IN THE MATTER OF	the Resource Management Act 1991
AND	
IN THE MATTER OF	applications by Central Plains Water Trust to: Canterbury Regional Council for resource consents to take and use water from the Waimakariri and Rakaia Rivers and for all associated consents required for the construction and operation of the Central Plains Water Enhancement Scheme Selwyn District Council for resource consents to construct and operate the Central Plains Water Enhancement Scheme
AND	
IN THE MATTER OF	a notice of requirement by Central Plains Water Limited to: Selwyn District Council for the designation of land for works associated with the construction and operation of the Central Plains Water Enhancement Scheme

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BRIEF OF EVIDENCE OF ANDREW WEBSTER MACFARLANE

BUDDLE FINDLAY
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Qualifications and experience

1. My full name is Andrew Webster Macfarlane.

2. I graduated from Lincoln College in 1981 with a Bachelor of Agricultural Science degree. I have 27 years experience as a Farm Management Consultant, 26 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 18 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 border-dyke and spray irrigation schemes for 26 years. In recent years a significant amount of my time has been involved with assisting farmers:

    - Re-develop existing irrigated areas (both spray and border-dyke) to enhance efficiency of water use and hence profitability.

    - Develop sound design and management practices for proposed water use, both individual and group schemes.

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.

Scope of Evidence

6. I was requested to provide evidence concerning the on-farm economics of irrigation from the Central Plains scheme. :

    - Farming in the Central Plains area today

    - Changes to farming in Canterbury with irrigation

    - Likely farming in the Central Plains area with irrigation including key assumptions.

    - Profitability of the Scheme to farmers.

- Impacts of the total Scheme on farm outputs
- "Blue Skies" possibilities.
- Key Conclusions
- Appendices of financial analysis

I summarise my work on those subjects in the evidence following.

Works undertaken

7. My analysis used a method applied in a number of other irrigation consent applications. I estimated the areas of typical farm types before irrigation and again after irrigation. We prepared budgets for each farm type and for the capital investment required by irrigation. By comparing the results of the budgets with and without irrigation I was able to estimate the change in profitability due to irrigation. I also estimated the capital investment required and calculated the return on that investment.

8. Farming in the Central Plains area today includes a wide range of farming systems from extensive dry land sheep farming to intensive arable, process crop, livestock finishing, dairying, and dairy support. The farm system evolved depends partly on soils and contour, but a major factor on the plains is the availability of irrigation water. Water provides reliability and predictability of income and hence is a major risk management tool. It allows the safe investment of capital for intensification. Intensification can generate income to support the additional capital required and generate additional profit.

9. Installing an irrigation system on a dry land farm involves a high capital cost and a high running cost. As a result irrigation pushes farmers towards increasing their profitability through increasing the quantity and quality of their production. Often this increase in output is not enough to generate a satisfactory return on capital and the nature of the farming system changes to one which is more intensive and more profitable e.g. from livestock to intensive arable farming or dairying. I have demonstrated that significant improvements in profitability are possible with irrigation.

10. Farm profitability in the whole area affected by Central Plains Water, measured as EBIT (Earnings Before Interest. Tax and Debt) will rise by $186m per year from a weighted average of $843/ha to $3,033/ha

11. This increase is the result of significant changes anticipated in land use and farming systems. I have assumed a move from dry land livestock (53%) and dairying (26%) before CPW towards intensive arable and process vegetable farming (18%), livestock finishing (4%) and dairying (55%) after CPW.

12. I anticipate that the farm capital invested in the 95,250ha area analysed will rise by $1,261m from $1,991m to $3,252m

13. I estimate the weighted average return on the marginal capital invested on farm in converting to irrigation at 14.8%. While this return is significantly above the cost of capital, principal repayments will utilise most farmer cash above the cost of funds. Hence I do not expect to see farmers generating short-term cash surpluses.

14. In addition, the extra return is diluted between the land owner and, in many cases, the share cropper or sharemilker. Typically with process cropping, a farmer with land, but a lack of contract, expertise, or plant will leave his paddock to one who does.

15. Hence a 14% return may be the return to the combined entities, but not to one individual.

16. Irrigation will result in a massive increase in farm outputs. This increase takes the form of quantity (more production per hectare), type (changes from lamb and wool to crops and dairying) and value (gross income per hectare). In my farm modelling I predict an increase in gross income by $327m from an average of $2,679/ha to $6,517/ha. Using a multiplier of 2.5 (Ford 2002, Appendix 1) the resulting effect on the region is an increase in turnover of over $800m.

17. This analysis focuses on the evolution of commercial farming under irrigation. There is further potential for small areas of high value horticultural crops. For clarity and simplicity I have included process vegetable production in a farm model (Number 6 in the appendix) called “Intensive Arable and Process Crops” rather than as a separate farming system.

Central Plains Water on-farm impacts

18. The figures summarised are calculated over 95,250ha, being the area we estimate to be directly affected by the 60,000ha CPW scheme.

PROFIT *	
Estimated "on-farm net earnings" prior to CPW	$72m
Estimated "on-farm net earnings" after CPW development	$258m
Gain in "on-farm net earnings" from Central Plains Water	**$186m**
CAPITAL INVESTMENT **	
Estimated capital investment (including land at Pre development costs) prior to CPW development	$1,991m
Estimated capital investment (including land) after CPW development	$3,252m
Marginal capital investment	**$1,261m**
RETURN ON CAPITAL	
Pre development weighted average Return on Capital	3.6%
Post development weighted average Return on Capital	7.9%
Marginal return on marginal capital investment	**14.8%**
ON-FARM NET EARNINGS PER HECTARE	
Pre irrigation weighted average net earnings/ha	$843
Post irrigation weighted average net earnings/ha	$3,033
Improvement in weighted average net earnings/ha	**$2,190**

* Defined as Earnings before interest, tax and debt or "EBIT"

** Note that of the 75,000ha irrigated after the scheme is built, only 60,000ha (80%) is subject to CPI off-farm development costs. The balance of 15,000ha is water anticipated to be pumped from underground as the result of transfer of existing underground water consents from 30,000ha replaced with surface Scheme water. The extra 15,000ha I refer to as transferring I have arrived at by looking at historical trends and assessing likely farmer responses. In my opinion the final outcome could be plus or minus 5,000ha depending on future farming economics and water availability.

19. The Central Plains Water Development will lead to a weighted average increase in earnings of $2,190 per ha affected by the scheme, representing a 260% growth in profitability from existing land use, or a 14.8% return on the development capital employed. The dramatic increase in earnings is a reflection of the leveraging impact of water on changing land use.

20. Such an outcome is sufficient to: encourage new investment into the CPW scheme area and encourage a number of existing farmers to take on significant debt in order to expand the size of their business and change their farming policies.

21. Such an outcome is not sufficient for many existing farmers to cash flow development, particularly those with lower land uses at present, or those with lower risk profiles. As such, some tensions will arise as some existing land owners decide against using scheme water, resulting in a lag in scheme uptake as intergenerational transfer and property sales take place over time. The current uptake still needs to be tested once farmers are asked to pay for scheme costs.

22. Those most likely to stay outside the scheme are older farmers and those who are debt averse because of the new debt required to irrigate and intensify their farms.

23. Younger farmers, or equity partnership farming entities, will willingly take on debt, requiring marginal returns in excess of 10% to compete with other options. Young farmers tend to accept higher risk and have more time to repay debt. They tend to be more objective when assessing investment options

24. As always, farmer confidence at key decision-making times is critical. The current upturn in commodity prices, particularly for milk and arable products, will assist this scheme uptake in the face of higher interest rates and currency cross rates. I anticipate a significant upturn in red meat prices within two years improving confidence in livestock farming**.**

25. A 14.8% return, while exceeding current market interest rates, will require a significantly lower cost of funds than current market rates, with very long repayment terms in order to allow for principal repayment, development, working and other capital outlay. Financing structures are possible to achieve low cost of funding start options.

26. When current land values are used as a starting point, the higher capital cost of this scheme means there is less likely to be a “development margin” for those taking on the debt and risk. Using the dairy farm case study as an example (livestock subtracted, shares included) there is little increase in the farm cost per kilo of milk solids before and after CPW:

	Cost per hectare	Cost per kg Milk Solids
Pre CPW Scheme	$32,540	$24.46
Post CPW Scheme	$40,508	$25.12

27. The increased capital value per ha can be justified because of savings in running costs (for example, deep well pump repairs, electricity) and increased productivity from new conversions. The rapid rise in milk solids price, from $4.46/kg to a December 2007 forecast of $6.90, has resulted in a corresponding rise in the market value of dairy farms to between $40,000/ha and $50,000/ha. I have not altered my July 2007 capital figures as the relative figures remain unchanged. The rise in land values over the past nine months has affected the value of land pre and post development. In my opinion the "development margin" between pre and post development values could be offset by inflation or scheme building costs. I will therefore not update these values without an update on scheme building costs.

28. Note that our dairy budgets assume an increase in milk solids production of 283kg/ha. For a number of existing farms with an existing allocation of reliable water (well), such an increase will not occur. Their gain from the scheme will be in pump and electricity running costs.

29. While the cost of capital is justifiable, there is no quick capital gain. Long term capital gain will be dependent on productivity gains, cost of funds, location issues and costs of production.

30. In my opinion, farmers will consider a pressurised (piped) option if the additional capital costs can be serviced for a similar amount to the cost of electricity for surface pumping.

31. At current land values the average existing return on capital in the CPW catchment is 3.6%. Such a return will require higher productivity and product prices for the sheep and beef proportion to be sustainable. An increase to 7.9% post development represents a major improvement, one sufficient to justify increased investment in infrastructure and maintenance of asset values. (See appendices)

32. My analysis of returns on capital (see Appendix V) shows relative returns from dry land conversion to intensive land use of:

Farm Conversion	**Return on marginal capital**
Dry land livestock (1) to livestock finishing (5)	5.1%
Dry land livestock (1) to dairy (7)	13.2%
Dry land livestock (1) to partially irrigated mixed farming (4)	14.2%
Dry land livestock (1) to intensive arable & process (6)	19.1%

33. Growth within the scheme area is likely to be in dairy and arable systems where farms are 100% irrigated. Short term, dairy growth is likely to exceed arable growth because of high milk solids prices. Long term, arable growth could exceed dairy as land use moves to higher forms and prices improve as markets develop. Much of that growth could occur in fresh vegetable production as land area devoted to such production in Pukekohe, Gisborne, Hawkes Bay and Marlborough reduces in the face of urbanisation and the growth of permanent crops (grapes, citrus etc). I also foresee growth in vegetable seed, and small seed multiplication. New Zealand is already a world leader in seed production but areas are being constrained by isolation requirements (up to 2km between crops). To that end, dairy and its support land uses are compatible with an expanded seed multiplication industry, as dairy farms create good isolation. Partially irrigated farms are most likely to be mixed crop & sheep/beef or dairy support land uses, where the higher capital cost can be spread over a greater area. The percentage of beef and dairy support will increase relative to sheep in response to higher pasture production under beef grazing systems. Such properties can also justify partial irrigation on the basis that being associated with an irrigated area enhances the profitability of the dry land portion of the farm. In practice, partial irrigation enhances the sustainability (both environmental and economic) of the dry land area of each property, and the productivity and sustainability of associated dry land properties.

Key points I wish to make are:

34. During the preparation of this data it has become apparent that there are some deficiencies in the data base of existing land use and water utilised. I have made estimates, using what data is available, of that existing irrigation take and current land use. A small change in my figures could, when multiplied into macro data, lead to larger differences. Any such differences, will not, in my opinion, materially change the return on capital or my key conclusions.

35. The marginal return on capital is in the band expected with a higher cost irrigation scheme. Historic analysis of other schemes shows better returns than those predicted in advance. It is only with hindsight that technology gains leveraging the impact of water are quantifiable.

36. Returns such as those described in section one are satisfactory for many, but not all investors.

37. There are potential gains in both productivity and profitability from converting deep-well systems to surface water schemes using stored water. Key gains can be generated from:

    (a) Higher productivity if increased water reliability can be secured. Water reliability is absolutely critical to the arable/horticultural sector, and is also particularly important to the dairy and dairy support sector.

    (b) Cost savings in energy consumption and deep well pump repairs and depreciation from converting deep well pumps to surface pumps. Typically, deep well pumps use around 1.5 kW/ha of electricity (and up to 2kW/ha) with surface pumps around 0.5kW/ha. The cost of capital is fixed. The ongoing repairs and maintenance costs are variable and will increase over time.

38. Environmental gains are evident from judicious use of scheme water. Strong evidence in Mid Canterbury shows enhanced ground water levels below the RDR scheme, in response to water not held in the root zone moving downhill towards the coast. Those groundwater levels dropped in the spring of 2005 in response to low levels of applied water out of the RDR in the higher rainfall 2004/2005 summer where only 57% of consented take was utilised.

39. Newly developed properties, particularly dairy and intensive cropping farms, will tend towards top end performance, by nature of their new development, debt loading, and management motivation. The previous land use will tend towards average or below average returns.

40. Therefore my analysis does not compare “apples with apples” when looking at “before & after” profitability. That is the nature of such developments. The post CPW development budgets therefore assume a higher management rating than the pre development budgets, in line with past experience.

41. Large scale irrigation schemes, with their associated development, usually require capital from outside the existing farmer base. That capital can come in the form of new farmers, new equity or debt investment into existing farm operations, or investment in off-farm infrastructure. The relative economics of undertaking the development relates to the cost of that capital. Historically, in the rural sector, the required cash return on equity has been lower than the cost of debt as farmers have taken into account lifestyle considerations and steady capital growth. For this project to proceed successfully, the cost of debt and equity will need to be low, accounting for community benefits outside the group of primary producers committing to the

overhead cost. Given that the current cost of debt is high, the community will need to price the "cost of equity" on a long term and lower cost basis. Such a scenario is and has historically been entirely plausible as owners tend to take a longer term view than lenders.

42. The relationship between the annual water charge and total capital cost relates purely to the required yield on the capital invested. Any means by which the cost of capital can be lowered is worth considering.

43. Short term development may show a different pattern to long term development. Short term conversion to dairy may exceed other land uses.

44. Dairy land use tends to attract external capital easier because: the returns can be quantified easier to non farmers; it is predominantly a single product business; the marketing structure is more readily understood; and typically the returns have been higher in recent years. In other words objectivity, simplicity and transparency are large in investor's minds. Long term, new arable and horticulture markets will develop that could compete with dairy land use. Such markets are most likely to be in the horticultural/intensive arable sector. Some opportunities are beginning to appear now, as annual cropping moves from Gisborne/Hawkes Bay/Marlborough under pressure from permanent crops (e.g. kiwifruit, grapes, mandarin). The Auckland region (Pukekohe, Warkworth etc) is under land-use pressure from lifestyle blocks. Those areas currently supply a significant proportion of New Zealand's needs for fresh or processed vegetable crops. The supply trend is moving south in response to land and water availability.

Current land use.

45. The best available data suggests approximately 22,000ha of the 60,000ha target area is already in dairy units and hence is also irrigated. I believe an additional 8,000 ha is probably irrigated, running mixed farming systems of dairy support, arable sheep, beef and some deer. A total of 30,000ha from 60,000ha (50%) is therefore existing irrigated land.

Affected Area.

46. I have assumed a total effective catchment within the scheme boundary of 85,000 ha (60,000 ha scheme, 15,000ha new wells, 10,000ha dry) and a further 10,250 ha of land whose economic return would be enhanced by irrigation on the land within the scheme boundary. That land would remain dry land post CPW, but at enhanced profit levels.

Possible land use post CPW commissioning.

47. I have assumed an effective farm area irrigated by the Scheme to be 60,000ha.

48. Replacement of well water with surface water on 30,000 ha would lead to an additional 15,000 ha irrigated with transferred consents, taking the irrigated farming area (well and surface) to 75,000ha. A further 10,000ha of non-effective area (ie lanes, trees, buildings, yards & watercourses) brings the total to 85,000ha. Another 10,250 ha of dry land with associated benefits bring the total to 95,250ha.

49. The farmed area affected totals 85,250ha of which 75,000ha are irrigated. I have assumed the following land use change:

Land Use	**Pre C.P.I. Area**	**%**	**Land Use**	**Post C.P.I. Area**	**%**
1. Livestock (Dr)	45,000	53%	* Livestock (Dr)	0	0%
2. Mixed (Ir)	8,000	9%	4. Mixed L/s (Pt.Ir)	10,250	12%
* Finishing	0	0%	5. Finishing (Ir)	3,000	4%
* Arable & Proce	0	0%	6. Arable & Proces	15,250	18%
3. Dairy (Ir)	22,000	26%	7. Dairy (Ir)	46,500	55%
Non effective	10,000	12%	Non effective	10,000	12%
Subtotal	**85,000**	**100%**	**Subtotal**	**85,000**	**100%**
Associated L/s	10,250		Associated Mixed	10,250	
Total	95,250		Total	95,250	

Performance level within land uses. (See attached budgets)

50. I have worked on the assumption that the new irrigated land will be operated at the top end of performance levels. My decision to use that performance is based on the fact that:

    (a) Farmers taking on the debt levels inherent in this structure will need to be top operators, either existing or new farmers with higher equity.

    (b) Technological gains are difficult to budget on, being an unknown quantity, but always occur in practice to “leverage” irrigation availability.

    (c) New higher profit crop options are equally difficult to budget in advance, but can be accounted for by assuming top profitability of existing known crops.

    (d) Lower performing farmers and those averse to risk will either not take up shares or will sell to those who will.

Capital Costs

51. Capital costs assumed are:

Off farm works	$6,826/ha
On farm irrigation development	$2,650/ha - $3,000/ha
On farm associated development	$550/ha

52. The $6,826/ha is the April 2007 costing of the initial cost to get water to the farm gate as supplied by URS.

53. The range $2,650/ha - $3,000/ha represents a typical cost for a Rotorainer irrigation system or centre pivots system with surface water pumps. No credit has been allowed for the residual value of deep well pumps. I have allocated the on-farm capital cost of new wells on the 15,000ha of transferred consents to each farm type pro-rata.

54. $550/ha is typical costing for such costs as re-fencing, shelter (in and out), digger work, tracks and fertility enhancement.

55. Other major on farm costs include additional livestock, working capital (particularly for arable) and plant and equipment (again for arable).

56. For dairy conversion, dairy specific capital costs include the cowshed tracks, waste water and housing. Separated costs include livestock and Fonterra Shares.

57. An economic argument can be made for excluding the Fonterra share cost from on farm capital. If Fonterra shares are excluded, then the dividend on that share would also have to be excluded. (approximately 45c/kg milk solids)

Irrigation Charges

58. We have assumed running costs of $71/ha and electricity costs of $165/ha (surface pumps). The irrigation capital is allowed in up front capital cost. The operating cost of additional pumping to the surface on the 15,000ha of transferred consents is spread pro rata in the farm working expenses of each farm type.

Off-Farm Scheme Capital

59. All of these calculations build in the off-farm scheme capital of $6,826/ha. How that capital is split (into charges or paid up capital) is a separate issue to

be addressed. Hence total farm capital post scheme development has $6,826/ha included.

Conclusion

60. High interest rates and lack of confidence in borrowing money will be a negative to initial farmer uptake in the current climate. On the positive side, high grain prices and high dairy prices are generating confidence as both land uses require reliable water. The spin off into dairy support is just as significant as dairy farming itself. While sheep farm confidence is currently poor I anticipate significant improvements in sheep farm viability between now and scheme commissioning. In general, farmer sentiment towards irrigation investment has improved over the past twelve months.

61. Conversely, new equity attracted to the region, investment in further processing, and new opportunities created through the availability of reliable water will see very good medium term uptake.

62. On a global scale, the world will need to double food output by 2050, or triple its output, if biofuel is taken into account. Much of the growth in demand will come from protein demand. Given that demand, where New Zealand is primarily situated as a global leader, and the projected world water shortage, then this project is well positioned to assist New Zealand's primary production objectives.

A W Macfarlane

Appendices:

1. Land Use
2. Farm Financial Analysis – pre and post CPW farm systems
3. Farm Capital Investment – pre and post CPW by farm type
4. Summary of Capital Investment – pre and post CPW
5. Return on Capital
6. Description of (400ha) farm models
7. Budget price assumptions
8. Detailed farm budgets – 7 farm classes

Appendix 6 – Description of 400ha Farm Models

Pre CPW

- Farm 1 Dry land Livestock: 2100 ewes lambing 125%, 475 hoggets lambing 50%, 52ha wheat & barley yielding 5t/ha; 28ha lucerne cut for sale. Average lamb price $63.70.

- Farm 2 Mixed irrigated arable & stock: 100% irrigated, 2100 ewes lambing 140%, 550 hoggets lambing 60%, finishing 1800 winter lambs, 120 dairy calves grazed for 15 weeks @ $5.00, 120 dairy heifers grazed for 12 months @ $8.00, 200ha wheat (8t & 10t/ha), barley, peas, grass & clover seed. Lamb price $69.00.

- Farm 3 Irrigated Dairy: 100% irrigated, 1400 cows producing 380kgMS/cow, 3.5 cows/ha and 1,330kgMS/ha. Milk solids budgeted at $5.50/kg.

Post CPW

- Farm 4 Mixed part irrigated arable & livestock: 50% irrigated, 2100 ewes lambing 150%, 475 hoggets lambing 100%, grazing 200 dairy calves for 15 weeks at $5 and 475 dairy heifers for 12 months @ $8, 72ha wheat (6t & 12t/ha) and barley.

- Farm 5 Intensive Irrigated livestock finishing: 23,500 lambs @ $16.45 margin and 1,570 steers finished at a $264 margin.

- Farm 6 Intensive Irrigated Arable and Process Crop: 5,890 lambs finished at $22.32 margin, 390ha arable crops (9 – 12t cereals / ha) including 65ha intensive process vegetables.

- Farm 7 Dairy: 1500 cows producing 430kgMS/cow, 3.75 cows/ha and 1,613kgMS/ha at $5.50/kgMS.

Appendix 7: Budget price assumptions

Milk	$5.50/kgMS
Lamb	$3.60 & $4.20/kg
Milling wheat	$400/t
Feed wheat	$360/t
Feed barley	$350/t
Peas	$275/t
Potatoes	$175/t
Grass seed	$2,400/t
White clover seed	$6,000/t
Dairy grazing	Calves - $5.00/wk Heifers - $8.00/wk Cows - $17.00/wk
Lucerne	16c/kgDM

Appendix 8: Model Farm Budgets

See detailed budgets for these 7 farm classes below.