i> )          | \$254                     |
| Salmon and trout ( <i>satisfactory to not satisfactory</i> )           | \$244                     |
| Tributary water quality ( <i>not satisfactory to poor</i> )            | \$224                     |

198 It should be noted that the values reported above are mean values. The distribution of WTA values across the population is illustrated in Figure 2 below<sup>20</sup>.

**Figure 2: Willingness to accept compensation for decline in water quality**



199 A particular objective of the study was to find out whether Canterbury region residents were equally concerned about the quality of the main river and the tributaries. One of the key findings was that **preferences for water quality improvement of tributaries were almost as strong as for the main river.**

<sup>20</sup> Note: for technical reasons this illustration of the distribution of WTA is based on a slightly different econometric model to the one used to derive the quantitative results derived above.

200 In 2011, I provided advice on a study that aimed to “inform advice to the Tasman District Council on setting management objectives for multiple uses and values across several catchments of the value of water quality improvements in Nelson”. Results are reported in Bell, et al., (2010). We found WTA reduction in water quality to be of a similar order of magnitude as estimated by Marsh and Phillips for the Hurunui. For example “the average willingness-to-pay (WTP) estimate was about \$250 per year for five years ... to avoid a change from excellent to good or fair in ‘fish and fishing’ on the Matakaitaki River, and about \$600 per year to avoid a change to poor”

#### **Other New Zealand Findings on Valuation of Water Quality: – The Waitaki Report**

201 Basil Sharp and Geoff Kerr’s report on the option and existence value of the Waitaki Catchment (Sharp & Kerr, 2005) includes a compilation of New Zealand Studies that indicate “potential value magnitudes”. The regional studies are probably most relevant to the current investigation and are reproduced below (Table 2):- Sharp and Kerr concluded their review of the New Zealand literature on water quality valuation with the statement that: *“Existing studies indicate that New Zealand residents can place high value on protection of the natural environment. Study design limitations ensure that it is not always possible to separate use and non-use values, but mean total economic value changes estimated for various management interventions for braided Canterbury rivers falls in the order of \$60 per household per year. Where separate values have been obtained, non-use values appear to be substantial.”*

**Table 2 Regional Estimates of the Value of Better Water Quality**

| Author(s)               | Study population                                       | Item valued   | \$ per h' hold per year | NPV \$ millions |
|-------------------------|--|---|-------------------------|-----------------|
| Harris                  | Households in 4 main Waikato urban centres             | Prevent <b>Waikato River</b> pollution returning to 1960s quality                       | \$93                    | \$928 m         |
| Kerr, Sharp & Leathers  | Canterbury households*                                 | Prevent <b>Waimakariri River</b> irrigation development for 5 yrs                       | \$37                    | \$155 m         |
|                         |  | Preserve the <b>Waimakariri River</b> in its existing state                             | \$42                    | \$421 m         |
|                         |  | Improve <b>Waimakariri River</b> water quality standard                                 | \$34                    | \$346 m         |
|                         | Canterbury households* that use the Waimakariri        | Prevent <b>Waimakariri River</b> irrigation development for 5 yrs                       | \$45                    | \$187 m         |
|                         |  | Preserve the <b>Waimakariri River</b> in its existing state                             | \$51                    | \$512 m         |
|                         |  | Improve <b>Waimakariri River</b> water quality from D to C standard                     | \$40                    | \$401 m         |
|                         | Canterbury households* that do not use the Waimakariri | Prevent <b>Waimakariri River</b> irrigation development for 5 yrs                       | \$15                    | \$63 m          |
|                         |  | Preserve the <b>Waimakariri River</b> in its existing state                             | \$12                    | \$117 m         |
|                         |  | Improve <b>Waimakariri River</b> water quality standard                                 | \$14                    | \$135 m         |
| Kerr, Sharp & Leathers  | Canterbury households*                                 | Prevent <b>Rakaia River</b> irrigation development for 5 years                          | \$44                    | \$182 m         |
|                         |  | Preserve the <b>Rakaia River</b> in its existing state                                  | \$43                    | \$430 m         |
|                         | Canterbury households* that use the Rakaia             | Prevent <b>Rakaia River</b> irrigation development for 5 years                          | \$77                    | \$321 m         |
|                         |  | Preserve the <b>Rakaia River</b> in its existing state                                  | \$77                    | \$766 m         |
|                         | Canterbury households* that do not use the Rakaia      | Prevent <b>Rakaia River</b> irrigation development for 5 years                          | \$25                    | \$104 m         |
|                         |  | Preserve the <b>Rakaia River</b> in its existing state                                  | \$25                    | \$249 m         |
| Beanland                | Manawatu-Wanganui Region households                    | Payment of a special rate to lease and preserve Aorangi-Awarua forest (on private land) | \$11                    | \$113 m         |
| Lynch                   | Canterbury households (excludes Ashburton)             | Preserve <b>Ashburton River</b> flows   | \$70                    | \$703 m         |
| Lock                    | Manawatu-Wanganui Region households                    | Payment into a Manawatu-Wanganui possum control fund                                    | \$88                    | \$879 m         |
| Mortimer, Sharp & Craig | Auckland households                                    | Maintain current conservation activities on Little Barrier Island                       | \$45                    | \$454 m         |

Notes: All money values were adjusted to December 2003 values using the consumers' price index.

[Multiply by 1.16 to adjust to Dec 2011 values].

Reproduced from Sharp & Kerr (2005)

## Valuation of water quality improvements since the Waitaki Report (1995)

- 202 I led a research project from 2007-2011, funded by FRST and industry stakeholders<sup>21</sup> that aimed to assist farmers and policy makers to identify the most cost effective options for achieving any given improvement in water quality by developing appropriate methodology for valuation of water quality improvements in New Zealand.
- 203 Results are reported in international peer reviewed journal articles (Marsh, 2012b; Marsh, Mkwara, & Scarpa, 2011), a report for the Environment Waikato Technical Committee (Marsh, Davies, & Petch, 2009), two papers in the Department of Economics working paper series<sup>22</sup> and in various conference papers and presentations.
- 204 *Work under this project included stated preference studies* to assess the total economic benefit from improvement in water. For example Marsh (2012b) provides estimates for use and non-use value of water quality improvements in the Karapiro Catchment in the upper Waikato, based on a survey of catchment residents. In determining the total economic value of water quality improvements in that catchment, we would need to *add* the benefits attributable to those who use the catchment but are not resident (e.g. recreational and commercial users) and also *add* the non-use values of non-residents.
- 205 In addition to the studies of the Karapiro Catchment detailed above, a further five studies relating to water quality are listed in the NZ Non-Market Valuation Database<sup>23</sup> for the period 2006-2011. Results from the Canterbury studies are broadly supportive of earlier work and increase our confidence in some of the specific estimates and results for particular groups of stakeholders (Table 3).

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<sup>21</sup> FRST Programme C10X0603: Delivering tools for improved environmental performance funded by The Foundation for Research Science and Technology (FRST) and the Pastoral 21 partners Dairy New Zealand, Meat and Wool New Zealand and Fonterra.

<sup>22</sup> <http://econpapers.repec.org/paper/waieconwp/>

<sup>23</sup> <http://www2.lincoln.ac.nz/nonmarketvaluation>

**Table 3: Selected Water Quality Related Studies since 2005**

| Topic   | Year | Authors                      | Method              | Results  |
|---|------|------------------------------|---------------------|--|
| Riparian attributes, lower Selwyn River         | 2007 | Geoff Kerr & Simon Swaffield | Choice Based Method | Mean Value: Farmers (type 1)(per annum): summer no flow day -\$2.49, winter no flow day - \$0.91, summer low flow day - \$1.48, clear water \$45, safe to swim \$122, grassy banks \$38 gorse on banks -\$39, local job \$23 |
| North Canterbury Freshwater fishing experiences | 2008 | Stephen Beville & Geoff Kerr | Choice Based Method | Marginal values (per angler visit): 1 trout = \$16, Increased fish size = \$24 per pound, Bag limit = \$27 per trout, Eroded riverbanks = -\$60, Didymo = - \$41, Encounters = -\$5  |

Source: New Zealand Non-Market Valuation Database  
<http://www2.lincoln.ac.nz/nonmarketvaluation/>

### Results from revealed preference studies.

- 206 Revealed preference methods of valuing environmental benefits often involve “a kind of detective work for piecing together clues about the values individuals place on environmental services as they respond to other economic signals” (Freeman, 1978). They provide an important supplement to stated preference studies and counteract the claim that some people would not actually pay the dollar amounts they report in contingent valuation and choice analysis surveys. It should be noted that revealed preference methods provide information on *use values* – they cannot (by definition) provide information on non-use (including existence) values.
- 207 Researchers in the Department of Economics at the University of Waikato have estimated some of the benefits of cleaner water in the Rotorua Lakes by analysing property prices and the behaviour of anglers. These results provide a broad indication of possible effects on property values and benefits to anglers in the Horizons region.
- 208 We found that that a one metre improvement in water clarity resulted in an average increase in house sale price of around 7 per cent. So for example a typical house on

Lake Rotoiti, worth \$300,000 – where water clarity has typically been 4 to 6 metres would increase in value by around \$70,000 if water clarity improved by 3 metres – achieving water quality levels similar to those currently found in Lake Okareka. We plan to carry out further analysis using this data base to refine the model and to help us to assess the overall impact on the value of housing stock in the district (Marsh & Woodham, 2011). This study demonstrates that the value of properties close to water bodies can be strongly influenced by water quality. Better water quality in the Canterbury Region will increase the value of such properties as property buyers are willing to pay more for better environmental quality.

- 209 Another researcher that I supervise, is using data from the National Angling Survey to look at how water quality affects anglers' choice of fishing destination. Travelling to a more distant lake increases travel cost, so this data can be used to put a lower limit on the amount that anglers are willing to pay to achieve better water quality. Preliminary results indicate that a modest (one metre) improvement in water quality<sup>24</sup> could produce direct benefits for anglers in excess of \$1 million per year (Marsh & Mkwara, 2011).
- 210 Further information on the benefits of angling to the New Zealand economy can be extracted from the National Angling Surveys conducted by NIWA (2012) on behalf of Fish and Game.
- 211 The report of the 2001/02 National Angling survey (2003) – notes that *“angling is primarily a local activity, often undertaken within 50km of where anglers live... Much of this angling takes place on waters which may be categorised as lowland rivers, and which several recent studies have shown are becoming increasingly degraded (Parkyn et al, 2002, Jellyman et al 2003). This resource is of fundamental importance to many New Zealanders”* (p. 23).
- 212 New Zealand's trout fisheries are recognized both internationally and domestically, attracting both local and foreign tourism. Tourism generated a direct contribution to

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<sup>24</sup> In seven lakes that currently have lower water quality (Rotorua, Rotoiti, Okaro, Rotoehu, Rotomahana, Okaraka & Rerewhakaaitu).

GDP of \$6.9 billion in 2010/2011, with total tourist expenditure totalling \$23 billion (Sharpe, 2012).

- 213 Trout fishing based tourism contributes a significant component of these figures, with recreational tourist anglers reported to spend more on their fishing holiday than most other tourist activities (Tourism New Zealand pers comm., 2009). In acknowledging the importance of New Zealand's rivers and their recreational value, the Associate Minister for Tourism stated that "New Zealand's rivers are assets that support tourism and recreational opportunities", and that "promoting and protecting our natural environment makes dollars and sense" (Dr Colman, 2009).

### **Conclusions on the Benefits of Better Water Quality**

- 214 The use of methods from environmental economics, including non-market valuation, to assess the benefits of improved water quality is well established internationally, especially in the United States and Europe.
- 215 In New Zealand we have access to a rapidly growing database of information on this topic. Stated preference studies have been used to assess willingness to pay for improved water quality and can take account of both use and non-use values.
- 216 In 2011 I investigated the preferences of residents of the Canterbury region with respect to existing conditions (the status quo) and potential future land use and water quality scenarios for the Hurunui catchment. Our survey provides new information (for New Zealand) in that we estimated values for WTA e.g. how much compensation would residents require to accept policies that would lead to deteriorating water quality. We found that Canterbury households would need to be compensated between \$244-\$315 per household per year for a decline in water quality attributes in the main river or tributaries.
- 217 I have also presented evidence from revealed preference studies. These studies provide estimates of the amount that consumers would be willing to pay for improved environmental quality based on their actual behaviour in purchasing houses and in selecting angling destinations.



- 218 We found that that a one metre improvement in lake water clarity resulted in an average increase in house sale price of around 7 per cent. So for example a typical house on Lake Rotoiti, worth \$300,000, would increase in value by around \$70,000 if water clarity improved by 3 metres.
- 219 Similar work on the behaviour of anglers using the Rotorua Lakes indicates that a modest (one metre) improvement in water quality<sup>25</sup> could produce direct benefits for anglers in excess of \$1 million per year.

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<sup>25</sup> In seven lakes that currently have lower water quality (Rotorua, Rotoiti, Okaro, Rotoehu, Rotomahana, Okaraka & Rerewhakaaitu).

## ASSESSMENT OF COSTS AND BENEFITS OF PROPOSED POLICY OPTIONS

220 The purpose of this section is to provide an overview of the costs and benefits of the proposed policies now under consideration, namely: the pCLWRP current approach and the approach proposed by Fish and Game. In addition a 'business as usual scenario' has been included to provide a baseline against which the benefits of the different alternatives can be compared.

**Table 4: Summary of Specific Policies Assessed**

|    | <b>Policy</b>  | <b>Description</b>   |
|----|--|--|
| 1. | 'Business as Usual'<br>Voluntary approaches                          | <i>Continue with Current NRRP approach plus voluntary adoption of good management practices etc</i>  |
| 2. | Current Approach in proposed Canterbury Land and Water Regional Plan | <i>Apply a two stage process: – support move to GMPs &amp; apply “holding approach” in enriched catchments until CWMS zone committees set limits</i> |
| 3. | Fish and Game proposal   | <i>Rules on N leaching ensure that N leaching is capped at 2012/13 levels and reduces over the next 5 years in over allocated catchments.</i>        |

221 Current and expected water quality outcomes are summarised in Table 5, drawing on evidence from Appendix 6 of the Section 32 Report where Meredith, Stevenson and Kelly divide the Canterbury Region into three main zones based on water quality outcomes:

- a. “Water quality outcomes not met” - where effects on instream values are observed, and a reduction in nutrient loads will be required;
- b. “Water quality outcomes are “at risk” - Effects on instream values are starting to become apparent or the water bodies are at, or close to, water quality limits/outcomes. Control of nutrient inputs into the catchment will be required;
- c. “Meets water quality outcomes” - effects on instream values are not apparent and/or are unlikely to be exhibited in the near future.

222 Professor Death on behalf of Fish and Game, discusses the zone allocation approach proposed by Canterbury and raises some concerns in regards to its robustness. The Fish and Game approach is modelled by Dr Jim Cooke (on behalf of Fish and Game) and discussed in his evidence.

223 Costs and benefits are assessed based on the following expected outcomes:-

- a. *Business as Usual*. Intensification is likely to continue and there will not be any widespread uptake of currently recommended mitigation practices because these tend to increase costs and reduce profit. I assume that water quality will continue to deteriorate in all catchments.
- b. *Proposed CLWRP*. Water quality will get worse in all catchments for at least the next five years. Given that Schedule 8 is blank, it is not possible to assess what will happen to water quality after a possible future plan change.
- c. *Rules proposed by Fish and Game*. Water quality will improve in over-allocated and at risk catchments and will at least be maintained in other catchments.

**Table 5 : Summary of Estimated Water Quality Outcomes**

| Nutrient Allocation Zone or Catchment | Current Situation  | 'Business as Usual'                       | pCLWRP | CFG Proposal       |
|---------------------------------------|--------------------|---|--------|--------------------|
| Hurunui Waiau                         | Yes (mainly)       | <i>Addressed by new sub regional plan</i> |        |                    |
| Red Zone                              | No                 | --ve                                      | -ve    | +ve                |
| Orange zone                           | At risk or not met | --ve                                      | -ve    | +ve                |
| Green zone                            | Yes                | --ve                                      | -ve    | Continue to be met |

## Cost of Proposed Policies

- 224 In assessing the likely cost of the policy proposed by CFG I will make use of analysis by Howard, Romera & Doole (2013 for Dairy New Zealand on the cost different N leaching targets under different allocation mechanisms.
- 225 This should be regarded as an upper limit for likely cost of mitigation. Reasons for this (see evidence by Alison Dewes) include the fact that precision irrigation was not considered and the benefits of some mitigations may not have been fully accounted for.
- 226 According to this analysis by Dairy New Zealand, the cost of a 32% reduction would be around \$170 per hectare (based on Table 17 in Howard et al.,). Based also on the data provided in this report the per hectare cost for dairy farmers of reducing N leaching by 16% appears to be around \$70 per hectare<sup>26</sup>.
- 227 Appendix 1 of Section 32 report provides data on the area of dairy farms leaching at different levels. Using this data and mitigation costs from Howard, Romera, Doole, I estimate **an upper bound for the direct cost of N leaching reductions to be of the order of \$21 million per year.**
- 228 To reach this figure, I assume that: land currently leaching between 20 and 25 kg/ha will not incur costs to reduce leaching. Land leaching 25-30 kg/ha (49,883 ha) and half of the land leaching more than 30kg/ha will need to reduce leaching by an average of 16% at a cost of \$70, the remaining half of land leaching more than 30 kg/ha will need to reduce leaching by an average of 32%.

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<sup>26</sup> A detailed breakdown by farming type is not provided for a 10% reduction; however Table 8 shows that profit is reduced by \$3 million for a 10% reduction in N leaching across the catchment. Given a 32% reduction for dairy to achieve a 20% reduction across the catchment, I assume that a 10% reduction across the catchment requires a 16% reduction by dairy farms.

| Section 32 Report Appendix 1 page 58-59 |    |         |             |                   |
|---|----|---------|-------------|-------------------|
|   |    |         | cost per ha | Total Cost        |
| More than 20 kg/ha                      |    | 122,957 | 0           | -                 |
| more than 25 kg/ha                      |    | 49,833  | 70          | 3,488,310         |
| more than 30 kg/ha                      | ha | 72,455  | 70          | 5,071,850         |
|   |    | 72,455  | 170         | 12,317,350        |
|   |    |         |             | <b>20,877,510</b> |

229 With time and access to the appropriate data, this estimate could be improved, to take account of the amount of dairy land in over allocated catchments which would be required to reduce leaching based on the new rules proposed by Fish and Game. It should also be noted that the maximum annual cost would not be faced for several years – depending on the time period over which it is decided that farmers should achieve target reductions. For example reductions may be achieved over a 5, 10 or even 20 year period.

#### **Assessment of policy proposed by Fish and Game**

230 Under the policies proposed by Fish and Game water quality is expected to slowly improve in over allocated and at risk catchments and is at least maintained in other catchments.

231 The ‘benefit’ of this approach is that water quality slowly improves whereas it deteriorates under the ‘Business as Usual’ scenario.

232 In Para 197 above, I refer to my finding that the benefit for Canterbury Region residents of avoiding deterioration in water quality in the Hurunui amounts to \$244 to \$315 per household per year.

233 This estimate of \$244 to \$315 refers to a single river. Given diminishing marginal utility and scope effects (Desvousges et al., 2012), this value cannot be simply multiplied by the number of significant rivers in the Canterbury region to estimate a regional benefit from protecting multiple rivers. Rather I take the very conservative approach of using this estimate for a single attribute for a single river (the Hurunui) to estimate a minimum value for the Region as a whole.

- 234 Statistics NZ<sup>27</sup> estimated the population of Canterbury Region in 2012 to be 558,800, up from 540,000 in 2006. Results from the 2006 census indicate 142,059 households in private occupied dwellings. Based on 142,000 households and a value of \$250 per household, **the benefit of avoiding deterioration in water quality exceeds \$35 million per year.**
- 235 Taking an even more conservative approach based on the Kerr and Sharp (2005) estimate of \$60 per household (updated to 2012 values = \$70 per household X 142,000 households). Canterbury Region residents willingness to pay for specific management interventions that would improve water quality would exceed \$10 million per year.
- 236 Use of WTP to estimate the benefits of improved water quality will significantly underestimate benefits, since the appropriate measure of the benefits of improved water quality is provided by the 'willingness to accept' measure (paragraph 193).
- 237 In either case the WTA/P of anglers, tourists and other recreational users from outside the region are very substantial and should be added to estimates detailed above.
- 238 **If one assumes that residents of the Canterbury Region have the right to water quality that is not deteriorating, the benefit of maintaining water quality has a value well in excess of \$35 million per year. This value is considerable more than an estimated upper bound for the cost of reducing N leaching (\$21 million per year).**
- 239 **The benefits of the Fish and Game proposals are likely to greatly exceed the cost of a set of appropriately designed policies that will deliver improved water quality. Implementation of these proposals should result in a net improvement in welfare for the residents of Canterbury Region and New Zealand as a whole.**

#### **Assessment of policy proposed by Environment Canterbury**

- 240 Under the policy proposed by Environment Canterbury, water quality will get worse in all catchments for at least the next five years (this is covered in the evidence of Dr Jim

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<sup>27</sup>[http://www.stats.govt.nz/browse\\_for\\_stats/population/estimates\\_and\\_projections/SubnationalPopulationEstimates\\_HOTPYe30Jun12.aspx](http://www.stats.govt.nz/browse_for_stats/population/estimates_and_projections/SubnationalPopulationEstimates_HOTPYe30Jun12.aspx)

Cooke, on behalf of Fish and Game). Given that Schedule 8 is blank, it is not possible to assess what will happen to water quality after a possible future plan change.

- 241 Using the same approach as detailed above, a deterioration in water quality would cause a net loss of at least \$35 million per year. On the other hand the cost (for farmers) of the policies proposed by Environment Canterbury may be substantially lower than the upper bound of \$21 million per year estimated for the Fish and Game proposal above.
- 242 Overall, the cost (net loss of at least \$35 million per year) of the pCLWRP approach exceeds the benefit (a reduction in the cost of up to \$21 million, that would otherwise fall on farmers).
- 243 **The costs of the ECan proposal (falling water quality) are likely to greatly exceed the benefits (lower costs for farmers). Implementation of these proposals is likely to result in a net loss in welfare for the residents of Canterbury Region and New Zealand as a whole.**

## **Comment on S42A Report Hearing Group 2 by Matthew McCallum-Clark, March 2013**

- 244 This section of my evidence provides a brief comment on the S42A Report R13/11 including the ‘additional recommended policies’ (recommended to be inserted immediately prior to recommended policy 4.28 on Page 105).
- 245 This report notes (p. 69) *“Rightly or wrongly, after significant industry consultation and involvement, the CRC settled on a form of “enhanced grandfathering” for management of nutrients. The enhancement takes the form of significant reliance on “industry articulated good practice”, which is the focus of an on-going project to identify and quantify “good practice”.<sup>86</sup> Overlaying this is the sub-regional framework which enables location specific solutions to be developed and implemented.”*
- 246 The addendum to the Section 42 Officer Report dated the 22 March appears to signal a further weakening of any intent by Environment Canterbury to ensure that water quality does not continue to deteriorate in the Canterbury Region.
- 247 This addendum recommends the insertion of additional policies “to meet water quality outcomes”
- a. that incorporate *“raising awareness, gathering information and encouraging good practice through the preparation, implementation and auditing of farm environment plans”*; and
  - b. *Promulgating a plan change that introduces into Schedule 8 nutrient discharge limits based on good practice*
- 248 The “good practice limits” are to be based on the *“nutrient discharges resulting from good practice farming activities, taking into account the variety of farming types, climatic conditions and soil types across Canterbury”*.
- 249 I contend that this approach will allow water quality in the Canterbury Region to continue to deteriorate since there is no mention of any intention to set limits in order to achieve environmental outcomes.



- 250 'Good practice farming activities' have not been defined although we are told that this "is the focus of an on-going project to identify and quantify good practice" (p. 69 S42 Officer Report). Further details are provided in the s32 report. I have already documented my concerns with this approach in my evidence (Appendix 1 paragraph 252 to end).
- 251 Voluntary adoption of 'good management practices' and 'audited self-management' will not stem the current decline in water quality and this approach has recently been rejected in the Environment Court (Horizons One Plan).
- 252 The key difference between the approach that I recommend and that which is proposed by Environment Canterbury is in the area of incentives.
- 253 I contend that the limit setting process should be designed to achieve economic, social and environmental outcomes and that farm level limits should be set and enforced. This will provide a clear incentive for landowners to implement good management practices that achieve environmental, social and economic outcomes.
- 254 Good management practices should be defined as those practices which enable economic, social and environmental outcomes to be achieved. Good management practices will vary from farm to farm and should often be left to the discretion of the individual farm owner, provided environmental outcomes are achieved.
- 255 Given the process which is currently being proposed I am very concerned that most farmers in a catchment may practice 'good management practices' (as defined by Environment Canterbury) and yet environmental quality will deteriorate.

### Comment on BNZ Submission on PCLWRP by Guy Ensor

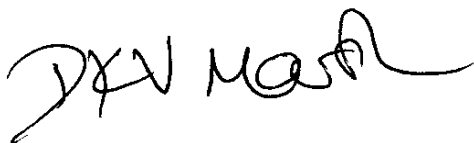
256 I support several of the comments made by Guy Ensor in the BNZ submission, especially with regard to the need to consider economic, social and environmental impacts. I share Mr Ensor's concern (para 10) that the "current analysis is inadequate justification" [under Section 32].

257 In order to rectify this concern it is necessary to take account not only of the **costs** that would be faced by farmers and other parties in implementing the plan but also the **benefits** of reducing the impact of farming on the environment. I present evidence on the likely magnitude of costs and benefits in my evidence below.

258 I agree with the submission by BNZ (Para 25) that limiting resource consents to five years in over-allocated catchments is too short. We address this concern in our proposed rules where we set a longer term year planning regime to achieve LWRP objectives.

259 I agree (para 19) that "The transfer of water permits - provided that environmental values can be maintained - should be provided for and not prevented. The ability to transfer entitlements between users so as to maximise the value users get from water is a key driver in realising the economic benefits of our fresh water resource."

**DATED** this 2nd day of April 2013

A handwritten signature in black ink, appearing to read 'DKV Marsh', with a stylized, flowing script.

Daniel KV Marsh

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## APPENDIX ONE

### Appendix 1: Detailed assessment of ECan's Section 32 analysis of nutrient management policies

- 1 The Section 32 report for the proposed CLWRP summarises the evaluation of the provisions of the Proposed Canterbury Land and Water Regional Plan (the pLWRP) undertaken by the Canterbury Regional Council as required by section 32 of the Resource Management Act 1991 (RMA). A synopsis of the material in the Appendix is provided on pages 64 to 68 while the full assessment is provided in Appendix 1 to the section 32 assessment.
- 2 On page 5 of Appendix 1 (A1 S32 PCLWRP) it is reported that *"The overall policy direction to manage the effects of land use on water quality in the region is based on the results of a pilot study in the Hurunui catchment,, known as the preferred approach"*... This appendix also describes the evaluation of alternative policy options (p. 39).
- 3 Results of this pilot study are written up in Brown, et al., (2011). I also have personal knowledge of this research, having participated in the development of this approach and in two of the catchment level workshops under PROJ-12559-PASTORAL-AGR funded by the Foundation for Science Research and Technology and Pastoral 21 partners - Dairy New Zealand, Meat and Wool New Zealand and Fonterra.
- 4 ECan use the term 'preferred approach' to refer to a two stage process: *"A process for setting of catchment nutrient load limits and a process for managing to these limits. The setting the limits stage can be further divided into two phases, a non-statutory community-led phase for establishing the limits, followed by the statutory Resource Management Act (RMA) phase"* (Environment Canterbury Regional Council, 2012)
- 5 In the case of the Hurunui pilot study, the outcome of the "non-statutory community-led phase for establishing the limits" was based on extensive consultation and detailed analysis.

- 6 I contend that the proposed “process for managing to these limits” has not been subject to appropriate analysis and is not based on thorough consultation with stakeholders. This process is not formally part of the proposed plan and so cannot be properly assessed as required under the Resource Management Act.

### **Community-led phase for establishing limits**

- 7 Describing the “non-statutory community-led phase for establishing the limits”, Brown et al (2011) report that:- *there was a general acceptance that the option that would ‘probably’ achieve all environmental outcomes was the appropriate risk management approach. This value judgement reflects an acceptance of only modest risk of breaching environmental outcomes - i.e. outcomes are likely to be achieved most, but not all, of the time and occasional breaches were, upon weighing all values, tolerable for the Group...*

*The scenario that would “probably” achieve the Canterbury Natural Resources Regional Plan objectives in the Hurunui main stem is a “current use”/maintain water quality at 2005-2009 levels. For the tributaries it meant a land use scenario that would lead to improvement on the current state (i.e. Scenario B returning to 1990-1995 water quality).*

### **The 'preferred approach'**

- 8 The preferred policy option consists of:-
- a. *An interim approach that would apply for ... (5 years) to give land owners an opportunity to put in place GMPs to avoid or mitigate nutrient losses ...*
  - b. *Land uses with high nitrogen losses or located in “sensitive” catchments would be required to implement a farm plan to minimise nitrogen losses to water...*
  - c. *A nutrient discharge allowance (NDA), linked to the catchment nutrient load limit, would be set for each property in a zone. The NDA would state the maximum amount of nitrogen (kg/ha/year) that may be discharged from a property. The catchment nutrient load limits and NDA would be added by a*

*variation or change to the sub-regional sections of the LWRP.*

- 9 ***The interim approach is contrary to the outcome of the limit setting phase of the consultation process.***
- 10 This interim approach is contrary to the strongly held desires of the community (for maintenance or improvement in water quality) and contrary to the outcome of the limit setting phase of the consultation process that was used by ECan to pilot and develop “the preferred approach” in Hurunui.
- 11 The “preferred approach” required maintenance of water quality in the main river at 2005-2009 levels and improvement to 1990-1995 water quality in the tributaries. Analysis in the ECan report by Norton and Kelly (2010)<sup>28</sup> suggests that achievement of these goals will require an immediate halt in the upward trend of nitrogen leaching and implementation of measures to bring about reductions in order to achieve improved water quality in tributaries
- 12 A proper assessment of the “preferred policy option” should therefore consider whether it provides the most efficient and effective method of achieving these agreed outcomes. This preferred approach is not formally included in pCLWRP and so cannot be assessed. Elsewhere in my evidence I detail my arguments that the proposed interim rules and empty schedule 8 will not be effective in meeting the requirements of the RMA and the NPS Freshwater.
- 13 Appendix 1 (A1 S32 PCLWRP) section 5.4 provides a comparative evaluation of three policy options to manage the cumulative effects of land use on water quality.

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<sup>28</sup> Ned Norton, David Kelly, (2010) Current nutrient loads and options for nutrient load limits for a case study catchment: Hurunui catchment , Report prepared for Environment Canterbury.



## Selected Quotes from the Comparative Evaluation (Section 5.4)

| Option 1   | Option 2  | Option 3   |
|--|---|--|
| <b>Continue with Current NRRP approach plus voluntary adoption of good management practices etc</b>  | <b>Apply a two stage process: – support move to GMPs &amp; apply “holding approach” in enriched catchments until CWMS zone committees set limits</b>  | <b>Establish Catchment load limits and Nutrient discharge allowances</b>   |
| <i>Unable to deal with the loss of nutrients from all land uses within a catchment in a consistent manner</i>  | <i>The combination of EMS/ farm plans in a regulatory framework is consistent with the “preferred approach” direction that the primary sector takes the lead in managing nutrient losses supported by a regulatory framework.</i>   | <i>... an interim set of limits is set in place in the LWRP, until the CWMS zone committees undertake a detailed technical assessment of environmental, social, cultural, economic values and recommend whether the catchment nutrient load limits and NDA should be retained or amended</i>   |
| <i>Catchment load limits are not defined.. Without a clearly defined catchment load limit, there is no upper limit on the use of a freshwater resource and the cumulative effect of diffuse source discharges land uses and point source discharges.</i> | <i>A five year transition period will give existing land owners and the primary sector sufficient time to make the changes to their farm systems and to build up expertise, while signalling that nutrient losses will need to be managed and existing lawful land uses will be required to comply once the rules become operative thereby avoiding the disadvantages associated with a voluntary approach.</i> | <i>The policy and rules apply to all land uses and discharges. The mix of land use and discharges rule would encompass either all or most of the activities that cause nutrient losses, including indirect effects, such as nitrate leaching from cultivated land left fallow during the autumn. Existing lawful land uses would be required to comply once the rules become operative... Landowners determine the most appropriate way of achieving their NDA</i> |
| <i>This option would not satisfy the requirements of the NPS ... or the CWMS targets for nutrient management</i>   |   | <i>.. interim nutrient loads in the LWRP would satisfy the requirements of the NPS for Freshwater Management and the CWMS targets for nutrients, the numbers are likely to be challenged ...</i>   |
| <i>Not considered to be the most effective means of implementing the LWRP objectives</i>   | <i>For these reasons, this policy option is considered to be the most effective means of implementing the LWRP objectives.</i>  | <i>The main advantage of this option is that landowners have a clear management target for their properties. Each NDA is linked to the load limit that has been set for the catchment.</i>   |

## Comment on the Comparative Evaluation

| Option 1   | Option 2   | Option 3   |
|--|--|--|
| Continue with Current NRRP approach plus voluntary adoption of good management practices etc           | Apply a two stage process: – support move to GMPs & apply “holding approach” in enriched catchments until CWMS zone committees set limits  | Establish Catchment load limits and Nutrient discharge allowances  |
| <p>I agree that this policy would not allow achievement of LWRP objectives and should be rejected.</p> | <p>ECan claim that this is the most effective means because the primary sector takes the lead and there is a five year transition period.</p> <p>I contend that these reasons are not sufficient to justify this claim.</p> <p>ECan do not attempt to analyse the costs and benefits of the proposed option. This would not be possible since the preferred option is currently undefined and will be developed at catchment level over the next five years.</p> <p>Allowing a five year transition period is not consistent with the outcome from the ‘community-led phase of establishing limits’.</p> | <p>I contend that the assessment of effectiveness of this option as detailed by ECan does not support the claim that “this policy option is not considered to be the most effective means of implementing the LWRP objectives”.</p> <p>Many of the concerns raised by ECan are addressed in the Fish and Game proposal.</p> <p>Fish and Game contend that establishment of catchment load limits and allocation of nutrient discharge allowances provides the most efficient and effective means of achieving the objectives of LWRP.</p> <p>As an interim measure ECan should adopt the regulatory framework proposed by Fish and Game. This will halt water quality decline and result in improvements in over-allocated catchments.</p> |

## Process for managing to these limits

- 14 On page 5 of Appendix 1 (A1 S32 PCLWRP) it is reported that the preferred process for managing to these limits involves:

*Landowners working with industry organisations or dischargers would take primary responsibility for reducing nutrient losses, within the catchment limits and the framework established by the LWRP. The preferred approach is based on the concept of audited self-management, using a “whole of farm” approach, e.g. farm plans, industry certification schemes, or irrigation schemes, to manage nutrient losses. The*

*performance of an audited self-management scheme would be assessed by an independent auditor...*

- 15 I have also studied the report by Brown and Mulcock<sup>29</sup> in order to try to understand the way in which they believe that Option 2 can be made to work. Brown and Mulcock seem to suggest that NPS water quality objectives can be addressed by:-
- a. the adoption of recognised 'good management practices' (p. 5);
  - b. individual farmers adopting Farm Environment Plans (FEP);
  - c. FEP specify targets for farming system components that have an impact on water (p.11);
  - d. Irrigation schemes and other collectives provide support for individual growers ... and a compliance regime that focuses on achieving improvements rather than strict enforcement and sanctions (p. 12);
  - e. "sanctions in some form" for those who "don't meet the minimum standard" (p. 12)
  - f. Improvements in performance can be incentivised "through a range of mechanisms such as financial incentives, easing the consenting pathway and longer consent durations"
- 16 My key concerns with this approach are as follows:-
- a. Reliance on the voluntary adoption of 'good management practices' will not stem the current decline in water quality. This approach has recently been rejected in the Environment Court (Horizons One Plan). There are opportunities for many farms to reduce leaching without a significant reduction in profitability (see evidence of Alison Dewes), however an appropriate set of rules will be required to provide sufficient incentive for most farmers to make these changes.

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<sup>29</sup> "Managing water quality and quantity within limits using irrigation audited self management". Stage 1 report, December 2012 by Ian Brown and Claire Mulcock

- b. There is no direct mechanism to ensure that FEPs in aggregate achieve catchment level objectives;
- c. Incentives to adopt actions that will improve water quality have not yet been addressed;
- d. The different incentives facing different growers in a catchment have not yet been addressed (e.g. existing drystock farm vs proposed dairy conversion);
- e. Use of “mechanisms such as financial incentives, easing the consenting pathway and longer consent durations” may cause inequity and distortion as well as being expensive and ineffective.

### **Voluntary adoption of ‘good Management practices’ will not be effective**

- 17 Brown and Mulcock suggest that “the most practical way to improve water quality on-farm is for individual enterprises to adopt ‘good management practices’”. This suggestion seems to take little account of the established literature on technology adoption in agriculture (Chavas et al., 2010). Farmers (at least in aggregate) are rational and if they are not currently adopting ‘good management practices’ then there will be a good reason why not. A properly designed policy to increase the uptake of such practices must directly consider incentives and constraints. The interim regime proposed by ECan will not be effective because it does not provide sufficient incentives for farmers to adopt management practices that will reduce nutrient leaching.
- 18 Voluntary approaches to improved environmental management have been heavily promoted in recent years. There has been some success in achieving target outputs (e.g. fencing of waterways) but little change to the generally increasing trend of nitrate leaching. Given several long standing initiatives to improve environmental management, I see no justification for another five year period to allow “land owners time to adopt GMP’s to avoid or mitigate nutrient losses”.

## Incentive based policies are required

- 19 I contend that most practical way to improve water quality on farm is *to provide appropriate incentives* for farmers to adopt appropriate, cost effective practices. The current ‘state of the art’ was summarised in a special issue of the American Journal of Agricultural Economics: ‘environmental economics: how agricultural economists helped advance the field’. This paper lists the top ten contributions with contribution #1 being: “Agricultural economists have developed the theory underlying innovative incentive-based policies to control environmental externalities for both point and nonpoint source pollution” (Kling et al., 2010).
- 20 The proposed approach of identifying and promoting ‘good management practices’ is similar to the Decision version of the Horizons One Plan. This was rejected at appeal by Judge Thompson who wrote that the “phrase reasonably practicable farm management practices (or variations on the theme) should not appear in the surface water quality objectives, policies or the rules of the One Plan”<sup>30</sup>.

***Use of the phrase “Reasonably practicable farm management practices” in objectives, policies, and rules, has already been rejected in the Environment Court.***

- 21 The One Plan Environment Court decision also supported the use of an incentive based approach and refers to [the need to follow] “the principle of internalising adverse effects” (para 5-180). In other words farmers should have to take account of the costs they impose on others.

*“For example, there are some existing dairy farmers who farm on land less (or even not at all) suitable for dairy farming, resulting in high amounts of N leaching, and with little ability to reduce leaching. Implementing Tier 1 mitigation [5-63] measures as far as reasonably practicable is not consistent with the principle of internalising adverse effects to an acceptable level. Tier 2 mitigation practices may be necessary, or if the situation is serious enough, certain types of land should not be used for dairy farming at all.”<sup>31</sup>*

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<sup>30</sup> Day et al v Manawatu–Wanganui Regional Council Decision No. [2012] NZEnvC 182. See Paras 5-181.

<sup>31</sup> Ibid, Para 5-180.

## Major gaps in the proposed Audited Self-Management System

- 22 One of the key elements missing from the approach which Brown and Mulcock refer to as an Audited Self-Management (ASM) system is a clear explanation as to how the proposed ASM of farm level plans will ensure that regulatory requirements are met. For example:
- a. Farms engaging in permitted activities are not required to undertake Farm Environment Plans (FEPs). How will they be engaged in this process?
  - b. Even if most farms in a catchment are engaged with the FEP process, how will this ensure that catchment level targets are achieved?
  - c. Actions – beyond [voluntary] implementation of ‘good management practices’ may be required, to achieve catchment level targets, how will this be achieved?
  - d. Stakeholders investing in new irrigation may need to persuade existing irrigators to invest in expensive technology (e.g. precision irrigation) in order to allow new development within catchment level targets. How will this be achieved?
- 23 Brown and Mulcock note that “developing an incentive scheme is beyond the scope of this study”. As such it is not appropriate to comment in any detail on the incentive and sanction mechanisms listed in para 4.2.4. (Financial incentives, easing the consenting pathway and longer consent duration).
- 24 However, an audited self management scheme should not be assessed or approved in isolation from consideration of incentives. Furthermore the possible incentive mechanisms that are listed do not seem to be appropriate:
- a. Are farmers that plan to implement more good management practices to be given an easier consenting pathway or longer consent duration?
  - b. By what mechanism will ECan ensure that these management practices continue to be properly implemented after the consent has been granted?

- c. Does this imply that farmers who propose to implement fewer good management practices will eventually gain consents – but this will be more difficult and the consents will be for shorter duration?
- 25 Some guidance on the ECan approach to managing to limits is provided in (Environment Canterbury Regional Council, 2012) page ii:
- “The fundamental philosophy of the managing to limits phase of the Preferred Approach is to empower those responsible for, or who benefit from, land use effects on water quality and quantity within a catchment to develop their own catchment-specific and property-specific means to deliver on the agreed management objectives. Overall the approach is best described as a collaborative self-management approach whereby industry and other stakeholders work within an agreed regulatory framework to achieve the desired outcomes.”*
- 26 While I support this approach to empower those responsible ..... it is important to consider key issues that will have to be addressed. In particular, why will a landowner agree to voluntarily reduce leaching – particularly if the benefit of this action will be received by others – or perhaps by another farmer who wishes to convert land to irrigated dairying?
- 27 It is also important to ensure that there is appropriate oversight of self-management approaches. For example the most recent report of the Clean Streams Accord reported that “Dairy cattle are excluded from Accord-type waterways on 84 percent of farms supplying Fonterra”<sup>32</sup>. However a nation-wide stock exclusion survey of Accord-type waterways conducted by the Ministry of Agriculture and Forestry between March and May 2011 found complete stock exclusion on only 42% of farms.

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<sup>32</sup> Fonterra Cooperative Group, Ministry for the Environment, Ministry of Agriculture and Forestry, & Local Government New Zealand, 2011 (2011)