Before a Hearings Panel of the Canterbury Regional Council

Under Resource Management Act 1991

And

In The Matter of applications for Regional Council Resource Consents to take and use water in the Upper Waitaki River Catchments

TABLED AT HEARING
Date 20/10/2009

BRIEF OF EVIDENCE OF ANDREW WEBSTER MACFARLANE

1. My full name is Andrew Webster Macfarlane.

Experience and qualifications

2. I graduated from Lincoln College in 1981 with a Bachelor of Agricultural Science degree. I have 29 years experience as a Farm Management Consultant, 28 of which have been in private practice. I am a registered member of the New Zealand Institute of Primary Industry Management and am the current New Zealand President of that Institute.

3. I have been farming on my own account, with both border-dyke and spray irrigation, for 20 years. My home property was awarded the "Ballance Farm Environment Award" (for setting a high standard in environmentally sustainable farming) in 2003.

4. My advisory work involves crop and animal systems, the impact of soil fertility and water availability on them, and the financial analysis of such systems. I have been advising farmers on management of their irrigation systems for 28 years. In recent years a significant amount of my time has been involved in assisting farmers:

    - Re-develop existing irrigated areas (both spray and border-dyke) to enhance efficiency of resource use and hence profitability.
    - Develop sound design, management and environmental practices for proposed water use, both individual and group schemes.
    - Manage production and financial risk around water enhancement schemes, both group and individual.

5. I have read the code of conduct for expert witnesses in the Environment Court practice note, and confirm that I have complied with the code in the preparation of my evidence. I will comply with that code when giving this evidence.

6. I have personal experience on a number of the farms in the UWAG group.

7. UWAG have asked me to assist in assessing the viability of the farm environmental management plans, the practicality and robustness of the mitigation measures, and the ability to monitor progress.

    I draw on both my professional and farming experience to do so.

8. UWAG organised a three day seminar in Twizel, the objective being to

- firstly – ensure UWAG farmers had thought through their farming system post irrigation.
- secondly – ensure UWAG farmers had considered the environmental impact of that system.
- thirdly – process the planned system through the Overseer model to not only examine consequences and outcomes, but to use "what if" scenarios to optimise environmental impact.
- fourthly – for my partner Hugh Eaton, and I, to have an input into ensuring the FEMP template produced by GHD (Melissa Robson) was capable of being implemented and maintained by UWAG farmers.
- fifthly – to liaise with Melissa, the environmental consultants (Richard de Joux, Haidee McCabe, Keri Johnston and Cathy Begley) and the attending farmers to ensure good communication of objectives, desired outcomes, and the best path to achieving those outcomes.

9. All participating farmers met with Melissa, either Hugh Eaton or I, their environmental consultant.

10. Those farmers whose Overseer analysis was not complete also met with their representatives from either Ballance or Ravensdown. Jeff Morton, scientist for Ballance and formerly a senior scientist with AgResearch, was also in attendance for part of the time.

11. Such a session, while a considerable financial investment on the farmers part, proved very useful in building understanding (in a collaborative manner) around the balance between farm management needs and environmental requirements.

12. A wide range of mitigation measures have been examined and/or adopted for the UWAG farmers. The mitigation measures can be classified under the broad headings of:

    12.1 Soil management

    12.2 Waste water management

    12.3 Crop management

    12.4 Nutrient management

        12.4.1 Fertilizer inputs

        12.4.2 Stock nutrient losses

    12.5 Land cover management

12.6 Water management

12.7 Weed and pest control

13. I will select some items as practical examples of new technology.

14. Increased soil root biomass.

That biomass has multiple uses:

- stabilisation of soil against erosion
- sequestration of carbon (into organic matter)
- fixing of nitrogen into organic matter

In the MacKenzie, the establishment of pastures and crops capable of generating soil root biomass is dependent on timely rainfall. Just one irrigation per year is often enough to guarantee a late summer establishment.

15. Use of fine particle size fertilizer

The dry climate in the MacKenzie means that large particle, traditional fertilizers dissolve extremely slowly when in a mineral form. Such elements include lime (for Calcium, which is naturally very low) and elemental Sulphur which is also low.

While such elements do not readily leach, they can be subject to runoff from unusual rain events, or simply remain unutilized.

New technology that reforms such elements into fine particle form is a major step forward in a climate such as the MacKenzie.

16. Use of liquid nitrogen.

A key variable in nitrogen use efficiency are the conditions in which the nitrogen is applied.

Ideally, application in the rain, which occurs rarely in Canterbury, would be perfect.

The use of liquid N through pivots has the advantage of artificially creating that environment. In addition, the "little and often" application policy reduces risk of poor plant uptake.

Liquid nitrogen technology is common in the Northern Hemisphere.

17. **Riparian management through either**

- good fencing design to prevent stock tracking
- fencing off of sensitive, silt laden waterways
- lining of stock drinking areas

18. **Use of Aquaflex technology** to monitor water status.

The Aquaflex technology, enables the farmer to (and if required to, remotely) monitor his/her ability to retain moisture status between the "tramlines" of field capacity and moisture stress.

Once the stress line is hit, productivity per mm of water declines.

If field capacity is exceeded too often, nutrient loss occurs, reducing productivity per kg of nutrient.

19. **Rabbit control**

- achieved through integrated pest management techniques including

RCD

poisoning

shooting

isolation (rabbit proof fencing)

regrassing

20. **Variable application irrigation technology**

The new technology enables a pivot to be pre programmed to apply moisture in variable quantities, depending on soil moisture holding capacity, crop/pasture requirements, and landscape items to be avoided (streams, tracks, swamps etc).

At a cost up to $100/m of pivot, it adds up to 33% to the cost of the pivot, but considerably enhances the "intelligence" of the watering pattern.

21. The on farm investment required for such mitigation measures varies widely, but could typically add 20% to the cost of a particular item, or might involve a larger one off cost.

For example, a typical irrigation development on 130ha could vary in cost as shown in Figure 1

Figure 1

Item	Lower capital lower water use efficiency	High capital, high water use efficiency
K Line	$200,000	
Pivot		$450,000
Additional pipe to pressurise water		$250,000
Variable application technology		$ 65,000
Aquaflex moisture sensors		$ 8,000
		$773,000
$/ha	$1,538	$5,946

22. On farm monitoring lifted in intensity about 10 years ago. The drivers to that increase were:

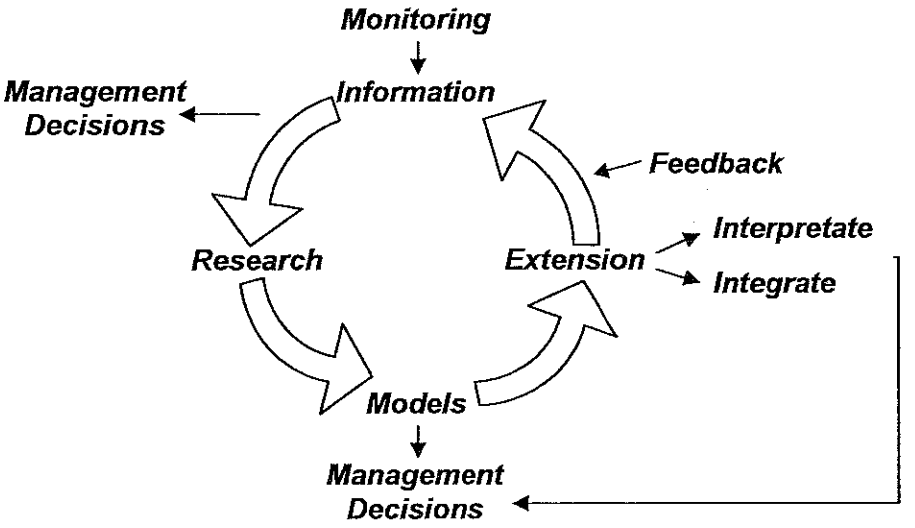
- the need to ensure that farming systems using water were economically sustainable.
- the need to prove environmental sustainability to ensure future access to water
- greater awareness of environmental science issues
- greater emphasis on water use efficiency
- improved mechanisms for monitoring

23. Associated with that increase in monitoring has been an almost exponential increase in the technology available to readily monitor anything from water flows, to soil moisture, to feed covers, to sugar content of biomass.

24. Those technology gains continue at present, making the quality of information that can be fed back into models like Overseer much more robust.

25. The information loop is therefore increasing in speed, as more information leads to better research, which leads to improved models, which leads to better extension, which increases demand for information.

26. That loop can be shown diagrammatically as:



27. I therefore have a high degree of confidence in the speed with which we are making progress on our ability to monitor, mode, and interpret interfaces around biological science, environmental science and management.

28. Overseer, as it stands today, is very accurate in most areas, and a reasonably blunt instrument in some areas. It is significantly more advanced than 3 years ago.

    As a base to build off it will be a viable and accurate tool as part of the information loop described above.

29. One of the key roles models like Overseer have for extension orientated people like me, is that it enables us to ask both farmers and researchers, the "why? and what if?" questions. Farmers sometimes lead the researchers, and sometimes researchers lead farmers, but it is building the connection that usually pushes the I.P. boundaries to make progress.

30. From an audit perspective, such models provide a mechanism to recheck trends over time, becoming more accurate the longer the time series becomes.

31. Given the large capital investment farmers developing irrigation need to make, risk minimisation is a key component of the economic took kit.

32. The key risk parameters revolve around:

    - climatic risk (which the water mitigates)

- risk of withdrawn access to the resource (non compliance, rule changes)
- interest rate/capital risk on borrowed development funds
- commodity price risk (global market demand)
- exchange rate risk (perception of NZ relative to other countries)

33. Given that exchange rate and commodity price risks are typically outside individual farmer control, the necessity to manage resource availability risk and climatic risk increases in importance as capital risk from borrowing increases.

    That is, a higher risk profile requires greater reliability of resource availability and output.

34. I therefore have no doubt that the dramatic increase in farmer focus on resource management outcomes will continue, not only to protect their future access rights, but to drive an economically viable outcome while meeting sustainability standards required to protect and enhance the New Zealand brand.

35. The MacKenzie basin is an area of climatic extreme in temperate New Zealand terms.

    The ability to predict cold in winter and heat in summer is high. The ability to predict timing and quantity of rainfall is extremely low.

    For that reason, policy decisions are made on the basis of uncertainty of feed availability. That conservatism is required to avoid, as much as possible, overstocking in a dry period.

36. Hence the reliable availability of water has multiple advantages:

    - firstly, it improves feed utilisation on both dryland and irrigated areas through knowing with more certainty the feed curve available. Hence output increases on both dryland and irrigation
    - secondly, it lessens the risk of overgrazing of pastures in a drought. Therefore long term dryland productivity increases.
    - thirdly, it allows better management and decision making planning on the farmers part, resulting in better timeliness of stock purchases and sales, and hence profitability.

Because irrigation typically only represents a small part of the total farm area in the MacKenzie, leveraging that available water on say 3% of the land area to create a small productivity increase on 97% of the land area has a significant impact on viability.

For example :	dryland farm of		4,000ha
	utilized feed		6,000,000kgDM
	Carrying capacity	=	**12,000su**
	with irrigation over		120ha
	utilized feed	=	1,200,000kg
	5% improvement in dryland	=	6,111,000kg
	Total utilized feed		7,311,000
	Carrying capacity	=	**14,622su**

37. My observation of MacKenzie basin farmers is that those who have had partial irrigation for a number of years have been able to farm the dryland component of their farm more sustainably.

I anticipate that with correct planning, management, and monitoring, the negative environmental impact of intensification of a small area will lead to positive environmental outcomes on the balance of the property.

A net positive balance is certainly possible.

AW Macfarlane
20.10.09