in the matter of: the Resource Management Act 1991

and

in the matter of: a number of applications to take and use water from the Upper Waitaki catchment

Brief of evidence of Simon Richard Harris

Dated: October 2009

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BRIEF OF EVIDENCE OF SIMON RICHARD HARRIS

INTRODUCTION

1 My full name is Simon Richard Harris.

2 I am the General Manager of Harris Consulting, and work as an environmental and resource economist based in Christchurch. I have a Bachelor in Agriculture Science (Hons) from Lincoln University

3 I am currently a member of the New Zealand Agriculture and Resource Economics Society.

4 I have spent over fifteen five years as a consultant specialising in environmental and resource economics and business analysis. I undertook the regional cost benefit analysis for the Waitaki Water Allocation Board, and have some familiarity with the Mackenzie Basin.

5 I have undertaken a wide range of economic impact and cost benefit assessments of proposed water resource allocation and management regimes. These assessments have included modelling and reporting impacts at the farm, district, regional and national level. Among other projects I undertook the *ex-post*[1] assessment of the impact of the Opuha Dam on farming communities and the local economy.

6 I confirm that I have read the Environment Court's Code of Conduct for expert witnesses and this evidence has been prepared in accordance with that code. I agree to comply with the code's terms. In that regard, I confirm that the statements made in this evidence are within my area of expertise (unless I state otherwise) and I also confirm that I have not omitted to consider material facts which might alter the opinions stated in this evidence.

7 In preparing this evidence I have reviewed:

7.1 Upper Waitaki - Mackenzie Irrigation Economic Impact Assessment (EIA); Prepared by Butcher Partners Ltd in association with MacFarlane Rural Business Limited (MRB);

7.2 Mackenzie Water Research Limited, Farm irrigation Analysis (12th Dec 2008); Prepared by Hugh Eaton of MRB;

[1] This study analysed the accounts of a number of irrigated and dryland farms in the Opuha command area to assess the changes that could be attributed to the Opuha dam development.

7.3 Mackenzie Water Research Limited, Farm Irrigation Analysis II - Partially Irrigated Farm Model; Prepared by Hugh Eaton of MRB;

7.4 Upper Waitaki - Mackenzie Irrigation Social Impact Assessment (SIA)(Dec 2008); Draft Prepared by Taylor Baines Ltd in association with People & Places Ltd;

7.5 Trolove, S. (2008). Yields of Dryland and Irrigated Crops Grown in the Upper Waitaki Catchment – Literature Review. Report prepared for GHD by Crop and Food Research;

7.6 Snow, V., King, W. (2008). Upper Waitaki Farm Systems and Nutrient Assessment. Stage 2: Pasture and Ryecorn Growth Modelling. Report prepared for GHD by AgResearch;

7.7 King, W. (2008). Upper Waitaki Farm Systems and Nutrient Assessment. Stage 2: Pasture Growth Literature Review. Report prepared for GHD by AgResearch;

7.8 Snow, V., Smeaton, D., Houlebrook, D. (2008). Upper Waitaki Farm Systems and Nutrient Assessment. Stage 3: Base Case Nutrient Assessments. Report prepared for GHD by AgResearch;

7.9 Snow, V., Smeaton, D., Houlebrook, D. (2008). Upper Waitaki Farm Systems and Nutrient Assessment. Stage 4: Irrigated Nutrient Assessments. Report prepared for GHD by AgResearch;

7.10 GHD (2009): Cumulative Water Quality Effects of Nutrients from Agricultural Intensification in the Upper Waitaki Catchment – Groundwater Report; and

7.11 GHD: Cumulative water Quality Effects of Nutrients from Agricultural Intensification in the Upper Waitaki Catchment – Summary Report (August 2009).

SCOPE OF EVIDENCE

8 In this evidence I outline:

8.1 My peer review comments on the Economic Impact Assessment (EIA); and

8.2 Comment on the assumptions in the GHD Cumulative Water Quality Assessment regarding existing land use and potential changes in land use, particularly in relation to the implications for nutrient loads and how the assumptions correlate with the material in the EIA.

8.3 Comments on the information provided in relation to the proposed mitigation.

THE ECONOMIC IMPACT ASSESSMENT

Methodology and Assumptions

9 The general methodology and assumptions used in the EIA are appropriate for a study of this nature and the results as presented can be considered as credible.

10 I have three remaining issues with the EIA as presented:

10.1 The first is relatively minor in that the value of costs assumed for on and off farm irrigation seem quite low. On farm costs are related to pressurising and applying the water through the irrigation system. Off farm costs are related to the costs of accessing water from the source and conveying it to the irrigator on the farm. The reports adopt a figure of $200 /ha for on and off farm costs. Earlier work carried out investigating the feasibility of irrigation in the Mackenzie Basin suggests that a higher figure may be more appropriate. For example a simple average of the on and off farm costs from a study by Glasson Potts Fowler in 2004 was $350/ha, with a range of $0 - $590/ha. Because the costs of establishing electricity delivery infrastructure to the Mackenzie are potentially so significant and variable, it would be useful to undertake a sensitivity testing of up to $500 / ha. The adoption of low costs for these areas of expenditure would have the effect of inflating the returns at the farm gate and the regional value added calculation as reported in the EIA.

10.2 The second is more important in that the assumed dairy price used in the modelling is 5% higher than that which would normally be assumed using the best practice methodology discussed in the EIA report. In a reply to a query about this Mr Butcher indicated that it had the effect of inflating dairy value added by 11%. This error has not been corrected in the final report but is mentioned in a footnote in the body of the report. Despite this, the impact of an inflated dairy price assumption on farm gate and flow on impacts is not mentioned in the Executive Summary of the Report.

10.3 The third area of disagreement is in relation to the farm systems and land use mixes adopted in the EIA not being consistent with those adopted in the water quality modelling for the GHD Cumulative Water Quality Assessment or with the applicants' intentions. In order to make a balanced consideration of all inputs the same systems and land use

mixes should have been modelled in both sets of analysis. The two sets of reports are reporting economic and water quality outcomes from different sets of core parameters around the nature of the farming systems being undertaken as well as the total land use mix. Consequently, the two assessments are reporting quite different irrigation development scenarios and therefore cannot be used in the same decision making framework. Later in my evidence I discuss further some of the key differences in the land use mixes used.

11 As the assumptions as to farming systems used in the EIA are, in my opinion, appropriate the fact that these assumptions have not been used in the water quality analyses is a significant weakness in the water quality modelling and its results. I will discuss this later in my evidence.

12 Despite the applicants responding to a survey with their intentions as to land use intensification/development it appears that this survey information has only loosely been used in the assumptions on land use mix in the EIA.

13 The EIA also reports an additional Scenario II which has a much more aggressive land use mix towards the higher returning dairy and dairy support options than Scenario I is based on. It is my opinion that the land use mix used in Scenario I is more aggressive towards the higher returning land uses than that intended by the applicants. Therefore, Scenario II as reported has little value in indicating the likely economic outcomes from irrigation development in the Mackenzie Basin.

14 The adoption of an over aggressively land use mix has the effect of over stating potential economic impacts.

15 The EIA analysis would also benefit from sensitivity testing of major parameters (including land use mix) to test its robustness.

Scope of economic assessment

16 When assessing a resource consent application, a useful assessment framework is set out in the MAF Technical Paper 2002/13[2]. This includes consideration of the:

- commercial viability;
- economic contribution; and

[2] Ford, S J ; Butcher, G; Taylor Baines (Dec 2002): Economic and Social Assessment of Community Irrigation Projects. MAF Technical Paper No: 2002/13.

- social impact

of community irrigation schemes. The use of this assessment framework is equally appropriate for the assessment of individual and grouped consents in the Mackenzie situation. In this framework an EIA reports economic contribution whereas a Social Impact Assessment reports social impact. There is a limited amount of discussion on commercial viability in the Farm Irrigation Analysis report by MRB.

17 The author of the EIA makes a number of comments that point to the fact that under an RMA evaluation this work is "partial". They point out that:

> *"This study is not an analysis of commercial viability."* (Page 5, Para 10)

> *"This analysis is not a cost benefit analysis, and hence is not a direct or complete measure of efficiency (section 7 (b) of the RMA)."* (Page 7, Para 2)

18 The authors also point out that the EIA analysis is restricted to an analysis of the impacts "to irrigation" and does not consider positive or negative impacts to third parties (externalities). One of these would be any possible negative impacts associated with changes in water quality in the Mackenzie Basin.

19 I believe that it would have been far more appropriate for MWRL to present evidence that includes consideration and /or analysis of the **total economic impact**, **commercial viability**, **water affordability** and **overall efficiency** (Benefit Cost Analysis) to allow the hearing process to fully evaluate the relevant section 5 and 7 economic tests.

20 Consideration of **total economic impact** would require an expansion of the current EIA to consider impacts beyond the study area (i.e. Mackenzie Basin) and to other potential uses of the water.

21 A wider viewpoint of consideration would more fully meet the requirements of section 7 by not only considering the impacts on the potential users and their immediate community but to also consider the impact on a wider community and other potential water users or beneficiaries of water use.

22 In the MAF Technical Paper it was suggested that **commercial viability** should be tested through analysis of Total Farm Profitability (cash farm surplus), Return on Marginal Capital (%

return on total development cost), water affordability (water charge as a % of marginal capital) and Farm Asset Value (Net increase in asset value).

23 Although all of these assessment parameters are available or can be deduced from the MRB reports they are not expressly calculated and discussed in the main report in terms of the **commercial viability** or affordability of irrigation development other than reporting Return on Marginal Capital. Better reporting of other indicators would test the hypothesis that the development being proposed as modelled is commercially viable / affordable.

24 I have already commented on the fact that I consider the off farm water costs assumed in the EIA are potentially below those that are appropriate for wide scale irrigation development in the Mackenzie Basin given the costs of setting up electricity delivery infrastructure. In order to test the sensitivity of **water affordability** I have re-calculated the farm budgets with an off farm water delivery charge of $500 / ha/ annum as previously discussed. This level of cost would consume the profit of all irrigated models other than dairying. Therefore, potential water costs become a critical issue in viability / affordability consideration of the land use development proposed. Assumptions as to potential water costs should be reported explicitly and sensitivity tested in order to consider the affordability of the land use development proposed.

25 **Efficiency** is best reported in a benefit cost format or framework. This lines up all benefits and costs that are possible as a result of a proposal. Some of these are able to be quantified (net change in farm profit, lost electricity generation, increased generation costs, lost recreation revenue etc) while others are only able to be qualitatively described (water quality, landscape values, community strengthening etc). Such an analysis would include a cashflow analysis that generated a net present value of the development at different discount rates, including the opportunity cost of water and any other impacts that were able to be quantified.

26 I have carried out a simple agricultural cost benefit analysis of land use mix shown in Scenario 1 in the EIA, incorporating the net farm returns and the associated capital development costs as provided by MRB. This analysis results in an aggregate NPV (at an 8% discount rate) of -$75.4m. The 8% discount rate is the current discount rate used by central government in its analysis of the welfare change impacts of projects. This is not a surprising result as the authors of the EIA indicated that the marginal returns from development were below the costs of borrowing money. There may be individual land uses or scales that do show a benefit, and there are other benefits on existing properties that would be partially irrigated associated

with reduced variability and resilience of the farm system that are not taken into account in that result.

27 The simple analysis that I have done is partial and does address potential cost issues in off farm water provision, nor does it address the opportunity cost of water used for irrigation. This would indicate to me that the applicants' proposals as presented in the EIA are not an efficient use of resources on their own merits, let alone if it comes at some external costs or to the detriment of other society values such as loss of landscape character etc.

THE GHD CUMULATIVE WATER QUALITY ASSESSMENT

28 The following comments on the GHD Cumulative Water Quality Assessment relate to issues relevant to the farm level modelling and its impacts on the wider catchment nutrient leaching results.

29 In my evidence I will comment on:

- the farm system modelling methodology and approach of MWRL to assessing nutrients;
- The lack of consideration of change in land use for land not part of the consent hearing in calculation of cumulative effects; and
- the effectiveness and feasibility of the mitigation proposed in the cumulative water quality assessment

to give further detail to my concerns around the water quality report and the approach described in the evidence of MWRL.

Methodology

30 The MWRL methodology relies on modelling farming systems in the Mackenzie Basin based on a combination of science review which then informs models of pasture production (Ecomod), which subsequently informs farm systems models (Farmax, Udder), the results of which are then run through a nutrient budgeting model (OVERSEER) to inform the leaching parameters of the water flow model.

31 This approach is one that I call a linked model approach.

32 In order to have confidence in the results of such a modelling approach there is a need to have confidence in both the appropriateness of the various models that are used and in the assumptions on parameter values that are used to drive the models.

33 The Mackenzie Basin is one of the most extreme farming environments in New Zealand. The soils are generally light and poorly formed with low soil moisture holding capacity and extremely low levels of soil carbon[3]. The climate averages and extremes in both hot and cold temperatures and the variability of those conditions are well beyond those experienced in the majority of farming areas in New Zealand.

34 Therefore it is necessary to be cautious as to the ability of the models to replicate such extreme conditions and whether they are able to be adapted to accurately replicate those conditions.

35 The concern that I have is that the models used by AgResearch in the MWRL nutrient research are not consistent with those used by experienced MRB consultants in the EIA commissioned by the applicants. The differences are shown in Table 1 below, and I would draw attention in particular to the pasture growth and nitrogen use assumptions.

36 **Table 1 : Parameter comparison between MRB (EIA) and MWRL.**

	Sheep Models		**Dairy Models**	
	MRB	**MWRL**	**MRB**	**MWRL**
Pasture (T DM / ha / yr)	11.3[4]	14.3	11.3[5]	13.5
Stocking rate (su or cows /ha)	16	13.7	3.0	3.7
Nitrogen Use (kg / ha / yr)	150	70	200	120 - 140
Crop (% irrigated area)	10	0	0	0
Supplement Introduced (kg / ha / yr)	0	0	1,743	1,100

37 The MWRL ***initial*** pasture modelling using Ecomod indicates a pasture production based on a yield of approximately 11,069 kg Dry Matter / ha / annum. This would appear to be supported by the EIA consultants, who have used 10.2tDM consumed in the dairy farm model. It is also consistent with the information that they gained during their literature review of pasture growth trials in the Mackenzie. The ***final*** MWRL modelling assumes pasture growth of between 13,500 and 14,300 kg Dry Matter / ha / annum. The initial pasture modelling was changed to the higher figure during the project on advice from station owners.

[3] Webb TH (1992): Soils of the Upper Waitaki Basin, South Island New Zealand. DSIR Land Resources Scientific Report No 3.

[4] Assuming 90% utilization.

[5] Asssuming 90% utilization.

38 The MWRL reports are silent on what evidence or data was presented by the station owners to make this change. The evidence of Dr Snow speculates that it is possible that widespread irrigation could lower summer temperatures. While this is a novel idea it is no more than an idea, it may have been more appropriate for the modellers to use conventional assumptions and data from field trials in their work.

39 The MWRL models use lower rates of N applied than does the MRB modelling, yet produces higher pasture growth. I note that the Scott pasture trials in the Macenzie reported in their literature reviews applied rates of N at 358kg/ha to achieve an average 11.7tDM produced.

40 In the first section of my evidence I indicated that the models used in the EIA were appropriate and credible models that represent the likely farm systems that would be adopted under irrigation in the Mackenzie Basin. These models were created by Mr Hugh Eaton of MRB; a highly experienced farm consultant. These models and their underlying assumptions were reviewed by Mr Andy MacFarlane, a consultant who has several decades of consulting experience to dryland and irrigated farmers in the Mackenzie Basin. Therefore, I have confidence that they are soundly based in an understanding of what is possible in the area and are technically and financially feasible. I would have greater confidence in the MWRL research if it had adopted these assumptions.

41 The concerns that I have with the MWRL modelling is that it purports to present feasible models of farm systems in the area. Their use of lower stocking rates, the reduced need for imported feed because of the pasture growth, and the low rates of N are likely to mean that their modelling of nutrient losses produces results that are lower than would actually occur under real feasible systems.

Land intensification not part of the consent hearings

42 I have concerns that aspects of the MWRL modelling make it difficult to gain an overall appreciation of the likely cumulative effects of land use intensification on water quality in the Mackenzie Basin.

43 In particular, I am concerned that the modelling is of a **static**, **steady state** system. In doing so MWRL have assumed that discharges from the dryland farming systems are static. This is not a realistic assumption to make. History shows that the intensity of farming dryland in the Mackenzie Basin has increased over the years with the use of improved genetics and farming technology, including pest control. This has been assisted by the increased trend to fodder and cereal cropping of the better soils to improve farm feed supply.

44 On farms that are partially irrigated, the irrigation development will accelerate that trend as farmers will reduce the uncertainty and variability of feed supplies and so will adopt less conservative dryland farming policies. This effect was observed in the study of the Opuha dam impacts, where the dryland part of partially irrigated sheep and beef properties had higher stocking rates than did equivalent wholly dryland properties.

45 Assuming a static state of land use intensity for land that is not part of the current consent hearings is not appropriate in considering the future potential cumulative impact on water quality.

Mitigation

46 The major conclusion from the MWRL research is that the impacts on water bodies are likely to be more than minor, and that mitigation will be required to manage these impacts. They are proposing a nutrient cap be calculated for all consent holders and that the consent holder submit a farm plan that is then audited to ensure the nutrient cap is not exceeded. I have some significant concerns over the information that they have supplied around this mitigation mechanism that can be summarised in the following categories:

a) Economics of farm systems that incorporate mitigation

b) Incorporation of land not part of the consent hearings in the nutrient caps

c) Property right issues surrounding the nutrient discharge allowances

d) Structures, complexity and costs of managing the nutrient cap system.

47 **(a) Economics of farm systems incorporating mitigation** – MWRL assert that all consents will be operating at best practice, and that where this is not sufficient there are a large number of options for mitigation of the impacts. While the use of best practice is ideal, we know from past experience that such best practice is far from widespread. The robustness of the systems that monitor the best practice is therefore critical, and this monitoring has costs that need to be accounted for in analysis.

48 More importantly however we know from the modelling that adoption of a farming system that is beyond normal best practice is

likely to be required in a number of circumstances. While it is accepted that such systems are possible, there is no evidence presented to demonstrate that such systems are economic in the Mackenzie. All mitigation will have costs – including charges on capital, operating expenditure, skill requirements and management focus. I cannot see where they have modelled these mitigation options to confirm they are feasible and efficient from an economic point of view. I would have greater comfort with the conclusions that mitigation is feasible if these costs were addressed directly and incorporated in the economic assessment of the proposals.

49 Given that mitigation has cost implications, and in the case of options such as feed pads or even housed systems, significant cost implications, it is hard not to believe that mitigations will only reluctantly be adopted, or that the farm systems will be even more uneconomic. Neither outcome gives great confidence that the irrigation proposals present an overall efficient outcome for the regional community.

50 **(b) Incorporation of land not part of the consent hearings in the nutrient caps** – the applicants are proposing essentially that they be granted the rights to all the remaining assimilative capacity of the Mackenzie basin. As noted above there is likely be continued development of both irrigated and dryland systems that are not subject to this consent hearing. In order for the proposed nutrient cap system to operate, all land in the Mackenzie basin will need to be brought into the nutrient cap system. It is not clear to me how the applicants propose that this happen.

(c) Property right issues surrounding the nutrient discharge allowances – as noted above, the consent applicants propose that they be allocated all rights to the remaining nutrient assimilative capacity of the Mackenzie basin. However existing landholders in the basin have reason to believe that they have a right to intensify their properties given that there is a reasonably amount of headroom in the assimilative capacity of the basin in the absence of large scale irrigation. The way these property rights are altered, allocated and potentially transferred has important implications for economic efficiency that do not appear to have been addressed by the applicants.

51 **(d) Costs of managing the nutrient cap system –** implementing a nutrient cap system is not simple. Both the Taupo and Rotorua Lakes nutrient caps took many years and considerable expense to implement (to the extent they have been implemented to date), and their efficacy is far from proven. I have seen no information regarding the costs of structures and processes required for the

nutrient cap system. These costs should be included in the individual farm budgets when demonstrating feasibility and in the overall cost benefit analysis (not yet undertaken) to demonstrate efficiency. I suspect that the demands of supporting a nutrient cap system will be significant in cash, time and skill terms.

52 Given the concerns above, my conclusion regarding the proposed mitigations is that they are far from proven as feasible either at a farm level or at a policy level. Far greater consideration of both the on and off farm implications is required.

CONCLUSIONS

53 The EIA multiplier methodology and parameter assumptions are generally appropriate and the results credible from that point. It would however benefit from sensitivity testing of major parameters (including land use mix) to test robustness.

54 The EIA analysis is partial in that it only considers impacts of irrigation in the Mackenzie Basin. It does not include other uses for the water, impacts on the environment, landscape and amenity values, and does not include costs of mitigation

55 As presented the EIA fails to provide efficiency tests in the areas of viability/ affordability and consideration of the total benefit cost framework and I suspect that if they were done these would be negative.

56 The farm systems modelled for nutrient impacts are not a credible representation of possible farming systems under irrigation in the Mackenzie Basin. They are considerably different from those adopted by experienced professionals in the EIA. Accordingly they potentially under represent the nitrogen input and level of cropping that would occur. This could lead to an under reporting of the potential level of leaching from the farming systems.

57 I would recommend that the Commissioners request that MWRL provide additional reporting on the:

a) water quality modelling incorporating the impacts of adopting the farm systems models as used in the EIA;
b) consideration of dynamic intensification of land uses not directly part of the consent hearing ;
c) the effectiveness of the available suite of mitigation tools and the economic feasibility of systems which use them.

d) consideration of the costs, complexity and feasibility of a nutrient cap system that applies to all land in the Mackenzie basin

58 This would enable the Commissioners to properly understand whether the proposed irrigation is efficient, whether the nutrient modelling has appropriately represents the likely outcomes post irrigation development, and whether the proposed approach to mitigation is feasible

59 It would also be helpful if the key parameter assumptions were made explicit in the reporting. All of the available scenarios should be tested as to their sensitivity to variability and uncertainty of the key parameter assumptions. This would enable the commissioners to understand the resilience of the decision they make to different real world situations.

Dated: June 2009

Simon Richard Harris