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 PHILIP THOMAS DONNELLY
31/1/2008

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1. INTRODUCTION

1.1 My full name is Philip Thomas Donnelly. I am the principal of Philip Donnelly and Associates Limited, an economic consulting firm.

1.2 I graduated with a Masters Degree in Economics from Canterbury University in 1967. I have almost 40-years experience in applied economics. During the last 15 years, I have been an economic consultant and have specialised in regional and resource economics, particularly in matters pertaining to the Resource Management Act 1991 (RMA). As a consultant, I have been engaged by several councils and by the Minister for the Environment. I was a member of the Resource Management Act Reference Group, which advised on legislative changes to the RMA and the implementation of programmes to improve practice and performance in the resource management area.

1.3 Prior to my work as a consultant, I was employed for six years as regional economist by the Canterbury Regional Council and its predecessor, the Canterbury United Council.

1.4 Before working for regional government, I held several senior economist positions in central Government. In two of these positions, I specialised in matters involving the analysis of the industrial structure of the New Zealand economy and assessment of the impact of major development projects on it. In addition, for nine years, I was the Director of Statistics New Zealand, responsible for the development of the New Zealand System of National Accounts and the development and review of price indices.

1.5 I have undertaken a wide range of projects for private and public sector institutions. I have also undertaken work for central Government departments, local authorities, quasi-government organisations, a university, business

organisations, community groups, local authority trading companies, public listed companies, a State-owned enterprise and private individuals.

1.6 I confirm that I have read the 'Code of Conduct for Expert Witnesses' contained in the Environment Court Consolidated Practice Note 2006. My evidence has been prepared to comply with that Code.

2. SCOPE OF EVIDENCE, ECONOMIC EFFICIENCY AND ITS RELATIONSHIP TO THE RMA

2.1 I have been asked by Central Plains Water Trust to present economic evidence in respect to the importance of irrigation to Canterbury's agricultural sector, the importance of exports in general and the agricultural sectors contribution in particular to economic well-being, the economic impacts of the proposed scheme on key economic variables, and the likely economic efficiency of the proposed scheme.

2.2 I consider economic efficiency is relevant to assessments required by section 7(b) – efficient use of natural and physical resources, section 32 (3b) – efficiency and effectiveness of methods in a plan and the enabling provisions of section 5(2) of the RMA. This is because I am advised by counsel that the High Court has said that the RMA recognises the importance of having environmental laws that are efficient while the Environment Court has said that there is a distinct thread in the RMA which takes an economic approach to sustainable management of natural and physical resources.

2.3 In my opinion two pragmatic reasons support the Court's decision that efficiency, in the context of the RMA, means economic efficiency unless another concept of efficiency is expressly stated.

2.4 First, it can be readily demonstrated that non-economic definitions of efficiency are problematic when applied to multiple resource use situations, e.g. when the efficiency of all natural and physical resources must be considered rather than a specific resource in isolation, such as land, water, and coastal space.

2.5 Second, economic efficiency and economic well-being are synonymous concepts. This is because economic well-being is the benchmark for determining whether an allocation of resources is allocatively efficient or inefficient. Resource allocations and interventions that make society better off improve efficiency. Conversely, allocations that make society worse-off are inefficient. Hence, use of economic efficiency in the assessments required by section 7(b) (and section 32(3)(b) where relevant) means that it is possible to directly determine whether natural and physical resources are being used in a way, or at a rate, that enables people and communities to provide for their economic well-being. Non-economic concepts are generally problematic in this respect and are not useful to assessments of whether economic well-being is promoted.[1]

2.6 In my opinion, the assessment of the proposed scheme's efficiency is directly relevant to determining whether it will promote the enabling provisions of section 5(2), RMA, with respect to economic wellbeing; whereas the other aspects of my evidence, including the economic impact analysis, broadens the assessment into socio-economic issues, i.e. it helps determine whether the scheme will promote social well-being.

[1] For example, just because water is applied more effectively to crops or pasture does not necessarily mean people are better off economically.

3. IMPORTANCE OF IRRIGATION TO CANTERBURY AGRICULTURE

3.1 Statistics New Zealand is currently undertaking the 2006/07 June year agricultural census, however, the results will not be available for some time. The latest available information on the New Zealand farm area under irrigation is from the 2002 June year Agricultural Census.

3.2 That census showed that for the year ended June 2002, only a small percentage of the land area occupied by farms was under irrigation systems, namely, 468,000ha or about 3 percent of total land area. Of that area, about 82 percent was actually irrigated during the June year 2002.

3.3 Table 1 shows that most of the total land area under irrigation systems, and actually irrigated during the year ended June 2002, was located in the South Island; namely, 393,000ha (84 percent) and 330,000ha (86 percent, respectively. Canterbury's share of total New Zealand farmland under irrigation systems, or actually irrigated, was 287,000ha (sixty-one percent) and 241,000ha (63 percent), respectively.

3.4 Two districts within the region contained most of the irrigated farm land, namely, Ashburton District 114,000ha (40 percent) and Selwyn District 60,000ha (21 percent). Timaru District contributed 30,000ha (10 percent), Waitaki District had 22,000ha (9 percent) while the Waimakariri District and Hurunui District share is around 20,000ha each (7 percent).

Table 1: Land area under irrigation system and land area irrigated

Region	*Land area under an irrigation system ha*	*Land area under an irrigation system as % of NZ total*	*Land area actually irrigated ha*	*Land area irrigated as % of NZ total*
Northland	7,041	2%	5,150	1%
Auckland	6,246	1%	3,821	1%
Waikato	12,652	3%	10,454	3%
Bay of Plenty	8,839	2%	6,960	2%
Gisborne	1,325	0%	935	0%
Hawkes Bay	18,158	4%	11,903	3%
Taranaki	2,941	1%	2,646	1%
Manawatu-Wanganui	7,967	2%	5,093	1%
Wellington	9,538	2%	7,019	2%
Total North Island	74,706	16%	53,981	14%
			0	
Tasman	10,042	2%	7,390	2%
Nelson	..C		112	
Marlborough	20,188	4%	17,409	5%
West Coast	2,462	1%	956	0%
Canterbury	287,168	61%	240,778	63%
Otago	68,869	15%	60,678	16%
Southland	4,075	1%	2,923	1%
Chatham Islands	..C	-		
Total South Island	393,025	84%	330,246	86%
New Zealand	467,731	100%	384,227	100%

C = not published due to not meeting confidentiality restrictions

3.5 The irrigation statistics highlight that, compared to other regions, Canterbury's irrigation dependence is exceptionally high. In my opinion this is due the significant level of versatile soils on relatively flat land and a relatively dry climate.

4. IMPORTANCE OF EXPORTS TO ECONOMIC WELL-BEING

4.1 Export receipts are vital to the health of the national economy as the range of commodities that New Zealand can efficiently produce domestically is limited. As export earnings pay for imports, without export earnings and/or an adequate growth in export earnings, New Zealand would become impoverished. Imports include essential commodities required to sustain the economic wellbeing of producers (e.g. farm machinery, manufacturing plant, motor vehicles, aircraft and ships), the economic welfare and health of people (e.g. prescription drugs, hospitals and education equipment), as well as providing consumer choice. If export earnings increase over-time, effectively imports can also increase and sustain a higher overall level of Gross Domestic Product (GDP).

4.2 In this respect, Table 2 shows customised Statistics New Zealand data for Canterbury and New Zealand commodity exports by the main exporting industries for the June 2007-year. This shows Canterbury's total commodity exports were $4.46B or 13 percent of total New Zealand commodity exports of about $35B.[2]

4.3 Agriculture and agricultural processing industries (i.e. food, beverage and tobacco manufactuure; textile, clothing, footwear and leather manufacture) are responsible for most of the value of exports from the region (62 percent) and nationally (58 percent).

4.4 Including services, total exports were approximately $48B for this year. Thus nationally, agriculture and agricultural processing industries contributed about 42 percent of New Zealand's total export receipts.

[2] Canterbury exports are indicative only as they were estimated by aggregating the sum of exports through Lyttelton and Timaru ports and Christchurch International Airport. However, while most of the regions exports are through those departure points some exports were also through other New Zealand ports and airports. Similarly, other regions will also export through Canterbury.

4.5 Those statistics highlight the fact that New Zealand's economic well-being is very dependent on primary products and processed primary products, especially those which are agriculture related.

Table 2: Canterbury and New Zealand merchandise exports by industry – June 2007 year

Industry	*Canterbury*	*NZ*
Agriculture	286,687,282	2,093,166,429
Services to agriculture, hunting and trapping		470,345
Forestry and logging	32,239,741	668,034,189
Commercial fishing	78,484,857	235,468,973
Mining, oil and gas extraction	747,129	507,582,603
Food and beverage and tobacco	2,079,800,878	16,585,348,585
Textile, Clothing, Footwear and Leather Manufacturing	409,031,803	1,728,781,924
Wood and Paper Product Manufacturing	161,033,506	2,681,192,309
Printing, Publishing and Recorded Media	4,476,579	117,170,534
Petroleum, Coal, Chemical and Associated Product Manufacturing	130,237,781	1,387,455,487
Non-Metallic Mineral Product Manufacturing	4,858,835	69,125,336
Metal Product Manufacturing	309,797,407	3,085,362,235
Machinery and Equipment Manufacturing	625,081,413	4,248,142,736
Other Manufacturing	22,038,616	329,832,324
Sub total	4,144,515,827	33,737,134,009
Total all other merchandise exports	316,455,428	1,201,491,916
Total merchandise exports	4,460,971,255	34,938,625,925

Statistics New Zealand

4.6 While the relationship between exports and GDP is very complex, over time the New Zealand economy has generally functioned on one dollar of export earnings supporting about four dollars of GDP (i.e. in terms of providing the foreign exchange required to purchase imports, but more recently this figure has declined to around one dollar of exports to three dollars of GDP. This has resulted in an unsustainable increase in the balance of payments deficit which is now around nine percent of GDP. Exports as a percentage of GDP

need to increase significantly to reduce the balance of payments' deficit to more sustainable levels).

4.7 If export earnings increase, effectively domestic activity can increase by a factor of three based on recent trends, although the blow-out in the balance of payments deficit suggests that a return to a one in four ratio is more realistic on a long-term sustainable basis.

4.8 At full production the total unprocessed and processed output of the Central Plains water scheme is estimated at $734M. Having regard to current and historic ratios of exports to GDP, the proposed scheme could enable a sustainable expansion in national economic activity of $2.2B to $2.9B or an expansion of around 2 percent in New Zealand's GDP.

5. TYPES OF ECONOMIC ASSESSMENTS

5.1 Economic assessments can be undertaken from two different but complementary perspectives; namely, cost benefit and economic impact analysis. Cost benefit analysis (CBA) is the standard, generally accepted, tool for assessing whether a project or policy is efficient (i.e. whether a specific allocation of resources results in a net improvement to society's economic well-being). Economic impact analysis, however, examines how the policy or project will change the economy, assessed in terms of snapshots of different points in time.

5.2 Cost benefit analysis is generally used to assess alternative projects (especially public projects), or policy options, compared with the no-change scenario and follows strict rules as to the determination of costs and benefits and their valuation. Economic impact analysis, on the other hand, focuses on

specific indicators of economic activity to determine how a project or policy may alter those indicators over time.

5.3 A fundamental distinction between the two approaches is that economic impact analysis is based on a "before" and "after" approach while cost benefit analysis is based on a "with" and "without" assessment basis. In addition, the treatment of some costs is also different in each analysis. For example, labour is a cost in economic terms, but from a socio-economic perspective employment is generally considered socially desirable. The implications of different approaches is that economic impact assessment is more suited to determining whether the proposed scheme will help improve the socio-economic well-being of society, as distinct from determining whether the proposed resource allocation is economically efficient.

5.4 The following evidence evaluates the advantages and disadvantages of the proposed scheme from both perspectives. The economic impact analysis is undertaken from a regional perspective while the cost benefit analysis is from a national perspective.

6. SCHEME SCENARIOS EVALUATED

6.1 There has been a range of storage scenarios that have been identified for the Central Plains Water Enhancement Scheme as described by Mr Tipler. The largest consented scenarios involves 280 million cubic metres (MCM) of storage, while the base case scenario involves only 240 MCM storage. The minimum storage required would be 220 MCM. The 280 million cubic metres "all consent component" option is what the consent application is based on and provides the required flexibility to accommodate the detailed design of the scheme, so as to avoid having to re-apply for consent to accommodate detailed design issues that may materialise.

6.2 I have selected the 240 MCM base case "gravity supply only to reservoir" scenario for my economic evaluation as the amount of work required to evaluate the potential continuum of storage scenarios discussed by Mr Tipler is unrealistic and unnecessary in my opinion. The 280 MCM represents a worst case (most expensive) scenario and for this reason is considered unsuitable for this economic analysis as it will tend to inflate the apparent economic impacts of the scheme and understate its economic efficiency as its costs are higher. That is because there will be more construction output, and added value and jobs, but this will reduce the proposed irrigation scheme's viability, as it is unlikely to yield offsetting scheme benefits. Thus the 240 MCM storage represents a realistic estimate of the storage that will be provided as discussed by Mr Tipler.

7. ECONOMIC IMPACT ANALYSIS

Introduction to assessment of economic effects

7.1 The rationale for an economic impact analysis is that it provides an indication of how key growth variables may change as a consequence of a project proceeding. Three measures were used to assess the potential over-all economic impacts of the proposed irrigation scheme on the regional economy; namely, output, added value and jobs.

7.2 Output is more or less the equivalent of an industry's turnover or sales. Added value, on the other hand, excludes intermediate inputs (i.e. the products and services purchased from other industries) from the value of an industry's output. It avoids double counting of economic activity. For example, in measuring the activity of the agricultural sector, added value excludes the goods and services purchased from other industries such as road transport,

fertiliser manufacture and business services. Added value includes salary and wage payments and profits before payment of interest and taxes.

7.3 Added value is conceptually the same as GDP, which is the universally accepted measure of economic activity. In the rest of my evidence I refer to the term GDP rather than added value.

7.4 In an assessment of how the key growth variables will change, there are three types of effects, namely direct, indirect and induced. Direct effects are self-explanatory. The indirect impacts relate to the flow-on effects to suppliers of goods and services provided to the project from within the district (i.e. forward and backward linkage effects). The induced effects are caused by the supply of goods and services to the employees that are directly or indirectly involved in the project, i.e. they are the direct and indirect effects caused by the demands they make on industries to service their personal expenditure (e.g. food, housing, domestic appliances, hardware, transport, education). Those impacts are generally referred to as multiplier impacts.

7.5 Multipliers are estimates of the relationship between direct and total economic impacts.[3] For example, expansion in the construction industry resulting from construction of the proposed scheme will lead to expansion in the cement and steel industries, and the expansion of wages in the construction industry will lead to expansion in the supermarket and restaurant industries.

Economic impact assumptions

7.6 The intention of the scheme is to irrigate about 60,000ha of land. To assess the economic impacts of this development, a number of assumptions were made by MacFarlane Rural Business and which are explained in more detail

[3] SNZ produce input-output tables for the New Zealand economy that indicate the multiplier impacts for each industry. However, as there are no sub-national multiplier estimates a proprietary model was used to derive multipliers for the purpose of the economic assessment from the latest national 2000/01 input-output study.

in Mr MacFarlane's evidence. In summary, it was assumed that the total scheme area is 95,250ha of which 10,000ha is non-effective (e.g. used for roads). Within the scheme area it is assumed that 10,250ha will remain in dry-land farming, but its returns/profits will be enhanced by irrigation of the land within the scheme area (e.g. because stocking rates can be increased due to integration with adjacent irrigated areas). The scheme will supply irrigation water to 60,000ha of which 30,000ha is currently irrigated from groundwater, i.e. the scheme will replace well-water with surface-water with respect to this land. This will enable farms within the scheme area that cannot be serviced by the proposed scheme to irrigate from the released groundwater. It is assumed that this freeing up of potential ground-water will enable a further 15,000ha to be irrigated in the scheme area even though that water is from ground-water. Hence, as a direct and indirect consequence of the scheme, the irrigated catchment area (well and surface water) will increase to 75,000ha

7.7 The present composition of farming in the scheme area is assumed to be made up of the following uses; namely, 55,200ha livestock, 8,000ha mixed livestock and crop, and 22,000 dairy. Post the establishment of the scheme, the land is assumed to comprise 10,250ha of mixed livestock dairy support, 10,250ha of dry land, 3,000ha of intensive stock finishing, 15,250ha intensive crop and 46,000ha dairy.

7.8 MacFarlane Rural Business assumed that new irrigated land will operate at the top end of performance levels reflecting the need for farmers to perform efficiently so as to service the debt levels that will be incurred as a consequence of the scheme's development. That company states that this assumption also allows for technological improvements and other profit-

enhancing factors that can reasonably be expected to occur following the scheme's coming into effect.

7.9 The scheme's capital costs are estimated by MacFarlane Rural Business as follows:

Off-farm works	$6826/ha
On-farm irrigation development	$2650/ha - $3000/ha
On-farm associated development	$550/ha
Dairy specific	$4320/ha

7.10 Macfarlane Rural Business prepared farm budgets for the farms within the scheme boundary pre and post-irrigation and from this the incremental changes in output, GDP and jobs resulting from the irrigation scheme were derived. The flow-on impacts were assessed using regional multipliers derived from Statistics New Zealand's 1996 inter-industry study.

7.11 An allowance of $71/ha is assumed for running costs and $165/ha for electricity costs.[4]

7.12 It is likely that part of the increased output resulting from the proposed scheme will be processed, resulting in additional impacts on the regional economy, i.e. over and above that generated by the expansion of agriculture. For example, livestock and milk solids will be processed for export markets. In this respect, conservative estimates (based on analysis of the 1996 inter-industry study) of the farm gate outputs that are likely to be processed were made. The inter-industry study was also used to derive regional processing multipliers.

[4] Ibid: 4.6.

7.13 The analysis assumes that off-farm construction would be completed over three-years. The analysis assumes that on-farm construction would commence in project year two and continue until project year six. Some associated capital expenditure was assumed to continue through to project year-nine (e.g. provision of shelter). It was also assumed that additional agricultural output resulting from the scheme's capital expenditure would commence in project year three and that full agricultural development would be reached in project year eight.

Agriculture and associated processing impacts

7.14 Table 2 shows the annual estimated direct and indirect agricultural and processing impacts generated by the scheme once it is fully developed and operational.

Table 3: Annual regional impacts of scheme at full production

Activity	*Output $M*	*GDP $M*	*Jobs*
		Direct	
Agriculture	327	219	560
Processing	407	71	417
Total	734	290	977
		Direct plus indirect	
Agriculture	554	347	1,218
Processing	755	237	1,466
Total	1,308	584	2,684

7.15 Regional direct and indirect agricultural output is expected to increase by $554M per annum once the scheme is at full production. A proportion of this

additional agricultural output will be processed and this is conservatively estimated, based on analysis of Statistics New Zealand input output study, to generate an additional $734M per annum. This is a combined increase of about $1308M per annum. As a consequence of those output increases, direct plus indirect regional GDP is estimated to rise by $584M per annum with agriculture contributing about $347M and processing $237M of that amount. Direct plus indirect employment is estimated to increase by 2,684 jobs with 1,218 of this increase being created by the expansion in agricultural output and about 1,466 from processing.

7.16 Table **4** shows the direct and direct plus indirect output, GDP and employment impact of the increased production created by the scheme over 35 years, the maximum consent period permitted under the RMA. This period is made up of a three-year off-farm construction period followed by a 32-year irrigation period. The total for the 35-year analysis period is shown in undiscounted and discounted values (i.e. NPV).[5]

[5] Discounting enables costs and benefits occurring at different points in time to be compared, as it recognises the time value of money and, therefore, the fact that the value of money in the future is not the same as the equivalent sum of money now. For example, at 10 percent discount rate $1000 in year 20 and year 30 is the equivalent of $164 and $63, respectively, in year one. The effect of discounting is to give more weight to current rather than future financial flows. The sum of discounted costs and benefits is referred to as net present value (NPV). Selection of the discount rate tends to be problematic, but for the purpose of analysis of the scheme, 10 percent is used as this rate is commonly used in New Zealand with respect to public sector project evaluation. A lower discount rate increases NPV while a higher percentage reduces it.

Table 4: Accumulated direct and indirect impacts $M

Year	*Direct output*	*Direct & indirect output*	*Direct GDP*	*Direct & indirect GDP*	*Direct jobs*	*Direct +I ndirect jobs*
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	183	327	72	146	244	671
4	404	720	159	321	537	1,476
5	624	1.112	246	497	831	2,282
6	734	1,308	290	584	977	2,684
7	734	1,308	290	584	977	2,684
8 to 35	734	1,308	290	584	977	2,684
Total	23,230	41,405	9,166	18,499	30,925	84,960
NPV	5,607	9,994	2,212	4,465		

7.17 Over the total analysis period, direct plus indirect agriculture and processed output increases by $41.4B ($10B NPV) and GDP by $18.5B ($4.5B NPV). The incremental employment created by agriculture and associated processing is estimated at around 85,000 job-years over the total analysis period.

Scheme construction impacts

7.18 The scheme's off-farm and on-farm construction activities will also generate economic activity in the region. Table **5** shows the activity that the scheme's construction is estimated to directly plus indirectly sustain. The total for the 35-year analysis period is shown in undiscounted and discounted (NPV) values.

Table 5: Construction impacts of proposed scheme

Year	Direct output $M	Direct + indirect output $M	Added value $M	Direct +indirect GDP $M	Direct jobs	Direct +indirect jobs
1	137	272	37	94	566	1007
2	164	334	44	115	624	1234
3	207	427	54	148	535	1584
4	86	188	22	66	93	707
5	73	160	19	57	80	604
6	30	66	8	23	34	251
7	2	3	1	2	2	15
8	1	2	0	1	0	7
9-35	0	1	0	0	0.2	4
Total	699	1453	184	507	1933	5412
NPV	591	1,224	156	426		

7.19 The scheme's total off-farm, on-farm (including associated development expenditure (e.g plant and equipment, livestock, dairy specific (e.g. milking sheds) and Fonterra shares) is estimated at $699M. The direct and indirect regional output generated by this expenditure is estimated at $1.45B ($1.22B NPV) while the GDP is estimated at $507M ($426M NPV). The regional activity created by construction is estimated to sustain about 5400-job years of work.

Combined construction, agriculture and processing impacts

7.20 Table 6 combines the construction, irrigation and processing impacts for the analysis period.

7.21 The construction and ongoing farm impact is estimated to directly and indirectly increase regional output by $42.9B ($11.2B NPV), GDP by around $19B ($4.9B NPV) and to create around 90,000-job years of work.

Table 6: Combined agriculture processing and construction impacts

Year	*Direct output*	*Direct +indirect output*	*Direct GDP*	*Direct +indirect GDP*	*Direct jobs*	*Direct + indirect jobs*
1	137	272	37	94	566	1,006
2	164	334	44	115	624	1,253
3	390	754	127	294	779	2,181
4	489	908	181	388	631	2,884
5	697	1,272	265	553	910	2,934
6	764	1,374	297	608	1011	2,700
7	736	1,312	290	586	979	2,691
8	735	1,310	290	585	977	2,688
9	734	1,309	290	584	977	2,684
10-35	734	1,308	290	584	977	2,684
Total	23,929	42,858	9,350	19.006	32,858	90,363
NPV	6,198	11,217	2,368	4,891		

8. COST-BENEFIT ASSESSMENT [CBA]

8.1 CBA is the standard, universally accepted, economic tool for assessing whether a project is efficient from society's perspective (i.e. whether a specific allocation of resources results in a net improvement to society's economic well-being). In this case, CBA is applied to determine whether economic efficiency is promoted by the scheme proceeding (a "with" scenario) compared to a without scheme scenario.

Technical issues - CBA

8.2 Appendix 1 briefly discusses some of the relevant technical issues relating to CBA assessments in general. In summary, however, there are potentially three groups of people associated with development and use of society's scarce resources, namely, producers, consumers and third parties who are affected by specific transactions in which they have no involvement. The objective of CBA is to make a combined assessment of the impact on the

three groups of people by quantifying, as far as is practical, the market and non-market costs generated by competing projects/options with the aim of determining the best alternative from society's perspective.

8.3 By a process of subtracting the net benefit of the assessed option (i.e. 240MCM – gravity supply only to reservoir) from the no-scheme scenario (i.e. continuing existing farming operations), it is possible to determine the potential improvement to society's economic well-being of "with" and 'without" the proposed irrigation scheme. Hence, the net benefit of the chosen option is calculated by estimating the 'change' in net benefit caused by the proposed scheme.

8.4 All costs and benefits in this analysis were discounted at 10 percent to net present values. The sensitivity of the alternative relocation options was tested for higher and lower discount rates.

8.5 As 35 years is the maximum term for a water permit, the CBA assessment was based on this period.

9. COSTS AND BENEFITS

Introduction to costs and benefits

9.1 In general terms, costs and benefits can be classified into market and non-market costs and benefits. Market costs and benefits are those that are realised through market transactions and are reflected in the cost of the scheme to the Central Plains Water Trust, the irrigation operating company and/or the irrigating farmers. They include the off-farm and on-farm costs involved in developing the irrigation scheme and the ongoing operating scheme costs. They also include the incremental farm operating costs of

post-scheme operations, i.e. the post-scheme operating cost less the pre-scheme operating cost.

9.2 Non-market costs and benefits, frequently, but not always, accrue to third parties. When they affect third parties, they are generally referred to, in economic jargon, as externalities. Externalities occur `whenever the activities of one economic agent affects the activities of another agent in ways that are not reflected in market transactions.[6] The potential non-market costs include the incremental or marginal adverse visual effects caused by the post-scheme farm operations.

9.3 Broadly, the scheme's potential adverse effects relate primarily to the impacts of taking water from the Rakaia and Waimakariri rivers, the construction of the Waianiwaniwa Reservoir, the use of water for irrigation, and the associated effects on groundwater and the effects of conversion to intensive farming. I understand that the following potential adverse effects have been identified:

- loss of non-market values (e.g. heritage sites, mudfish habitat) in respect to land in the Waianiwaniwa Valley.[7]

- anoxic conditions developing in the lower Waianiwaniwa Reservoir which is a common condition in a new reservoir

- no more than minor impacts resulting from taking water from the Rakaia River, which is protected by a National Water Conservation Order, other than a possible reduction in frequency of conditions deemed to be ideal for salmon fishing

6 Page 802, Microeconomic Theory Basic Principles and Extensions.

7 The loss of the productive value of this land is a market cost as compensation is payable on taking of the land and, therefore, included in the cost of the scheme. To the extent that payments to landowners include an allowance for other factors (e.g. social disruption), those non-market costs are also included in the cost of the scheme.

- taking of 40m^3/s from the Waimakariri River with some detrimental environmental effects. These impacts primarily relate to the possible reduction in frequency of conditions deemed to be ideal for salmon fishing.

- increased groundwater levels under the scheme in some areas of up to 10.5 metres and at the edge of the confined zone increased groundwater levels of about 2m. The latter effect will impact on drainage with land staying wet for longer periods more frequently. The costs involved in mitigating those effects are uncertain at this stage

- potential slight increase in groundwater nitrate levels due to increased drainage from irrigated land with potential slight implications for potable water supplies in some places

- potential slight increase in Nitrate-N levels in the spring-fed streams flowing into Lake Ellesmere. However, the applicant does not expect this to accelerate phytoplankton growth in the streams or the lake.

9.4 Conversely, I understand that increasing the supply of water to the groundwater aquifers of the Central Plains will result in the following potential positive effects:

- increasing pressure in the aquifers feeding lowland streams (including. The Avon and Heathcote Rivers) and Lake Ellesmere with potential beneficial effects to the environment and recreational users; and lower pumping costs to existing abstractors.

- improved reliability of access to groundwater within the West Melton area which is currently subject to restrictions at times of low groundwater levels.

- potentially increased recreational opportunities associated with use of the storage reservoir or other waterbodies designed into the scheme for that purpose.

- the potential for new wetlands to be created by including them in the scheme design.

- increased rural population and improved rural employment.

9.5 It is noteworthy that non-market costs and benefits may be reflected indirectly in the price of traded commodities. For example, the vista or heritage values of a building may increase or decrease its value. Therefore, it should not always be assumed that non-market values are excluded from being taken into account in market transactions. However, in the case of third party effects (i.e. externalities), this is not the case.

9.6 In the next few paragraphs I briefly discuss the schemes potential non-market costs and benefits with the purpose of supporting the conclusion I have reached, namely, if they were valued and included in the CBA they are unlikely to negatively influence the result.

9.7 While the anoxic conditions in the lower Waianiwaniwa Reservoir is an adverse effect on the reservoir it is unlikely to be a net adverse economic effect per se. That is, because it will simply reduce the extent of any positive effect of the construction of the storage reservoir.

9.8 The detrimental effect on the salmon fishery is potentially measurable using non-market techniques. In this respect, the economic value of the Rakaia River has been assessed and, subject to adequate survey information on salmon fishing in the Waimakariri River, the Rakaia study could be used to assess the value of the loss of salmon fishing days using a transfer benefit approach.

9.9 Groundwater effects that adversely affect the productive use of land are potentially measurable providing there is adequate information. However, I understand that the physical impact is uncertain. Regardless, exacerbating existing wetness problems to land that is already affected could be minor in economic terms (i.e. incremental costs are small), as drainage troubles tend to restrict the productive uses of land. For example, land subject to periodic wetness is generally unsuited to the growing of crops or fruit trees. On the other hand, pastoral farming may accommodate such land with little or no consequence to net farm income by resting the land from grazing during wet periods as part of the normal rotational cycle.

9.10 Non-market techniques could, in theory, be used to cost the effects of increased nitrate levels on groundwater, streams and Lake Ellesmere. The cost directly attributable to the proposed irrigation system may be difficult to determine in isolation from other sources. However, increased nitrate levels resulting from agricultural intensification is perceived by many people to be a general problem with significant total cost, i.e. having regard to the effects on all water-bodies from all sources.

9.11 Conversely, some people may view the potential for increased pressure in aquifers with the associated effects on rivers and streams as very beneficial and value it highly.

9.12 Without a very exhaustive, and beneficial, non-market valuation study it is impossible to draw definitive conclusions on third party effects on the proposed scheme. However, I would expect that the value of positive effects should exceed the cost of the negative effects, as the latter can be avoided, remedied or mitigated. For example, I understand that good farm management practices can reduce the increase in nitrate levels. Similarly, increased drainage problems may be avoided and/or mitigated by farm management practices and/or remedied by drainage works.

9.13 Therefore, while the remainder of my evidence is devoted to an assessment of market costs and benefits of the selected option, it is likely that the non-valuation of non-market costs and benefits will not result in a significant negative impact.

9.14 The specific costs and benefits assessed in the CBA are as follows:

Farm benefits and costs

9.15 The farm benefits of the scheme represent the additional farm gate returns of the "with" scheme scenario compared to the scheme not proceeding and no change in current farm activity, i.e. "without" scheme scenario.

9.16 Farm costs of the scheme represent the incremental costs of the scheme compared to the 'without" scheme scenario. Those costs include the additional upfront and ongoing capital and operating costs with the scheme compared to the scenario without. The upfront capital costs comprise incremental irrigation costs to take advantage of the water supplied by the scheme, as well as associated capital expenditure to accommodate the predicted farm type activity under the "with" scheme scenario. This includes new fencing, grass seed, associated cultivation and fertiliser. The ongoing

capital cost includes the additional replacement capital expenditure required by the "with" scheme scenario compared to the "without" scheme scenario.[8]

9.17 The effect of the proposed irrigation scheme on existing output and farm costs and revenues was undertaken by MacFarlane Rural Business Limited.[9] Appendix 2 shows the farm budgets prepared by McFarlane Rural Business Limited prior to and after commissioning the scheme while Appendix 3 shows existing and post-development capital expenditure.

Off-farm irrigation costs and benefits

9.18 Off-farm costs include the construction cost of the scheme and were supplied by URS.

Summary of CBA results

9.19 Table **7** shows the costs and benefits of the scheme. Non-market costs and benefits are included in the table to highlight those elements that have not been valued.

[8] One notable capital item included in the analysis is the purchase of Fonterra shares. This could be viewed as a transfer payment (i.e. expenditure that does not reflect the use of resources per se) and under the rules of CBA should be excluded from the assessment. However, purchase of the shares can also be viewed as the cost of purchasing the processing capacity to enable the value of the farm output to be realised, as without a means of processing and distributing the incremental output, a proportion of the additional output would be of little value.

[9] Analysis of Central Plains water on farm impacts, 30 April 2007.

Table 7: NPV benefits and costs at 10 percent discount rate

Costs	*$M*	*Comment*
Costs market		
Net change in off-farm capital expenditure	373	
Net change in on-farm development expenditure	99	
Associated on-farm capital development	24	
Specific on-farm capital expenditure	80	
Plant & equipment	13	
Livestock	130	
Fonterra shares	242	
Net change replacement capital expenditure	32	
Net change on-farm operating expenditure	1,130	
Total net change in market costs	2,124	
Costs - non-market		
Anoxic reservoir	not valued	reduce reservoir benefit
Rakaia take	not valued	no more than minor
Salmon – Waimakariri	not valued	measure by transfer benefit
Increased drainage problems	not valued	likely small cost
Increased groundwater nitrates	not valued	Requires willingness to pay survey
Increased surface water nitrates	not valued	Requires willingness to pay survey
Total non-market costs	not valued	
Total market and non-market costs	2,124	
Benefits market		
Net change increased farm gate output	2,449	
Benefits - non market	not valued	
Scheme reservoir	not valued	Affected by fluctuating lake levels
Increased flows lowland streams	not valued	Requires willingness to pay survey
Lower pumping costs to existing users	not valued	Requires willingness to pay survey
Improved West Melton groundwater access		potentially measurable
Scheme recreational opportunities	not valued	requires willingness to pay survey
New scheme related wetlands	not valued	requires willingness to pay survey
Net national welfare gain	375	

9.20 The analysis shows that, discounted at 10 percent, the gross farm gate benefits of the scheme over 35 years are $2,449M NPV while costs are $2,124M NPV. Thus, the irrigation scheme is estimated to generate a net welfare gain to society of $375M NPV which indicates the scheme is efficient.

9.21 However, that estimate excludes the scheme's non-market costs and benefits. Regardless, for the scheme to be judged inefficient and, therefore, welfare reducing) at 10 percent discount rate, non-market costs would have to exceed non-market benefits by $375M NPV. This proposition seems very unlikely given the apparent potential to avoid, remedy or mitigate some potential adverse effects (e.g. increased wetness and nitrate levels) by good farm management practices while still capturing prospective non-market gains.

9.22 Another measure of the scheme's efficiency is its internal rate of return (IRR). This shows the maximum interest rate that can be applied to a series of net cash flows without yielding a negative NPV. The IRR for the proposed scheme was assessed at 14.4 percent

Sensitivity assessment of discount rates

9.23 The sensitivity of the CBA to variations in the base case (i.e. scenario (i)) assumptions (i.e. set out in paragraphs 7.6 to 7.13 and discounted at 10 percent) was tested. The revised assumptions were selected to examine the impact of realistic variations in key categories of costs and benefits, individually and together. The purpose was to see by how much base case assumptions and estimates would have to be altered before the conclusions drawn from the analysis would change. The variations in assumptions involved the following:

- scenario (ii) - off-farm development cost increased by 20 percent
- scenario (iii) - all cost other than Fonterra shares increased by 20 percent
- scenario (iv) - revenue decreased by 10 percent while cost remain the same as the base case
- scenario (v) - revenue decreased by 20 percent, while cost remain the same as the base case
- scenario (vi) - all cost, excluding Fonterra shares, increased by 20 percent, with revenue 10 percent lower
- scenario (vii) - all cost, excluding Fonterra shares, increased by 20 percent, with revenue 20 percent higher
- scenario (viii) - revenue stream lagged by two years.

9.24 In the addition to the above, the sensitivity of the discount rate was also tested, using rates of 12 percent, eight percent and five percent, as the selection of the appropriate discount rate can be problematic.

9.25 Arguments favouring very low discount rates are generally based on intergenerational equity issues or concerns. That is, higher discount rates give far less weight to future costs and benefits and, therefore, for example, encourage projects with more rapid rates of resource depletion than low discount rates. The argument in New Zealand for a 10 percent discount rate was in part based on the avoidance of bias in favour of public sector investment, i.e. favouring public sector over private sector investment. For example, low discount rates encourage Government investment in activities considered uneconomic by the private sector. The purpose of selecting several rates was to examine the impact on the base case results and thereby determine just how sensitive the conclusion drawn from the analysis

was to variations in the discount rate. Only one rate above 10 percent was selected as the arguments in economic literature are generally for discount rates lower than this. The results of the analysis showed that there was no purpose in testing rates below five percent as lower discount rates enhanced the estimated net gain of the proposed irrigation scheme to society.

Sensitivity results

9.26 Table 8 shows the results of variations to the key assumptions and discount rate.

Table 8: Sensitivity of CBA to discount rate

Summary Sensitivity	*Costs*	*Benefits*	*Net gain*	*Difference net gain to base case*	*IRR*
(i) base case	2,124	2,499	375	0	14.4%
(ii) - off-farm development cost 20% higher	2,198	2,499	301	-75	13.3%
(iii) - all cost excl Fonterra 20% higher	2,268	2,499	231	-144	12.5%
(iv) - revenue 10% lower	2,124	2,249	125	-250	11.6%
(v) - revenue 20% lower	2,124	1,999	-125	-500	8.7%
(vi) costs excl Fonterra 20% higher, revenue 10% lower	2,268	2,249	-19	-394	10.0%
(vii) - costs excl Fonterra 20% higher, revenue 20% higher	2,268	2,999	731	356	17.2%
(viii) - costs same, deferred revenue stream	2,268	2,499	231	-144	12.5%
Base case 12% discount rate	1,883	2,045	162	-213	14.4%
Base case 8% discount rate	2,444	3,124	681	305	14.4%
Base case 5% discount rate	3,166	4,596	1,430	1,054	14.4%

9.27 Increasing off-farm development cost by 20 percent (scenario (ii)) reduces the net gain to society by $75M NPV to $301M NPV. Assuming all costs other than Fonterra shares are 20 percent higher (scenario (iii)) reduces the net gain to society by $144M NPV to $231M NPV. The IRR falls to 13.3 percent and 12.5 percent, respectively, under scenarios (ii) and (iii).

9.28 A 10 percent reduction in revenue (scenario (iv)) lowers the net gain by $250M to $125M (IRR to 11.6 percent), while a 20 percent reduction (scenario (v)) causes net gain to fall by $500M NPV to –$125M NPV (IRR 8.7 percent). Increasing all costs other than Fonterra shares by 20 percent while lowering revenue by 10 percent (scenario vi)) reduces the net gain by -$394M NPV to -$19M NPV. Assuming all costs other than Fonterra shares and revenues are 20 percent higher (scenario (vii)) increases net gain by $356M NPV to $731M NPV (IRR 17.2 percent). Lagging the growth in revenue by two years to full development (scenario (viii)) lowers net gain by $144M NPV to $231M NPV (IRR 12.5 percent). At a 12 percent discount rate the project's net national gain declines by $213M NPV to $162M NPV.

9.29 Discount rates lower than 10 percent make the project more favourable as, while market costs increase as the discount rate falls, market benefits increase by even greater amounts. Consequently, the net national gain from the project rises from $375M NPV at 10 percent to $681M NPV at eight percent and $1,430M NPV at five percent. Thus, the principal conclusion drawn from the CBA analysis, namely, that the proposed irrigation project improves society's economic well-being, is enhanced by discount rates below 10 percent. A two percent lift in the rate to 12 percent reduces the net gain by about half, but it does not change the conclusion that the project is efficient and enhances economic well-being.

Sensitivity analysis conclusions

9.30 Several conclusions can be drawn from the sensitivity analysis. First, the analysis is not sensitive to the selected discount rate; especially, as the general debate in economic literature is that rates lower, rather than higher, than 10 percent are applicable from society's perspective. Second it shows that the scheme's capital and operating cost could be much higher than

estimated while still producing a strongly positive welfare gain to society. In fact. estimated costs could increase by almost 70 percent before the scheme created a net loss to society. Third, the analysis is far more sensitive to variations in revenue than cost assumptions, with a 20 percent overall fall in the revenue creating a net welfare loss to society. Fourth, the scheme is not particularly sensitive to the uptake assumption. The rate of uptake could be much slower than assumed while still being assessed as efficient.

9.31 The sensitivity analysis highlights the importance of the revenue assumptions to the overall conclusion. In this respect, it is noteworthy that the revenue assumptions have been based on a exchange rate of NZ$1 = US$0.76. Historically, this is a very high rate and, therefore, there is a far greater potential for the New Zealand dollar to fall against the USA dollar rather than to increase in value against that currency. This means that the analysis is more likely to be understating rather than overstating likely revenue receipts and thus net welfare gains. For example, a fall in the value of the NZ dollar to NZ$1 = US$0.68 cents would increase revenue returns at assumed prices by 12 percent. A fall in the value to US$0.60 cents would increase revenue by 27 percent, whereas at US$0.50 cents would increase revenue by 50 percent. Costs would also rise due to the import component of inputs into farmers' production and associated processing cost, but by a much smaller percentage than revenues.

9.32 Downward movements in the exchange rate, which is likely over the medium to long-term, could offset other potential revenue risks such as commodity prices being lower than assumed. For example, a downward movement in the exchange rate could offset a fall in dairy prices. For this reason the revenue assumptions are considered relatively robust and, therefore, unlikely to overstate the financial benefits of the scheme. Because the analysis is not

very sensitive to significant variations in cost assumptions, it is very likely that the scheme will involve an efficient use of society's resources and result in a substantial welfare gain, i.e. even if costs proved to be understated. The non-quantified, non-market costs, would have to be substantial for this conclusion to change.

Alternative projects

9.33 It is noteworthy that the CBA has been assessed on a "with" and 'without" the proposed irrigation scheme. It has not been tested against any competing projects that may also wish to use the water for irrigation and/or other purposes (e.g. hydro electricity generation). Without such comparisons it is impossible to say definitely that the proposed scheme is the best use of society's resources, including the water to be abstracted. However, the following points are relevant in this respect:

- The RMA adopts a first-in first-served approach to resource consent applications to use water, which may at times result in the most efficient use of the resource missing out in favour of less efficient uses. The most appropriate means of addressing this potential problem, from an economic perspective, is to allow transferability of water permits, as provided for by the RMA, which through trade will encourage the water resource to be reallocated to its best use, whether that is to other farmers in the scheme, or other irrigation or non-irrigation projects.

- Hydro electricity generation will generally have an inferior return to irrigation schemes, unless water in an existing scheme (e.g. where nearly all the costs are sunk) is used and/or is part of a joint irrigation/hydro electricity generation scheme. Therefore, it is unlikely that use of the

subject water for hydro electricity will yield a greater net gain to society compared to the proposed irrigation scheme.

- Potential mutually exclusive irrigation uses of the subject water can be classified into those involving the subject land and those involving other areas of land not included in the Central Plains scheme. There are no known proposals that fall into the first category. Rather, there are potential gains in both productivity and profitability from converting deep-well systems within the proposed scheme's catchment to surface water schemes. That is, the proposed scheme will compete with existing schemes and encourage existing schemes on the subject land, as has been assumed in the analysis, to be converted, thus freeing up deep-well water. In this respect, Macfarlane Rural Business note that water reliability is absolutely critical to the arable/horticulture sector, and is also particularly important to the dairy and dairy support sector. It also cites cost savings in energy consumption and deep well pump repairs and deprecation from converting deep well pumps to surface pumps.[10]

- In respect of irrigation use of the subject water outside of the scheme area, there are two factors that need to be considered. First, a large scheme has potential for greater economies of scale compared to smaller schemes, i.e. in terms of the volume of water abstracted. This is because it allows for potential common costs to spread over a much larger land area (e.g. resource consent, scheme inlets, river to reservoir canals, main canals), thus lowering the off-farm cost per hectare. Second, even if this is not the case, a larger scheme may still yield a much larger net gain than a smaller scheme or combination of smaller schemes even though individually the smaller schemes may be more efficient (i.e. yield a higher

IRR than the scheme's 15.7 percent return to society). In this situation, the relevant concern is what economic options, if any, there are for the use of unallocated resources (e.g. un-abstracted water). If smaller competing schemes deny society the potential to maximise the irrigation net gain from the subject water they are less efficient.

9.34 Those points suggest that the proposed scheme is likely to optimise the net gain to society from use of the proposed water resources.

10. CONCLUSION

10.1 Export receipts are vital to the health of the national economy as the range of commodities that New Zealand can efficiently produce domestically is limited. If export earnings increase over-time, effectively imports can also increase and sustain a higher overall level of GDP.

10.2 New Zealand's exports are still heavily dependent on agriculture and processed agricultural commodities and this situation is likely to continue for the foreseeable future.

10.3 Canterbury is a major contributor to agricultural and processed agricultural exports. Those exports are heavily dependent on irrigation.

10.4 At full production the additional exports generated by the scheme could enable a sizable expansion in national GDP of around two percent or up to $2.9B per annum.

10.5 The regional economic impact assessment indicates that the scheme will substantially increase key economic activities with regional output increasing by around $1.3B per annum, GDP by $584M per annum and jobs by about

[10] Ibid: Section 3.

2,700 per annum. In addition, the scheme's $681M construction expenditure will significantly boost economic activity.

10.6 The CBA assessment of the proposed scheme shows that market benefits exceed market costs at 10 percent discount rate by $375M NPV. For the scheme not to be assessed as efficient, the excess of non-market cost over non-market benefits would have to exceed that sum, but that appears unlikely as the proposed scheme will give rise to a number of positive effects on the environment while there appears to be potential to avoid, remedy or mitigate at potential adverse effects.

P T Donnelly

APPENDIX 1: CBA TECHNICAL ISSUES

A1.1 There are in effect three groups of people associated with development and use of land, namely, producers, consumers and third parties. The objective of cost benefit analysis is to make a combined assessment of the impact on the three groups of people within the study's boundaries, i.e. New Zealand. The net benefit derived by producers is referred to as 'producer surplus'. Producer surplus is calculated by deducting producer costs from revenues. The net benefit derived by consumers is referred to as the 'consumer surplus'. Consumer surplus is the amount of unpaid-for benefit which accrues to consumers. It is calculated by subtracting the market price of a good or service from consumers' maximum 'willingness to pay' (i.e. consumers' top bids if they were forced to disclose them). The net benefit of a project or policy can be expressed as follows:

nb = ps + cs + pe – ne
where:
nb = net benefit
ps = producer surplus
cs = consumer surplus
pe = positive externalities
ne = negative externalities

A1.2 By subtracting the net benefit of the preferred option (e.g. land use A) from the next best alternative option (e.g. land use B) it is possible to determine the potential improvement to society's economic wellbeing of moving from one state to another.

A1.3 In theory all costs and benefits should be included at their true opportunity costs rather than at market prices. In practice this means that if labour rates are inflated by government policies (e.g. minimum wage rates, dole payments which inhibit the true market price being established) the real wage rates should be derived by the analyst and used in preference to the market rate. However, for the purpose of this CBA there is little reason to believe there will be any substantial divergence and, therefore, market prices are used.

A1.4 All costs and benefits in this CBA are discounted to common values (e.g. year 1). This enables costs and benefits to be compared even though they may occur in different years.

A1.5 Discounting enables the value of future years' income streams (i.e. cost and benefits) to be expressed in common values, called net present values (NPV).

A1.6 A thirty-five year assessment period was adopted for the purpose of the analysis. A longer period would have an insignificant affect on the results due to the effects of discounting.

A1.7 As previously stated, consumer surplus is measured by determining the difference between the discounted maximum price consumers would pay for goods and services produced from the subject land and what the market actually requires as a consequence of competition between producers. Because most if not all of the additional output produced from the proposed irrigation scheme will be exported there is effectively no producer surplus in this case.

A1.8 Externalities occur whenever the activities of one economic agent affects the activities of another agent in ways that are not reflected in market transactions. The affects can be positive (welfare enhancing) or negative (welfare reducing).

A1.9 Assessment of third party effects can be time consuming and expensive as it generally involves a willingness to pay for surveys. The proposed irrigation scheme will have both positive and negative visual effects.

11. APPENDIX 2: CENTRAL PLAINS IRRIGATION FARM FINANCIAL ANALYSIS

Prior to Commissioning C.P.I.

Farm Type		**1. Livestock (Dr)**		**2. Mixed (Ir)**		*** Arable & Process**		**3. Dairy (Ir)**		**TOTAL**	
Area		**per ha**	**55,250**	**per ha**	**8,000**	**per ha**	**0**	**per ha**	**22,000**	**per ha**	**85.250**
			$K		**$K**		**$K**		**$K**		**$K**
SHEEP		429.6	23,733	843.2	6,746		0		0	357.5	30,479
WOOL		86.4	4,775	96.7	774		0		0	65.1	5,549
CATTLE			0		0		0	381.4	8,390	98.4	8,390
MILK			0		0		0	7,315.3	160,937	1887.8	160,937
DEER			0		0		0		0	0.0	0
VELVET			0		0		0		0	0.0	0
GRAIN AND PULSE PRODUCE			0		0		0		0	0.0	0
Previous Yr Sales			0		0		0		0	0.0	0
Current Yr Sales		195.5	10,795	866.7	6,,933		0		0	208.0	17,728
Unsold At Year End			0		0		0		0	0.0	0
SMALL SEED PRODUCE			0		0		0		0	0.0	0
Previous Yr Sales			0		0		0		0	0.0	0
Current Yr Sales			0	701.5	5,612		0		0	65.8	5,612
Unsold At Year End			0		0		0		0	0.0	0
MISCELLANEOUS INCOME		28.7	1,587	151.1	1,209		0		0	32.8	2,795
										0.0	0
STOCK PURCHASES										0.0	0
	Sheep	-9.2	-510	-216.9	-1.735		0		0	-26.3	-2,245

	Cattle		0		0		0	-37.5	-825	-9.7	-825
	Deer		0		0		0		0	0.0	0
	Other		0		0		0			0.0	0
											0
CASH FARM INCOME		730.9	40,380	2,442.3	19,539	0.0	0	7,659.2	168,502	2,679.4	228,421
Change in value of stock on hand			0		0		0	0.0	0	0.0	0
Change in value of produce on hand		0.0	0	0.0	0	0.0	0			0.0	0
GROSS FARM INCOME		**731**	**40,380**	**2,442**	**19,539**	**0**	**0**	**7,659**	**168,502**	**2,679**	228,421
WAGES		92.5	5,113	248.8	1,990		0	989.5	21,769	338.7	28,872
ANIMAL HEALTH		24	1,324	27.2	217		0	280.0	6,160	90.3	7,701
STOCKFEED PURCHASED		13.8	765	3.1	25		0	1,476.0	32,472	390.2	33,262
OTHER STOCK EXPENSES		7.3	404	7.3	58		0	151.3	3,328	44.5	3,790
FEED CONSERVATION		40.2	2,221		0		0	260.5	5,731	93.3	7,952
CONTRACTING			0	8.7	70		0	11.0	242	3.7	312
CARTAGE		15.7	868	49.8	398		0	24.6	540	21.2	1,807
FERTILISER & LIME		89.9	4,970	249.6	1,997		0	693.7	15,262	260.7	22,229
SEEDS & TREATMENT		33.9	1,873	107.9	863		0	26.5	583	38.9	3,319
SACKS & SEED DRESSING			0	66.7	533		0		0	6.3	533
WEED & PEST CONTROL		74.7	4,130	141.0	1,128		0	26.7	586	68.6	5,844
REPAIRS & MAINTENANCE		44.9	2,479	80.8	646		0	125.0	2,750	68.9	5,875
VEHICLE EXPENSES		49.7	2,748	109.0	872		0	104.4	2,296	69.4	5,916
ELECTRICITY		5.1	283	261.5	2,092		0	555.0	12,210	171.1	14,586
OTHER WORKING EXPS			0		0		0	0.0	0	0.0	0
ADMINISTRATION		23.1	1,275	38.5	308		0	107.4	2,363	46.3	3,945
STANDING CHARGES		37.2	2,054	49.5	396		0	70.0	1,540	46.8	3,990

CASH FARM WORKING EXPENSES		**552**	**30,507**	**1,449**	**11,595**	**0**	**0**	**4,901**	**107,833**	**1,759**	**149,935**
Depreciation		51.3	2,834	159.0	1,272		0	112.5	2,475	77.2	6,581
Earnings Before Interest and Tax:		**$127**	**$7,039**	**$834**	**$6,672**	**$0**	**$0**	**$2,645**	**$58,194**	**$843**	**$71,905**

Post Commissioning C.P.I.

Farm Type		**4. Mixed L/s (Pt.Ir)**		**5. Finishing (Ir)**		**6. Arable & Process (Ir)**		**7. Dairy (Ir)**		**TOTAL**	
Area		**per ha**	**20,500**	**per ha**	**3,000**	**per ha**	**15,250**	**per ha**	**46,500**	**per ha**	**82,250**
			$K		$K		$K		$K		$K
SHEEP		576.7	11,822	3,575.6	10,727	1,109.8	16,925		0	463.0	39,473
WOOL		94.3	1,934	156.0	468	34.7	529		0	34.4	2,931
CATTLE			0	3,502.3	10,507		0	404.8	18,824	344.1	29,331
MILK			0		0		0	8,869.4	412,426	4,837.8	412,426
DEER			0		0		0		0	0.0	0
VELVET			0		0		0		0	0.0	0
GRAIN AND PULSE PRODUCE			0		0		0		0	0.0	0
Previous Yr Sales			0		0		0		0	0.0	0
Current Yr Sales		581.8	11,928		0	3,536.7	53,934		0	772.6	65,862
Unsold At Year End			0		0		0		0	0.0	0
SMALL SEED PRODUCE			0		0		0		0	0.0	0
Previous Yr Sales			0		0		0		0	0.0	0
Current Yr Sales			0		0	1,370.0	20,893		0	245.1	20,893
Unsold At Year End			0		0		0		0	0.0	0

MISCELLANEOUS INCOME		608.3	12,470		0		0		0	146.3	12,470
					0		0		0		
STOCK PURCHASES					0		0		0		
	Sheep	-9.2	-189	-2,584.6	-7,754	-709.4	-10,819		0	-220.1	-18,762
	Cattle		0	-2,441.0	-7,323		0		0	-106.4	-9,067
	Deer		0		0		0	-37.5	-1,744	0.0	0
	Other		0		0		0		0	0.0	0
					0		0		0		
CASH FARM INCOME		1,851.9	37,965	2,208.3	6,625	5,341.7	81,461	9,236.7	429,507	6,516.8	555,558
Change in value of stock on hand			0		0		0		0	0.0	0
Change in value of produce on hand		0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
GROSS FARM INCOME		**1,852**	**37,965**	**2,208**	**6,625**	**5,342**	**81,461**	**9,237**	**429,507**	**6,517**	**555,558**
					0		0		0		
WAGES		186.4	3,821	328.7	986	271.8	4,145	937.0	43,571	616.1	52,522
ANIMAL HEALTH		27.4	561	102.6	308	15.4	235	281.3	13,078	166.4	14,182
STOCKFEED PURCHASED		3.1	63	3.8	12	3.1	47	1,564.4	72,746	854.7	72,867
OTHER STOCK EXPENSES		7.3	150	11.0	33	2.6	39	153.8	7,149	86.5	7,371
FEED CONSERVATION		34.3	702	25.4	76		0	284.3	13,218	164.2	13,996
CONTRACTING		0.0	0		0	197.5	3,012	11.0	512	41.3	3,523
CARTAGE		39.6	811	213.5	640	270.4	4,124	26.1	1,213	79.6	6,789
FERTILISER & LIME		186.2	3,818	237.5	713	691.3	10,543	668.2	31,073	541.3	46,146
SEEDS & TREATMENT		44.3	907	31.2	94	385	5,871	25.0	1,163	94.2	8,035
SACKS & SEED DRESSING		0.0	0		0	116.5	1,776	0.0	0	20.8	1,776
WEED & PEST CONTROL		82.0	1,681	34.9	105	383.3	5,846	26.7	1,239	104.1	8,871
REPAIRS & MAINTENANCE		60.3	1,235	64.1	192	92.3	1,408	125.0	5,813	101.4	8,648
VEHICLE EXPENSES		53.8	1,104	53.8	162	140.4	2,141	105.0	4,883	97.2	8,289

ELECTRICITY		82.1	1,682	155.1	465	155.1	2,366	235.0	10,928	181.1	15,441
OTHER WORKING EXPS		0.0	0		0		0	0.0	0	0	0
ADMINISTRATION		30.8	631	38.5	115	38.5	587	115.9	5,388	78.8	6,721
STANDING CHARGES		76.7	1,572	105.5	317	108.5	1,655	125.0	5,813	109.7	9,356
Additional opex on bore irrigated land		14.0	286	27.9	84	27.9	425	27.9	1,297		2,093
CASH FARM WORKING EXPENSES		**928**	**19,024**	**1,434**	**4,301**	**2,900**	**44,218**	**4,711**	**219,082**	**3,362**	**286,625**
					0		0		0		
Depreciation		79.5	1,630	107.7	323	210.3	3,207	112.5	5,231	121.9	10,391
					0		0		0		
Earnings Before Interest and Tax:		**844**	**17,310**	**$667**	**$2,001**	**$2,232**	$34,036	**$4,413**	$205,194	**$3,033**	**$258,541**

12. APPENDIX 3: CAPITAL EXPENDITURE BUDGETS

Pre C.P.I capital Investment per hectare

Farm number	1	2	3	*	Total
Area (ha)	55,250	8,000	22,000	10,000	95,250
Farm Class	Livestock	Mixed	Dairy	Non eff	
Land	$15,000	$15,000	$15,000	$5,000	$1,329
Off farm development					
On farm development		$2,650	$3,000		$87
Associated			$550		$12
Dairy Specific			$4,300		$95
Plant & Equipment	$500	$550	$640		$46
Livestock	$497	$497	$7,688		$201
Fonterra Shares			$8,386		$184
Working capital	$293	$773	$664		$37
Total per hectare	$16,289	$19,469	$40,228	$5,000	
Total Investment ($m)	$899.99	$155.76	$855.01	$50.00	$1,991
Total/ha (excl Land)	$1,289	$4,469	$25,228	$0	
Tot Inv ($m excl Land)	$71.24	$35.76	$555.01	$0.00	$662.00

Post C.P.I capital Investment per hectare

Farm number	5	6	7	8	*	**Total**
Area (ha)	20,500	3,000	15,250	46,500	10,000	**95,250**
Farm Class	Mixed	Finishing	Arable	DairyNon Eff		
Land	$15,000	$15,000	$15,000	$15,000	$5,000	**$1,329**
Off farm development	$2,730	$5,461	$5,461	$5,461		**$410**
On farm development	$1,345	$2,728	$3,078	$2,928		**$219**
Associated	$475	$550	$550	$550		**$45**
Dairy Specific				$4,320		**$210**
Plant & Equipment	$500	$400	$1,500	$640		**$64**
Livestock	$497	$2,048		$8.256		**$400**
Fonterra Shares				$10,945		**$509**
Working capital	$775	$775	$1,700	$664		**$75**
Total per hectare:	**$21,322**	**$26,962**	**$27,289**	**$4.8764**	**$5,000**	
Total Investment ($m)	**$437,10**	**$80.89**	**$416.15**	**$2,267.54**	**$50**	**$3,252**
Total/ha (excl Land)	**$6,322**	**$11,962**	**$12,289**	**$33.764**	**$0**	
Tot Inv ($m excl Land)	**$129.20**	**$35.89**	**$187.40**	**$1,570.04**	**$0.00**	**$1,923**