THE OPUHA DAM:

An *ex post* study of its impacts on the provincial economy and community

AUGUST 2006

MORAKI
DEVELOPMENT TRUST

"If we have the right tools, we make better decisions. This report will lead to enhanced targeting of investment"
Murray Cleverley

Ministry of Economic Development
Manatū Ōhanga

"A benchmark report will provide communities with a framework with which to assess the effect of proposed irrigation schemes in their region"
Ministry of Economic Development

FEDERATED FARMERS OF NEW ZEALAND (INC)

"We need the community to understand irrigation is much more than a bonus for farmers"
Tom Henderson

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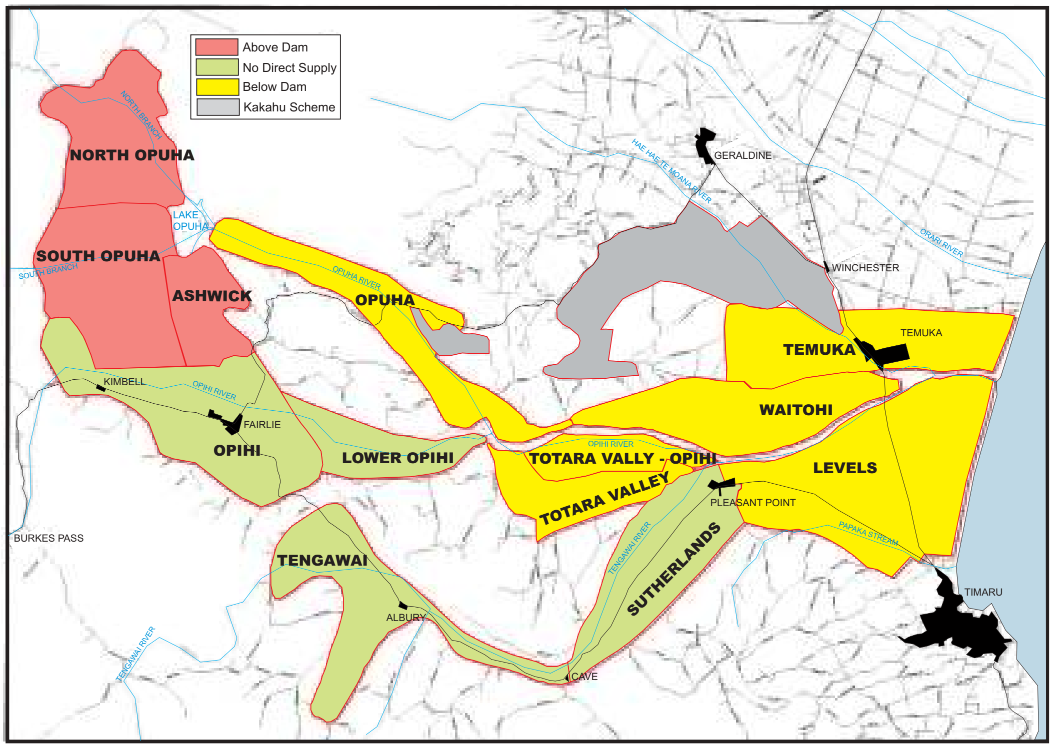
SCFIS Area
CHRISTCHURCH
DUNEDIN
INVERCARGILL
NELSON
Stewart Island/Rakiura


Above Dam
No Direct Supply
Below Dam
Kakahu Scheme
NORTH OPUHA
NORTH BRANCH
SOUTH OPUHA
SOUTH BRANCH
LAKE OPUHA
ASHWICK
OPUHA
OPUHA RIVER
GERALDINE
WINCHESTER
ORARI RIVER
TEMUKA
WAITOHI
KIMBELL
OPIHI RIVER
FAIRLIE
OPIHI
LOWER OPIHI
TOTARA VALLY - OPIHI
TOTARA VALLEY
LEVELS
PLEASANT POINT
PAPAKA STREAM
BURKES PASS
TENGAWAI
TENGAWAI RIVER
ALBURY
SUTHERLANDS
CAVE
TIMARU

Acknowledgements

This study was funded by Ministry for Economic Development (MED) through the Aoraki Development Trust.

This kind of research can only be carried out if farmers and the general business sector are prepared to provide comprehensive information, and we would like to thank those who assisted for their information and time. We trust that this report will lead to greater public understanding of the role of irrigation in the local economy, and that this in turn will in some measure repay respondents for their assistance.

Disclaimer

TABLE OF CONTENTS

TABLES

1 EXECUTIVE SUMMARY

1. The Opuha Dam was commissioned in 1999 after a protracted development stage including many years to secure agreement and resource consents, and a breach of the dam during construction. While initial uptake of irrigation was relatively slow, the scheme is now fully subscribed and shares have sold at a premium of over 10 times their original cost. This study investigates the impacts of the Opuha Dam on the farms and community it services. The study is based primarily on surveys of properties serviced by the Opuha Dam infrastructure, comparing these with dryland farms in equivalent circumstances, and assessing wider impacts through a model of the local economy.

2. The Study Area comprises the Timaru District and those parts of the Mackenzie District which are East of the Hunter Hills and the Two Thumbs Range. The study covers two financial years, 2002/3003 and 2003/2004. These financial years were considered to be the most recent ones for which farmers were likely to have records, and rainfall records indicate they were normal or slightly below normal growing seasons.

3. The project commenced in April 2005, and interviewing was completed in April 2006. The sampling procedure was weighted quota based sampling, and the final sample included 32 irrigated properties and 20 dryland properties. Detailed account analysis was undertaken for each of the survey properties. Interviews were also held with a number of businesses and other stakeholders in the Study Area. The 5,000 ha of irrigation included in the sample is approximately 30% of the total irrigated area and approximately 15% of the irrigation shareholders. The results have some confounding factors associated with pre-existing irrigation, and do not distinguish between irrigation *causing* changes on farm and *being associated* with changes on farm.

4. The irrigated farms sampled had a total effective farm area of 10,410 ha with 49% or 5,129 ha of this area being irrigated. Average farm size was 325 ha with an average irrigated area of 160 ha. The dryland farms sampled totaled an area of 6,521 ha with an average farm size of 326 ha. This would indicate that the dryland sample closely matched the irrigated sample in scale of operation.

5. Soil fertility (as measured by Olsen P) was higher on the irrigated properties, and these properties also applied more N than dryland properties on both their irrigated and dryland areas. The irrigated farms had a higher proportion of dairying and cropping than the dryland properties, and had higher stocking rates for sheep, beef and deer. While productivity measured by lambing/calving % was not higher, the crop yields were significantly greater on irrigated land than dryland. Higher value processed vegetable crops were also more dominant on the irrigated sample.

6. Financial information taken from farm accounts for the years 02/03 and 03/04 was averaged to present financial performance from the dryland and irrigated data sets. All data is compared on equivalent areas of dryland properties and irrigated properties.

Table 1: Financial Performance Summary Table

	Dryland		Irrigated	
	% of Revenue	$/ Eff ha	% of Revenue	$/ Eff ha
Total Revenue		**862**		**2073**
Farm Working Expenses*	**76%**	**655**	**73%**	**1503**
Cash Farm Surplus*	**24%**	**208**	**27%**	**570**
Total Overheads		**213**		**484**
Net Trading Profit After Tax*	**-1%**	**- 5**	**4%**	**86**
Disposable Surplus (Deficit)		**(142)**		**(153)**

* As a proportion of Total Revenue

7. **<u>On Farm Impacts (Table 1)</u>**
   - Total revenue is 2.4 times as high at $2,073 / ha for the irrigated farms than the dryland at $862 / ha.
   - The relationship of Farm Working Expenses to Total Revenue is very similar between the dryland and irrigated properties (76% and 73% respectively).
   - Cash Farm Surplus as a proportion of Total Revenue is similar for the two farm types at 24% and 27% respectively but the dollar value of the surplus on the irrigated farms is substantially higher. From the data we have received, capital expenditure per ha is no greater on irrigated properties than on dryland properties.

8. **Scheme Wide On Farm Impacts (Table 2Table 13)**
   - An increase in Total Farm Revenue of approximately $40 m / annum.
   - An increase in Total Farm Working Expenditure of approximately $28 m / annum.
   - An increase in Cash Farm Surplus of approximately $12 m / annum.
   - An increase in Net Trading Profit after Tax of approximately $3 m / annum.
   - In terms of on farm impacts the irrigated farms generate 2.0 times, as many jobs, 2.3 times as much value added, and 3 times as much household income per ha as do dryland farms.

Table 2: Direct Financial Impacts of Irrigation

	Total Revenue	Farm Working Expenses	Cash Farm Surplus	NTPAT
Impact / ha Irrigated ($/ha/annum)	$2,457	$1,722	$735	$186
Impact over scheme area. ($m / annum)	$39,740,000	$27,850,000	$11,890,000	$3,000,000

9. **Location of Impacts:** We asked farmers what proportion of their spending they did in rural areas and small centres (i.e. other than Timaru), and the results indicate that approximately 55% of expenditure is in rural areas or small towns, with a further 34% - 39% in Timaru. The results indicate that expenditure patterns were similar for dryland and irrigated properties.

10. **Whole Community Impacts(Table 3):** We developed a model of the Study Area economy to investigate the flow on and downstream impacts of the changes. For the entire economy of the study area – Timaru District and the Fairlie Basin -each thousand hectares of irrigation adds $7.7 million in output, 30 FTEs, $2.5 million in value added and $1.2 million in household income. The increase in value added associated with irrigation from the whole Opuha Dam scheme was $41 million per year, which is equivalent to 3.1 % of total value added in the Study Area in the 2003/04 year. It also generated an additional 480 jobs, which is 2.4 % of total employment in the Study Area.

Table 3: Summary of Whole Economy Impacts

	Dryland	Irrigated properties	Additional impact with irrigation
Output ($/year)	$75,000,000	$199,000,000	$124,000,000
Value Added ($/year)	$23,000,000	$64,000,000	$41,000,000
Household Income ($/year)	$13,000,000	$33,000,000	$20,000,000
Employment (FTEs[1])	404 FTEs	884 FTEs	480 FTEs

11. Electricity generation contributed a further $1.03 million to direct output, but the employment and flow on impacts of this activity are substantially smaller than that for farming.

12. In addition to the calculated economic impacts, interviews with businesses reveal that irrigation is associated with an increase in confidence, infrastructure, and enables better utilization of capacity in downstream businesses. We also note that dryland farmers may be receiving benefits from irrigation associated with opportunities for grazing and greater demand for stock and other products.

13. Social indicators on which data was collected indicate that younger, better educated farmers, and greater employment are associated with irrigation. In addition a significant proportion of farm direct spending occurs in small centres and rural areas and therefore flow on economic impacts may be concentrated in these areas. These changes are likely to result in more vibrant and sustainable rural communities.

14. The dam has had positive and negative environmental impacts. Anecdotal evidence suggests the trout fishery was initially greatly improved, but this has dropped off with the development of algal problems over the last couple of years. Greater flows have resulted in fewer river mouth closures, with benefits for water quality and the salmon fishery. The salmon fishery in particular has been very good in recent years. The lake itself has

[1] Full Time Equivalents

provided recreational and hunting opportunities, but has not established itself as a successful wild fishery. Soil fertility indicators suggest higher fertility but also higher intensity of land use and application of N fertiliser. To date there is no evidence that this is adversely affecting water quality.

2 Background

In recent years the benefits and costs of an expansion of irrigated farming have become hotly debated topics, particularly in Canterbury which has dry summers and the potential for large increases in the area of land under irrigation. However while there have been a number of feasibility studies of the likely impact of irrigation development, there have been very few studies after irrigation has been installed. This study was commissioned to address that shortfall. It investigates the impacts of the Opuha Dam on the farms and community it services.

The Opuha dam is located in the upper part of the Opuha river and forms the 700ha Lake Opuha, flooding the land east of the Clayton Road on Sherwood Downs, Opuha Gorge Road. It is a 47 m high earth dam with a crest length of approximately 100 m. Water is discharged into the regulating reservoir via a 7.6 MW turbine.

The Opuha Dam was commissioned in 1999 after a turbulent start including many years to secure agreement and resource consents, and a breach of the dam during construction. While initial uptake of irrigation was relatively slow, the scheme is now fully subscribed and shares have sold at a premium of over 10 times their original cost.

The study we have undertaken is based primarily on surveys of properties serviced by the Opuha Dam infrastructure, and comparing these with dryland farms in equivalent circumstances. The study also involved interviews with other businesses in the area, and the development of a model of the local economy.

2.1 History

- The Opihi Augmentation Society had a consent to irrigate from the Tekapo river, which was based on an allowance in the original agreement when the Waitaki hydro scheme was developed. ECNZ at the time of taking over the consent wished to see this allowance removed, and funded studies to prove the feasibility of other sources. These studies identified the Opuha as a feasible scheme.

- In 1992 the Opuha River Development Company was incorporated and approached a number of other parties for potential involvement. In February 1994 the Opuha Dam Limited company was incorporated and was granted "requiring authority" status under the RMA, with Opuha Dam Partnership being formed later to act as the beneficial owner of the dam assets.

- The funding for the project from irrigators was requested in 2 stages – an initial deposit of $12.50/ha, followed by a call of $50/ha. The Levels Plains part of the irrigation was fully subscribed, primarily because that area had an already operational scheme whose reliability was to be reduced by a revised flow regime in the Opihi River. Take up of shares in the SCFIS area was slower, and private non irrigator interests purchased 20% of the shares (these shares were subsequently sold to the Kakahu irrigation scheme).

- A contract for dam construction was let to Doug Hood Ltd in October 1995. Construction started in 1996, and proceeded to near completion when the dam was breached by overtopping on 5 February 1997. Construction was restarted in early 1998 with Alpine Energy and South Canterbury Finance providing a guarantee to the BNZ. The dam was finally commissioned in November 1999.

- Electricity generation commenced immediately, but irrigation uptake was slow over the first two years. The irrigation is fully operational now, and there appears to be a process of consolidation and leasing of the water shares. For example in the SCFIS area there were 175 shareholders in 1999 and by 2005 this had fallen to approximately 100 shareholders. In the Levels Plains area, leasing appears to be a more common phenomenon, with larger potato and vegetable growers leasing shares from smaller and lifestyle farmers.

- Share prices remained close to original cost for the first three years of the scheme operation. However since the final shares held by non-irrigator interests were bought by the Kakahu Irrigation Society the share price has increased dramatically, and now sits at around $4,000 per share[2].

2.2 Opuha Dam Structure

The Opuha Dam and associated infrastructure is operated by the Opuha Dam partnership. This has four main partners[3]:

- Alpine Energy via Timaru Electricity Ltd (50%)
- Opihi River Development Company (private investors) via Opihi River Holdings Ltd 36%
- South Canterbury Farmers Society Ltd via SCFIS Holdings Ltd (8.6%)
- Levels Plains Irrigation Company Ltd via Levels Plains Holdings Ltd (5.4%)

The assets of the dam are held by Opuha Dam Ltd.

The irrigation part of the ownership is structured such that farmers hold shares in irrigation companies (South Canterbury Farmers Irrigation Society (SCFIS) and Levels Plains), who have a contract for 80% of the water allocated to their scheme from the Opuha Dam on a take or pay basis. Timaru District has an agreement for a further 2l/s for the full irrigation season on a take only basis.

The Opuha Dam partnership ran at a loss for the first five years of its existence, which is two years longer than was forecast in the feasibility studies. Electricity returns have been more variable than forecast, and operating expenses appear to have been slightly higher than forecast. The dam partners have introduced further capital into the company to reduce debt and ensure the operation remains viable. It is possible that the irrigation companies will buy out the ORDC (private investors) shareholding over the next few years.

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[2] Each share is 4 ha of irrigation

[3] Source: Nigel Gormack, Hubbard and Churcher, pers. comm..

Because of changes to the scheme around the time of finalization and changes to river management regimes, shareholders in different parts of the district experience different irrigation conditions. Those above the dam, and in the Tengawai catchment, may be unable to irrigate with their shares from the Opuha Dam because the flows in their catchment prior to the confluence with the Opihi are too low. This situation was exacerbated by changes to the location of measurement for minimum flows in these rivers, and the non implementation of infrastructure which had been originally envisaged to take water from the dam to the south east into the Tengawai and Opihi catchments.

The process of leasing and sale requires approval from the Boards of the irrigation societies. The irrigation societies are looking at facilitation of trading, particularly for within-season transfer of water. Initially this will involve transfers from users who can't irrigate due to low flows in the catchments above the Opuha confluence, but may be extended to other situations. The ability to trade is complicated by the need to involve ECan and consent processes.

3 Method

The aim of the study is to determine, after the fact (*ex post),* what the impacts of the Opuha Dam have been on the farm operations, businesses and local community. In doing this it has not been possible to compare the situation before the dam with the situation after the dam. This is because there have been large scale changes of ownership, changes in productivity generally, and changes in product price structures. Furthermore the pre-dam period is simply too long ago to allow reasonable analysis using people's memory and accounts. Because of these confounding influences we have chosen to compare the situation with irrigation in the community with that which would exist without irrigation. We have done this by comparing irrigated properties with dryland properties in the same general location – on the assumption that if irrigation had not gone ahead those properties which are now irrigated would have developed along the same lines as currently dryland properties. Even this approach has a number of complicating factors, which are discussed below, but it does allow clear separation of the effects which can be attributed to the irrigation and those which have resulted from other changes in the industry and community more generally.

The study is based on survey and modeling of the regional economy. These are discussed below.

3.1 Study Area

The areas in which irrigation schemes exist and have their economic impacts do not always conform to Territorial Local Authority Boundaries. In the case of the Opuha irrigation scheme we have determined that the relevant area for economic impacts includes the Timaru district and those parts of the Mackenzie district which are East of the Hunter Hills and the Two Thumbs Range. Throughout this report we refer to this as the Study Area. It was decided not to include the entire Mackenzie District in the study area because it was considered that the Mackenzie Basin area had a significantly different economy and flows of trade to that of the rest of the study area. Its inclusion would have potentially distorted the results for the study.

In the interview process we also distinguished between the rural and small centre economies and the Timaru economy. The results of the spending pattern survey were not incorporated into the economic model because of the scale was too small for the model, however we have reported the location of direct farm expenditure as an indication of the relative scale of impact.

3.2 The Study Period

The study covers two financial years, 2002/3003 and 2003/2004. These financial years were considered to be the most recent ones for which farmers were likely to have records.

The rainfall and moisture deficit information for those two growing seasons is shown in Table 4 and Table 5 below. The data suggests that the two growing seasons were close to or slightly below average. Rainfall in the October to March period was below average, slightly outside a single standard deviation for the year ending June 2003, but only moderately below average for the year ending June 2004. For the peak summer months both years had rainfall that was below average but within a single standard deviation, and the rainfall in spring and autumn was lower by a larger amount than summer for both years.

Soil moisture deficit information is calculated from the difference between rainfall and pan evapotranspiration, and should be used as an indicative figure only. The maximum deficit in both study years was higher than the average, but again this was well within a single standard deviation of the average.

Farmers anecdotally report both years as being ‘not too bad’, and we therefore expect that differences between the dryland and irrigated returns can be attributed to differences in the farm systems rather than as differences in financial performance as a result of dryland farmers having to cope with drought. Because drought years do occur within the study area, and the irrigated farmers are less likely to be affected by those droughts, we consider that the results from the study will ***underestimate*** the total impact of the irrigation development on the farming operations and on the surrounding community. This underestimate is unavoidable because of the need to limit the number of years studied, but means that the results can be considered conservative in relation to the long term expected outcome.

Table 4: Rainfall at Timaru Airport (source NIWA 2006)

Description	Full Season	Spring	Summer	Autumn
Months covered	October - March	Oct - Nov	December-Feb	March - April
1991	332.4	132.4	166.8	33.4
1992	172	119.4	57.4	19
1993	281.4	102	134.8	101.6
1994	437.6	95.2	169.2	120.8
1995	243.4	65.4	115.8	117
1996	388.4	126.6	178.4	122.6
1997	368.2	143	172	98.2
1998	221	63	102	57.6
1999	234.8	102.2	94.4	91.8
2000	351	118	158.4	162.6
2001	190.4	97.2	94.2	15.6
2002	367	131.6	208.2	107
2003	*205.6*	*79*	*125.8*	*64.8*
2004	*270.2*	*103*	*168.4*	*49.4*
2005	469.2	109	219	76.6
Average	**302.1**	**105.8**	**144.3**	**82.5**
Standard Deviation	**92.7**	**23.8**	**45.5**	**42.2**

Table 5: Maximum Soil Moisture Deficit Estimates for Timaru Airport (source NIWA 2006 – higher number means drier period)

Description	Full Season	Late Spring	Summer	Early Autumn
Months covered	October - March	Oct - Nov	December-Feb	March - April
1993	125.5	77.7	122.5	125.5
1994	132.9	132.9	123.6	100
1995	135.2	120.2	135.2	133.1
1996	124.8	80.4	124.8	101.4
1997	118.7	79.2	118.4	115.8
1998	145.2	136.9	145.2	124.8
1999	143.7	119.1	143.7	127.4
2000	122.7	96	117.7	122.7
2001	142.2	100.4	136	142.5
2002	124.8	99.8	124.8	116.3
2003	*143.9*	*113.8*	*143.9*	*137.1*
2004	*143.5*	*112.3*	*143.5*	*118.3*
2005	121.5	108.6	121.5	77
Average	**132.6**	**105.9**	**130.8**	**118.6**
Standard Deviation	**10.0**	**19.3**	**10.6**	**17.5**

3.3 Survey Procedure

1. The project was commenced in April 2005. An initial postal survey was commissioned to help define land use, land areas and scale of irrigation development. The postal survey instrument was developed and tested in April 2005, with forms being sent to all irrigators in the SCFIS and Levels Plains schemes.

2. Returns were received through May, and a database of returns and answers collated in June. A return rate of only 30% was achieved despite telephone follow up. As a result the data from the postal questionnaires was not used in the final analysis, although it was used as a check on the aggregated data from the personal interviews to reduce the likelihood of significant biases having been introduced through the sampling process.

3. A workshop was held in May attended by Willie Smith (Auckland University), Geoff Butcher (Butcher Partners), Cheryl Macauley (Commercial Property

Investments) and Simon Harris (Harris Consulting). The workshop was used to develop the personal interview form and identify the sampling process.

4. A training session was held with the interviewers in late May 2005, and the interview tool was tested in June 2005 using four interviewers doing two interviews each. A feedback session was held with the interviewers, to discuss the interview and issues which had arisen. Adjustments were made to the form to reflect the feedback.

5. Data from the irrigation companies regarding shareholdings was used to develop a sample. The sample method chosen was a weighted random sample, with the final sample reflecting area under irrigation. The weighting was used to generate an ordered sample list. The sample was also checked for land use to ensure the final sample reflects the distribution of land use as indicated by the postal survey.

6. Interviews were undertaken on a quota basis, with the interviewers working through the list until their quota of interviews was completed. SCFIS and Levels Plains schemes were treated as separate samples, with the quotas for each scheme reflecting their share of the total irrigated area.

7. A data entry template was developed in Excel. Interviewers entered completed surveys and returned these for checking and analysis.

8. The postal survey results were analysed to develop a distribution of soil types in the irrigated area. This soil distribution was used together with a map of farms in the study area, and a map of irrigated properties to identify dryland properties for surveying. The dryland properties were selected on the basis of location and soils. Names from the farm maps were matched against information from the telephone book. A final sample list was randomized, and letters sent out to those on the list indicating that they were likely to be contacted for an interview. The dryland sampling was also a quota sample, but was partly non-randomised because a degree of personal judgement was

required from the interviewer following initial contact to determine whether the property was appropriate for comparison with the irrigated properties in the area.

9. The irrigated personal survey form was adapted for the dryland sample. Two interviewers were used to undertake the dryland sampling, and a separate data entry template was developed.

10. Personal interviews have been held with a 5 businesses in the area to determine impact from irrigation on the economy and subsequently written up. Interviews with businesses in the area undertaken for a previous project were utilised for the report. Interviews were also held with Fish and Game New Zealand, Environment Canterbury, Hubbard and Churcher and Alpine Energy.

The data was consolidated and analysed. Several interviews were discarded because of data problems, and a further two dryland data sets were altered to accommodate differences in the soil types on areas of the farm[4]. The sample was as follows:

Table 6: Sample Size

	Sample provided	Interviews completed	Discarded	Sample size	Area
Irrigated	97	41	9	32	10,410
Dryland	54	25	5	20	6,301
Total	151	66	14	52	

While the sample size fell well short of the initial targets for the project, the process of securing interviews proved more difficult than had been anticipated. Whilst a number of people were willing to be interviewed, once beyond those eager to help the task of finding suitable interviewees and organizing interviews became very difficult. This caused motivation difficulties with interviewers, and long delays in completing the interviews. Ultimately it was decided that delaying the completion of interviewing to achieve the desired number of interviews was becoming

[4] These properties included substantial areas of higher soils which were very low productivity. The effective farm areas, productivity and financial results were adjusted to accommodate these areas.

counterproductive, and the project was better to report current data based on a smaller than desired sample rather than wait longer.

3.4 Sources of Error in the Sample

The 5,000 ha of irrigation included in the sample is approximately 30% of the total irrigated area and approximately 15% of the irrigation shareholders. However it is difficult to determine the true population size of the irrigators, because of leasing and sale of shares among farmers. However despite this we believe we have a reasonably good sample of the irrigated population, although not at a level which would allow analysis for individual land uses.

The differences between the dryland and irrigated samples are potentially a source of error, particularly if the dryland properties have different soils or climate from the irrigated properties. We have controlled adequately for climate by selecting properties in the same general location as the Opuha delivery area. However the soils are more difficult to control for, since the exact makeup of soils on a single property is very difficult to determine in advance despite the use of soil maps. Whilst questions were asked regarding soil types in the interview process, description by interviewees of their soil types has proven too variable to allow proper analysis and comparison of the results. The information has been used to exclude results which were clearly too different to allow proper comparison, but it is not possible to control for more subtle biases.

No non respondent survey was undertaken, although the results from the interview were compared with the postal survey. The personal interview has a higher average farm size, greater proportion irrigated, and slightly shorter time in ownership than the postal survey. However these results can be explained by the weighting of the sample for farm size.

Table 7: Comparison of Postal Survey and Personal Interview Results

	Postal Survey Average	Interview Survey Average
Total Area	190	325
Area typically irrigated	114	160
Number of owner managers	1.4	1.5
Number of employees	1.3	2.8
Years in current ownership	18	12
Gross annual revenue	$484,000	$674,000
Revenue/ha	$2,550	$2,070

3.5 Modeling the Regional economy

This chapter contains definitions of terms used in this report and a summary of the way in which regional economic tables were developed and multipliers calculated. The section on the theory of economic impact models is brief, and assumes the reader has some prior understanding. Those who wish to know more should consult one of the numerous texts on the subject[5].

3.5.1 Definitions

Employment -Employment is work done by employees and self-employed persons, and is measured in Full-Time-Equivalent jobs (FTEs). The respondents were asked to estimate FTEs of a part time job on the basis of a 40 hr week for a full year per FTE. Hence 20 hours per week is 0.25 FTEs.

Where work is seasonal, the conversion to FTEs is based on 12 months work per year. So a seasonal worker working full time for six months per year is 0.5 FTEs, and a part time seasonal worker working ten hours per week for six months is 0.125 FTEs.

5 For example, Richardson et al., (1972); Jensen & West (1982), Butcher (1985).

Output - Output is the value of sales by a business. In the case of wholesale and retail trade, it is the total value of turnover (and not simply gross margins)[6].

Value-Added - Value-added includes household income (wages and salaries and self-employed income), and returns to capital (including interest, depreciation and profits). It also includes all direct and indirect taxes.

Household Income - Household income is the gross income of households. It includes the income of self-employed persons. There is sometimes considerable uncertainty as to the proportion of business income which goes to households and this is particularly the case for farms, where tax accounts are more likely to show various forms of income and drawings which are tax effective as opposed to a realistic assessment of the actual flows of funds during the year. When estimating indirect economic impacts, one needs to know the increase in household income which occurs in the District and how it will be spent. Where owners of business capital live out of the District, dividends and interest do not form part of the District household income. Even where the owners do live in the District, profits which are not used for household spending do not lead to economic impacts[7].

Direct Economic Impacts - The direct impact arises from the production by farmers of goods and services. The direct employment is of people who work on the farms. The direct output is the value of sales made by farmers at their usual point of sale. The direct value-added is the value-added in those farming businesses. It is the returns to land labour and capital and is equivalent to EBITDA[8] + wages.

Indirect Economic Impacts - The indirect impact arises from increased spending by businesses as they buy additional inputs so that they can increase production. This indirect effect can be envisaged as an expanding ripple effect. A farmer sells milk,

6 Care has to be taken in combining retail sales figures with employment per $m of output from input - output tables. In these tables, output is generally defined as gross margin. By contrast, business statistics figures usually give employment per $m of turnover.

7 Profits may be invested back into the District, but the impacts of this investment are excluded on the grounds that the investment could be financed by borrowing and hence is not dependent on the earlier profits.

8 Earnings before interest, tax, depreciation and amortization.

but has to buy fertiliser and hire a contractor to spread it. The contractor has to buy fuel and get his truck serviced. The mechanic has to purchase electricity and waste disposal services to operate his business. All of these businesses have to employ more staff to cope with the increase in work. All the increased employment, output and value-added (apart from that on the farm) is the indirect effect. Note that indirect effects only include "upstream" effects (via buying more inputs), but do not include any stimulated development downstream which is addressed separately.

Induced Economic Impact - The induced impact is the result of increased household income being earned and spent, and leading to a further ripple effect of increased employment, output and income.

Downstream Impacts - Impacts which are not driven by an activity's demand for extra inputs, but which might arise as a result of a particular activity, are sometimes called the "downstream impacts". An example in farming is meat processing and milk processing because the increase in farm output leads to increased activity in the processing works. The processing industries do not provide an input into farming, and hence are not an indirect or induced effect of the farming. They are a downstream effect and have been estimated separately in this study.

Total Economic Impacts - The total impact is the sum of the direct, indirect and induced impacts.

3.5.2 Principles of Multiplier Analysis

When farmers spend money on various services and goods, this generates direct employment, output, and value-added. The businesses which sell to farmers use part of the money received to purchase goods and services from other local businesses, which as a result purchase more inputs than they otherwise would. These "business support" effects are generally termed "indirect" effects. To find out the scale of the indirect effects, we must examine the expenditure patterns of the farm businesses. What do they buy, and from where do they buy it (in the Study Area or out of the

Study Area) ? This examination was done through the expenditure survey of farmers (see Section 3.3).

Businesses purchase not only goods and services, but also labour. The businesses pay for labour via either wages and salaries or drawings (by the owners of the business). The increase in household income arising from farming activity leads to increased household expenditure, which further increases output, value-added and employment in the Study Area economy. These additional effects generated by household spending are termed “induced” effects, and their extent depends on the proportion of household spending which is undertaken within the Study Area (this proportion was estimated during the survey of farmers as being about 80 per cent).

3.5.3 Generation of a Study Area Economic Model

Regional economic models can be generated using a national production function and modifying the input coefficients to reflect average regional self-sufficiency in the various input industries. This approach presumes that input structures for a given industry are the same in different regions. By contrast, survey-based analysis establishes the input structure (type and origin) of the industries in question (in this case, farming industries) in the particular region. The survey-based approach gives far more reliable results, and surveying is essential in a situation such as the Opuha irrigation scheme when national level data for the farm types in question are either not available or are not representative of the industry in the region.

While one can question farmers to find out what they purchase, this gives only the first round of indirect impacts. To estimate the further impacts caused by the spending of businesses further down the chain, one has the option of surveying all those businesses as well (which is prohibitively expensive), or estimating the probable pattern of their expenditure on the basis of information that already exists about national average expenditure patterns of businesses of this type, and the regional location of businesses that supply those inputs. For example, if we know that one per cent of all farm costs are spent on wool packs and we know that the Study Area has no factory producing wool packs, then we can assume that this one per cent of costs is imported into the region. If we know that on average three per cent of farm costs are spent on fertiliser and if we know that there are sufficient fertiliser blending and storage facilities in Timaru for the Study Area to be 80 per cent self-sufficient in fertiliser, then we assume that 2.4 per cent of inputs are purchased from the local fertiliser industry, and a further 0.6 per cent of inputs are imported into the area.

All the information and assumptions are incorporated into a separately estimated Study Area input-output model. This specific Study Area model is generated using an existing national input-output model, information about the regional distribution of employment and output, and a mathematical technique called GRIT [9] (Generation of Regional Input-output Tables - which estimates the source of inputs into regional industries). This model is then adjusted by incorporating into it the survey data that has been gathered about the type and source of purchases by farmers in the area of the Opuha irrigation Scheme. The input-output model can be used to calculate the total effects on all sectors of an increase in output of any single sector. These total effects include the original effect and all the consequential rounds of indirect and induced effects. Note that it does not include any downstream impacts (see definition of indirect impacts above), which have to be calculated separately.

The Study Area economic model generated for this study is based on the national inter-industry model for 2000/01. Up-to-date (2005) business survey employment data, gathered by the Department of Statistics was then incorporated into the Study Area model to update it still further.

The GRIT process uses Study Area output by industry as its starting point. There is limited information currently available on regional output by industry, especially for a small region such as the Study Area, and Statistics New Zealand will not release highly disaggregated data on the grounds that to do so would breach commercial confidentiality of businesses supplying the data. For the Study Area the most detailed data that are available relates to employment as measured by the census and the

9 Developed in Australia and widely used there and in New Zealand. See West et al., (1982), or Butcher (1985).

annual Business Enterprise survey. The Study Area inter-industry table is estimated using the standard GRIT procedure.

Once the survey information had been incorporated into the Study Area model, employment, output, value-added and household income multipliers can be estimated for each farming scenario using matrix algebra[10]. Type II multipliers (which include induced effects) were calculated. It is clear that the increased direct household income from farming stimulates household spending and hence economic activity in the Study Area, and for this reason it seems appropriate that Type II multipliers be used to calculate total economic impacts.

For this project, we estimated multipliers separately for irrigated farms and dryland farms.

10 Customised software (e.g., IO7- available from the authors) which undertakes the matrix manipulation is readily available. Numerous texts are available which describe general input-output models.

3.6 Interpreting the results

There is little doubt from the results we have collected that the properties which have been irrigation capability show considerable increase in turnover, net returns, and economic impact on the district. We do not define whether this impact is a *benefit* associated with irrigation, merely that the study has observed that each ha of irrigated land has an *associated impact*. This impact will be derived from a number of sources:

On the irrigated area:

- Increase in production associated with irrigation on existing systems
- Change in systems to higher intensity land uses such as dairying and cropping which are possible with more reliable irrigation.

On associated dryland areas

- Increase in production on associated dryland from changes to the overall system from a reduction in perceived risk
- Increased investment with new owners and lower perceptions of risk
- Different management regimes with different owner types - for example irrigated owners were typically younger than those on dryland.

Some of these differences can be seen as *causal*, and some are not – for example irrigation has a causal linkage with an increase in production on the irrigated land, because more water is being applied. Some of the linkages with increase in production on dryland has a causal linkage with irrigation – such as confidence to increase investment and a perceived reduction in risk. However some increases may be *casual* – for example farmers who chose to take up the irrigation from the Opuha may have been better managers than those who chose to remain dryland. We cannot distinguish entirely between the causal and casual factors involved, and therefore some caution is warranted in interpreting the results.

3.7 Other confounding influences

The results are presented as aggregate differences between irrigated and dryland areas. Within the scheme there was a significant area that was already irrigated which comprised the Levels Plains irrigation scheme and some farmers currently shareholders in SCFIS. The reliability of the Levels Plains scheme without the Opuha Dam would have been significantly reduced by a revision in the Opihi River Management Plan which raised the minimum flow. Whilst irrigation would likely have continued without the dam, it would have been at a lower level and intensive land uses such as vegetable cropping, dairying and horticulture would not have been viable. It has not been possible in the course of this study to estimate what irrigation would have been undertaken in the absence of the dam, and what the associated economic impacts would have been. The results therefore report the net impact of irrigation associated with the dam, not the net impact from the dam. We believe that because the irrigation without the dam would have been unreliable[11] and because a significant proportion of the increased impact comes from the highly intensive land uses that require high reliability, the difference between these two numbers is not great. It is important to note however that they are not the same.

In a similar vein there are a number of shareholders for whom reliability is compromised by the river management plan flow regime. Those shareholders who are not in the direct flow below the dam benefit from enhanced flows in the Opihi below its confluence with the Opuha, but not at their own take points. For example the Opihi upstream from the confluence, the Tengawai, and the North and South Opuha above the dam all experience restrictions as a result of minimum flow regimes at their take points which are not ameliorated by releases from the dam. This issue was not anticipated when the dam was originally set up because the minimum flow regime for the whole catchment was based on the flow at SH1. However after the dam was built pressure came on these other tributaries, and the regional council responded by establishing minimum flows for each branch. This situation means that the results

[11] Under a 3.2cumec minimum flow, there were an estimated 3 years in 25 with more than 2 months of restriction, and further 7 years with more than 18 days of restrictions.

for the study are valid, but do not represent the impact associated with a fully reliable system as was intended when the Opuha was first mooted.

4 Results: Physical and Resources

The sample of irrigated farms (selected randomly) was 32 properties. A small number of properties also had access to groundwater for irrigation. The irrigated farms sampled had a total effective farm area of 10,410 ha with 49% or 5,129 ha of this area irrigated. Average farm size was 325 ha with an average irrigated area of 160 ha. This indicates that the 16,175 ha of irrigation capacity enabled by Opuha shares have created an area of 32,830 ha of farmland associated with irrigation capability from the scheme.

The sample of 20 dryland farmers was selected to ensure that they were within the potential command area of the Opuha scheme and closely matched the characteristics of the irrigated properties in terms of location, soil type and climate zone. The dryland farms sampled totalled an area of 6,521 ha with an average farm size of 326 ha. This indicates that the dryland sample also closely matched the irrigated sample in scale of operation.

4.1 Resources

Table 8: Land Area of Sampled Farms (ha)

	Dryland	Irrigated
Total Effective Area	6,521	10,410
Average Property Size	326	325
Irrigated Area (Total)		5,129
Average Irrigated area		160

Table 9: Soil Fertility on Sampled farms

	Dryland	Irrigated
Average Soil Test Range (Olsen P)	13 to 17	24 to 40
N applied (kgN/ha)	37	58 (dryland) 87 (irrigated)

Olsen P is a measure of the P status of the soil, and because P is one of the key limiting nutrients in NZ soils, Olsen P is a good measure of the likely productivity of that soil. It has the advantage of being readily available as it is measured by most farmers as part of their fertiliser programme, and is not subject to large intra or inter seasonal variations that occur with a nutrient such as N.

The irrigated properties had much higher soil fertility with average Olsen P levels ranging from 24 to 40 while the dryland properties ranged from 13 to 17. This is most probably a reflection of the application of capital fertiliser, to lift average fertility levels as part of irrigation development and associated increases in land use intensity, rather than an indication of differences in inherent soil fertility characteristics between the samples.

4.2 Land Use

Irrigation capability enables farmers to intensify land use through increases in intensity of their current land use as well as diversification into new land uses. Diversification can be partial in that the mix of land uses on a farm can change, e.g. more arable cropping, or can see a complete property change of land use e.g. conversion to dairying.

Table 10 reports the differences in land use intensity and diversity between the dryland and irrigated properties.

Table 10: Land Use on Sampled Farms

	Dryland	Irrigated
Proportion of Pastoral Stock units%		
Sheep	75%	44%
Beef	18%	12%
Dairy	0%	35%
Deer	8%	9%
Stocking Rate on Effective Area (su / ha)	9.0	9.9
Stocking Rate on Livestock Area (su / ha)	11.4	13.7
Proportion of Cropping Area		
Feed crops grown for sale	2%	9%
Cereal grain area	53%	38%
Process Vegetable area	3%	23%
Small seed area	28%	23%
Other crop area	15%	7%
Crop as a % of Effective Area	15%	25%
Horticulture, Viticulture and Other		15%

The dryland properties are predominantly livestock land use with 85% of the land area in Sheep Beef and Deer farming and 15% of the area in cropping. Livestock operations are dominated by sheep farming (75%) while cropping is strongly based on cereal grains (53%) with small areas of small seeds and other crops. The average stocking rate is 9.0 Stock units per ha (su / ha) over the total effective area and 9.9 su / ha over the livestock area (Effective area – Crop area). There is no intensive land use such as dairying, viticulture, horticulture or other diversified land uses.

The irrigated farms have a much different mix of livestock activities with higher proportion of land in crops (25%) with sheep farming (44%) being less than half the livestock farming activity. Dairy farming contributes 35% of the livestock units. Stocking rate on the livestock area is much more intensive at 13.7 su / ha.

Cropping is a much more significant land use with 25% of the land area in some form of crop. The nature of the cropping activity is significantly different than dryland with the crop mix having a much higher proportion of process vegetable production (23%) and feed crops grown for sale (9%) with less reliance on cereal grains.

Horticulture and viticulture development are equivalent to approximately 15 % of the arable area.

4.3 Productivity

As shown in Table 11, the most significant differences in productivity measures between Dryland and Irrigated properties are in the area of crop yields. This is a reflection of increased productivity enabled by irrigation capability which is shown by the lift in average cereal yields from 6.5 to 8.0 T / ha. The other difference is the variety of crops grown under each heading. For example the process vegetable crop grown under dryland is mainly process peas with relatively low yields. The process vegetable crops grown under irrigation includes potato crops with very high yields.

Table 11: Productivity Measures on Sampled Farms

	Dryland	Irrigated
Lambing %	136%	144%
Beef Calving %	94%	94%
Milksolids / Cow		384
Fawning %	89%	84%
Velvet kg / ha		44
Feed crop yield (T / ha)	3.1	12
Grain Yield (T / ha)	6.5	8
Process Vegetable (T / ha)	5.6	24
Small Seed (T / ha)	1.7	1.9

The irrigated respondents were asked to identify changes in their farm systems over the period of ownership, and to compare current production with pre irrigation levels. The main changes included a major change to the farm system (34% of respondents), a change to dairying (27%), increased stock numbers (27%), better finishing (24%) and increased scale (24%). Subdivision, pasture renewal and crop changes were also significant changes (15 – 20% of respondents).

5 On Farm Impacts

Financial information taken from farm accounts for the years 02/03 and 03/04 was averaged to present financial performance from the dryland and irrigated data sets. Table 12 presents a summary of that data. More detailed presentation of the individual revenue and expenditure category headings is appended as Annex 1.

Table 12: Financial Performance Summary Table

	Dryland		Irrigated	
	% of Revenue	$/ Eff ha	% of Revenue	$/ Eff ha
Total Revenue		**862**		**2073**
Farm Working Expenses*	**76%**	**655**	**73%**	**1503**
Cash Farm Surplus*	**24%**	**208**	**27%**	**570**
Total Overheads		**213**		**484**
Net Trading Profit After Tax*	**-1%**	**- 5**	**4%**	**86**
Disposable Surplus (Deficit)		**(142)**		**(153)**

* As a proportion of Total Revenue

The following discussion refers to the Summary Financial table above but also draws from information in the more detailed financial table in Annex 1.

- Total revenue is significantly higher (+140%) at $2,073 / ha for the irrigated farms than the dryland at $862 / ha. There is also a significant difference in the sources of income with Sheep being the dominant income source on the dryland with 45% of the revenue while only contributing 18% of the revenue on the irrigated farms. Livestock revenue in total is 68% of revenue on dryland farms and 55% on the irrigated farms, with dairy farming providing more than half the livestock revenue on the irrigated properties.

- Cropping is a much more significant revenue source on the irrigated farms than the dryland farms with 45 % of the total revenue on irrigated farms coming from the arable and process crops grown. A large contributor to the impact of crop revenue in the command area of Opuha irrigation is process vegetable cropping. Process vegetable cropping accounts for approximately

23% of the cropped area on irrigated sample farms but contributed approximately 35 to 40% % of the total crop revenue. The influence of the high total revenue per hectare cropped from process vegetables lifts the average returns from the total cropping area well above the gross return possible from any of the other individual cropping options. The influence of the land use choices made available by the process cropping industry in South Canterbury is significant in the financial impact results reported in this study.

- The relationship of Farm Working Expenses to Total Revenue is very similar between the dryland and irrigated properties (76% and 73% respectively) therefore the difference in total expenditure is very similar to the difference in revenue (130% greater). The most significant category changes in expenditure are less livestock expenditure for irrigated farms and, obviously, more irrigation expenditure. Other than that, expenditure categories are very similar as a proportion of total expenditure for both farm types. Expenditure as a proportion of revenue is higher than indicated in other surveys such as MAF Farm Monitoring data, but this may relate to the use of farm accounts rather than cashflow, and since accounts are prepared for tax purposes they tend to include items of expenditure that may otherwise be attributed to development or non farm activities.

- Cash Farm Surplus as a proportion of Total Revenue is similar between the two farm types at 24% and 27% respectively but the surplus on the irrigated farms is 175 % higher than the dryland farms at $570 / ha.

- Overhead expenditure (Interest, Rent, Depreciation and Tax) is significantly higher on the irrigated farms although they are a very similar proportion of Total revenue at approximately 24%. Interest costs at approximately $240 / ha on the irrigated farms compared with $68 / ha on the dryland farms are the biggest difference. As a proportion of total revenue, interest costs on the irrigated farms are 11.5% of Total Revenue compared to 8% on the dryland properties.

- Capital expenditure on irrigated properties is no greater than on dryland, on a per ha basis. This appears slightly counter-intuitive, but may relate to the timing of the study in relation to recent capital expenditure associated with development. There are also structural issues with the accounts studied, with a number of properties having separate companies for holding assets and for operations. This made proper analysis of capital structures and expenditures difficult.

- The average Net Trading Profit after Tax on the dryland properties is marginally negative while slightly positive on the irrigated properties. After provision for Drawings, Principal Repayment and Capital Expenditure the disposable deficits are very similar on both farm types at approximately $150 / ha. This indicates that both farm types are most likely funding capital programmes (new purchases, replacement and depreciation) out of increased debt. Accordingly both farm types will be achieving balanced cash positions after new borrowing to fund capital activities. Note that both Net Trading Profit and Disposable Deficits are highly influenced by the fact that the accounts we analysed were prepared for taxation purposes. Cash Farm Surplus is probably the more reliable measure to use for comparison under these circumstances.

5.1 Scheme Wide Financial Impacts of Irrigation

Scheme wide financial impacts have been calculated by deducting dryland performance from irrigated performance on the sample farms to determine the financial impact of irrigation at the total farm area level (reported on a $ / ha basis). This result has then been divided by the proportionate area irrigated to report the financial impact per hectare irrigated. The impact per hectare irrigated multiplied by the scheme area reports the total financial impact of the Opuha scheme at the farm gate.

The results of these calculations are reported in Table 13 for the major financial parameters.

Table 13: Direct Financial Impacts of Irrigation

	Total Revenue	Farm Working Expenses	Cash Farm Surplus	NTPAT
Farm Level Impact of Irrigation / ha ($) *	$1,211	$849	$362	$92
Impact / ha Irrigated ($)**	$2,457	$1,722	$735	$186
Impact over scheme area. ($m / annum)***	$39,740,000	$27,850,000	$11,890,000	$3,000,000

* = $ / ha Irrigated properties - $ / ha dryland properties

** = Impact of Irrigation / proportion of area irrigated. (0.493)

*** = Impact / ha irrigated x scheme area. (16,175 ha).

Table 13 indicates that the total farm gate impact attributable to the Opuha Irrigation Scheme is;

- An increase in Total Farm Revenue of approximately $40 m / annum.
- An increase in Total Farm Working Expenditure of approximately $28 m / annum.
- An increase in Cash Farm Surplus of approximately $12 m / annum.
- An increase in Net Trading Profit after Tax of approximately $3 m / annum.

6 Community Impacts

This chapter describes farm-related impacts including direct, indirect and induced output, employment and value added, as well as all downstream processing-related impacts from meat processing and dairy processing. We show direct economic impacts on farms as well as the first round spending impacts on minor urban centres which service the farming sector. Finally, we show the total impacts, including farming and processing multiplier impacts and total processing industry impacts, on the entire Timaru district.

6.1 Direct Farm Impacts

- As noted above output averages about $0.86 million / 000 ha / yr on dryland farms and $2.07 million / 000 ha / yr on irrigated farms in the Opuha scheme. Hence the irrigated farms are 2.4 times as productive per ha as dryland farms.

- The data indicates 5.6 FTEs per $million of output on dryland farms and 4.6 FTEs / $million on irrigated farms. Given the large differences in output per ha on the two farm types, we estimate that there are 4.8 FTEs per 000 ha on the dryland farms and 9.5 FTEs per 000 ha on irrigated farms. Hence the irrigated farms generate 2.0 times as many on-farm FTEs per ha as do dryland farms.

- Value added averages $0.25 million per 000 ha / year on dryland farms and $0.57 million / 000 ha / yr on irrigated farms, so the irrigated farms generate 2.3 times as much value added per ha as do the dryland farms.

- The household income figures for farms (which are a part of value added) are very uncertain because the reported allocation of income between profits and drawings tends to reflect accounting for tax purposes rather than actual financial flows. However, on the basis of the information we were given we estimate that farm-generated household income including drawings was $0.10 million / 000 ha / yr on dryland farms and $0.30 million per year on irrigated farms; so the irrigated farms generate 3.0 times as much direct household income as do dryland farms.

6.2 Effects on the Rural Area and Small Centres

We asked farmers what proportion of their spending they did in rural areas and small centres (i.e. other than Timaru). The results indicate that expenditure patterns are similar for dryland and irrigated properties. On the basis of their responses we estimate that direct farm spending in the rural area and small towns by dryland farms averages $383,000 per 000 ha., whereas for irrigated farms it averages about $927,000 per 000 ha. The impact per ha is about 2.5 times as great for irrigated farms as for dryland farms.

Table 14 Proportion of Spending in Various Areas

	Rural and small Towns	Timaru	Out of Study Area
Dryland	54 %	34 %	12 %
Irrigated	55 %	39 %	6 %

6.3 Multiplier and Flow-on Effects

As described in section 2, multiplier and flow-on effects of these increases in farm production were estimated through a regional model. The processing impacts are based on the assumption that all milksolids will be processed in the district at the Clandeboye plant, that all vegetables will be processed locally, and that about one quarter of the cattle and one half of the sheep meat production will be processed in the study area[12]. Details of the impacts are contained in Table 15 below.

On the basis of the results, we estimate:

- Total regional output will be approximately $2.3 million / yr / 000 ha of dryland and $6.1million per year / 000 ha of irrigated property.

[12] Some cattle are slaughtered locally and there is a sheep chain at the Smithfield works. The proportions we have assumed are slaughtered locally are based on survey responses from farmers.

- Every 000 ha of dryland will generate 12 FTEs in the region compared to the 27 FTEs generated by irrigated properties.
- Every thousand hectares of dryland will generate $0.71 million / year of value added (including $0.38 million of household income) compared to the $2.0 million of valued added (including $0.99 million of household income) generated by irrigated properties.

Table 15: Economic Impacts per 000 ha

	Dry Land	Irrigated Land
Output ($m / year)		
Direct on Farm	$0.86m	$2.07m
Direct in Processing	$0.67m	$2.04m
Indirect and Induced	$0.76m	$1.94m
Total	$2.29m	$6.05m
Employment (FTEs)		
Direct on Farm	5.1	9.6
Direct in Processing	1.8	4.8
Indirect and Induced	5.4	12.6
Total	12.3	26.9
Value Added ($m / year)		
Direct on Farm	$0.25m	$0.75m
Direct in Processing	$0.14m	$0.38m
Indirect and Induced	$0.32m	$0.83m
Total	$0.71m	$1.96m
Household Income ($m / year)		
Direct on Farm	$0.10m	$0.30m
Direct in Processing	$0.08m	$0.20m
Indirect and Induced	$0.20m	$0.49m
Total	$0.38m	$1.0m

Table 16 Total Economic Impacts associated with irrigation from the Opuha Scheme

	Dry Land	Irrigated Land	Difference	Total Economy for Study area	Opuha Impact as a proportion of Study Area Economy
Output ($m / year)					
Direct on Farm	$28m	$68m	$40m		
Direct in Processing	$22m	$67m			
Indirect and Induced	$25m	$64m			
Total	$75m	$199m	$124m	$3,550m	3.5 %
Employment (FTEs)					
Direct on Farm	16	314	145		
Direct in Processing	60	156			
Indirect and Induced	164	394			
Total	404	884	480	$19,950	2.4 %
Value Added ($m / year)					
Direct on Farm	$8m	$25m	$16.3m		
Direct in Processing	$4m	$13m			
Indirect and Induced	$11m	$27m			
Total	$23m	$64m	$41m	$1,333m	3.1 %
Household Income ($m / year)					
Direct on Farm	$3m	$10m	$7		
Direct in Processing	$3m	$7m			
Indirect and Induced	$7m	$16m			
Total	$13m	$33m	$20m	$850m	2.4 %

We estimate that the total area for farms which are completely or partially irrigated from the Opuha irrigation scheme is 32,830 ha. The irrigation associated with the Opuha has led to an increase in direct farm production of $40 million per year and has generated an additional 145 on-farm FTEs. It has also generated an additional $16.3 million of added value per year on farm, including $7 million / year of household income.

For the entire economy of the study area – Timaru District and the Fairlie Basin - the increase in value added has been $41 million per year, which is equivalent to 3.1 % of total value added in the Study Area in the 2003/04 year. It has also generated an additional 480 jobs, which is 2.4 % of total employment in the Study Area.

Table 17: Impact of irrigation per 000 ha of irrigation

	Gain per 000 ha of irrigation		
	Direct	**Total**	**Direct as a proportion of Total**
Output ($m/000 ha)	$2.8	$7.7	36%
Employment (FTEs/000ha)	9	30	30%
Value Added ($m/000ha)	$1.0	$2.5	40%
Household Income ($m/000 ha)	$0.45	$1.2	38%

The impacts discussed above come from a combination of irrigated and dryland on the same property, with the change to irrigation apparently inducing further changes on the dryland area. Attributing the entire difference between dryland and irrigated just to the irrigated area gives the results shown in Table 17 above. They show that for the whole economy adding another thousand hectares of irrigation adds $7.7 million in output, 30 FTEs, $2.5 million in value added and $1.2 million in household income. The direct on farm impact is between 30% and 40% of the total impact in the local economy.

6.4 Electricity Impacts

The dam generates electricity through a 7.6MW turbine at the bottom of the dam. The generator requires 16 cumecs to operate. The electricity is sold on a fixed price variable volume basis. The generation side of the dam operation is not optimised for a number of reasons:

- The generator operates most efficiently at full flow. However the required throughput at full flow is too large to allow it to pass down the river. The generator is operated in 2 three hour slots each day, with water stored at the bottom of the dam and released into the river at a steady rate of 3 cumecs.

- The river rules are designed to maintain storage for irrigation and environmental flows. This prevents the ability to maximise electricity generation in the peak winter period. The operator also needs a period of experience with the river and irrigator behaviour before it is able to move to other ways of selling the electricity which are potentially more lucrative.

- Issues related to dam construction have meant that since December 2002 the dam has operated 2m below maximum capacity. This has constrained electricity generation, and has also had some adverse environmental impacts as no spillway usage has occurred, resulting in a lack of flushing flows down the river.

- There have been a number of periods where the generator has been off line, including maintenance, inspection and a fire in November 2003.

Alpine Energy's holding in the Opuha Dam generated a net loss of $120,000 in 2002, increasing to a net profit of $99,000 in 2004.

We calculated the impact of the electricity generation side of the dam operation on the regional economy. Because the plant is run by a number of part time staff in conjunction with other responsibilities, the results for employment are estimates based on discussions with Alpine Energy and[13] the long term averages for the industry. The results are shown in Table 18 below. They show that the magnitude and flow on impacts of electricity generation are considerably less than those associated with farming. This is because electricity generation is highly capital intensive, and the ongoing costs are generally small and many services are sourced outside the study area.

Table 18: Study Area Economic Impacts of Electricity Generation

	Direct	Total
Output ($m / year)	1.03	1.22
Employment (FTEs)	1.2	3.72
Value Added ($m / year)	$0.45	$0.57
Household Income ($m / year)	$.08	$0.2

[13] Because there have been an unusual number of one-off costs for the dam operation over the last few years which make estimation of inputs difficult.

6.5 Impacts on businesses in the district

In addition to the calculated impacts reported above, we have interviewed a number of infrastructure and processing businesses located within the district which we considered likely to have been affected by the Opuha project. Of these, only Alpine Energy was directly involved in the dam partnership.

The impacts reported by these businesses cannot, apart from Alpine Energy, be directly attributed to the dam and associated irrigation. Attribution is not necessary because the model estimates impacts on these businesses directly through the farm financial information and model analysis. However the interviews have revealed a number of important impacts of irrigation in the wider area on their operations which are not picked up in the model of the study area economy. These include:

- **Confidence** – all businesses reported significant increases in confidence in their own business and in other businesses with which they deal. While some of this can be attributed to better trading conditions for the agricultural sector, which has major impacts for the district, there is little doubt among the interviewers that the irrigation development has proven a huge boost for the confidence to invest. In particular interviewees noted the certainty that investors in processing and transport operations had regarding future volumes and the ability to plan ahead for growth that is associated with major development of irrigation.

- **Processing Activity** – irrigation development can be directly associated with the development and growth of dairy processing and vegetable processing in the area. These are largely not dependent on the Opuha irrigation specifically, but irrigation in the wider area is a pre-requisite. The siting of an onion processing plant within the district is directly linked to the development of the Opuha dam and its associated irrigation, since without it the necessary reliability for onion crops would not be available locally.

- **Flow on infrastructure** – the wider availability of irrigation has seen development of infrastructure in the district. In particular the port and Alpine

Energy have seen significant increases in activity associated with the rural sector. Again, the Opuha Dam development was not the sole cause of this development, but irrigation in the wider area (including outside the district) has been the primary cause of this development.

- **Better utilization of capacity** – three businesses interviewed noted the change in capacity utilization associated with irrigation. Irrigation changes peaks of production through the season, so that more product is spread over a longer season, and improves the ability of the processors to plan for product arrival. They noted that in relation to livestock in particular this led to better utilization of capacity and existing infrastructure when compared to the peaky nature of dryland product which is driven by climate and means that farmers want to all get rid of stock at the same time. In cropping the opposite may be the case, with more reliability meaning all crops mature at the same time, although the ability to plan for these peaks was enhanced.

- **Benefits to dryland farmers** –dryland farmers in the same area as irrigated properties receive benefits associated with greater competition for stock, even in bad years, and opportunities for grazing and sale of feed. Thirty per cent of dryland respondents reported direct interaction with irrigated properties, but the benefit from increased stock prices and availability of feed would not have been identified in the analytical process we have used.

7 Social Impacts

This section describes the impact that the irrigation development has had on those indicators which affect social wellbeing. Totals have been created by the / ha values from the survey participants being rated up to an area of 32,830 ha. Key results are shows in Table 19 to Table 23 below. Other results are shown in Annex 1.

Table 19: Years in current ownership

% of respondents in each category	1 to 5	6 to 10	11 to 15	16 to 20	>20	Average
Dryland	35%	15%	25%	15%	10%	11.1
Irrigated	34%	22%	22%	6%	16%	12.3

Differences in years of ownership, and by implication, farm turnover, are very small. Critically in the 1 – 5 years category the numbers are very similar, indicating that the level of turnover among properties with irrigation has been similar to that of dryland properties. These results may be skewed slightly because:

- They do not take account of farm consolidation, although again the similarity in size of dryland and irrigated properties indicates that rates of consolidation have also been similar.
- Farms owned for less than 3 years were excluded from the sample because accounts were not available for the study years.

Table 20: People Engaged in Farming for Total Area

	Dryland	Irrigated
Employed FTE's	41	167
Employed Number	74	192
FTEs per person employed	0.58	0.87
Owner / Operator FTE's	133	144
Owner / Operator Number	141	145

Both the number of people and amount of work involved is significantly higher on irrigation properties than on dryland. There is possibly some double counting among the number of people employed, because the individuals who hold part time positions on a number of farms may have been counted in more than one interview.

Table 21: Age of Respondent

% of respondents in each category	20 – 40 yrs of age	40-50yrs of age	50-65 yrs of age	65+ yrs of age
Dryland	5%	47%	42%	5%
Irrigated	25%	34%	34%	6%

Table 22: Education

% of respondents in each category	0 to 5	6 to 10	11 to 15	>15
Dryland	0%	35%	30%	35%
Irrigated	0%	28%	44%	28%

Table 23: Security - How secure is your farm business (1 = very insecure, 5 = very secure)

% of respondents in each category	1	2	3	4	5
Dryland	0%	0%	6%	50%	44%
Irrigated	0%	3%	13%	34%	50%

Although the number of responses limits any rigorous statistical analysis, the data are indicative enough to support the view that irrigation (more intensive farming) does have a range of positive social implications for the communities concerned.

In particular:

- Irrigated properties have significantly more employees (almost 4 times as many FTEs). Each of the jobs also appears to be more full time (0.57 FTEs/person employed on dryland, versus 0.87 for irrigated)
- Irrigation respondents are on average younger.
- Irrigation farmers tend to be better educated (in a formal sense) than dryland farmers, with a third of dryland farmers having no formal qualifications
- Irrigated farmers use a much broader range of information sources regarding their farm business. In particular irrigation farmers use more specialist (and expert) sources.

- Most irrigated farmers have made major changes within the last five years (90%) versus 70% for dryland farmers.

Data provided in Annex 1 shows that most people engaged in farming live in small centres or rural areas, which supports the data from expenditure patterns in drawing the conclusion that the irrigation development has had a significant impact in the rural parts of the community.

Interestingly in contrast with other studies undertaken on irrigation development[14], the data here suggests that the turnover of irrigated properties is no higher than that of dryland properties. This may be a result of a high proportion of properties only being partially irrigated, with changes in systems perhaps not being as significant as they would be for completely irrigated properties. It is also likely that a number of recently purchased properties were excluded from the sample because they did not have accounts for the study period. However it does suggest that the social upheaval of large scale ownership change associated with irrigation development may not be inevitable.

These demographic characteristics are fundamental to maintaining a healthy, sustainable rural community – they provide the basis to maintain the necessary enrolments for schools, sports clubs and other voluntary groups that bind a community together. They also provide the basis to support older people in the community (as for example in providing voluntary services such as "Meals on Wheels" or home-care). It is the absence of schools, sports clubs and voluntary community services that have been identified as characteristic of community decline and as a threat to the long-term viability of rural communities[15]. Such demographic

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[14] e.g. see McCrostie Little, Heather and Nick Taylor (2001). "Social and Economic Impacts Associated with irrigated land use change". Paper presented to the New Zealand Association for Agricultural and Resource Economics Conference, Blenheim, 6 – 7 July 2001.

[15] See Tony Rhodes, Brian H. Willis, Willie Smith, and Jude McCann (2002) "Farm Adjustment and Restructuring in the North Island Hill Country" MAF Technical Paper 2003/2

characteristics also, of course, greatly increase spending power and the capacity to maintain commercial services.

From the perspective of a sustainable agricultural economy, the data also indicate major benefits emerging from irrigation. While the overall level of security felt by both groups was similar, the irrigated farmers had a significant difference in their sense of security in the face of climate uncertainty compared with their dryland counterparts. While both farm groups share a vulnerability to market forces, dryland farmers face the additional major threat of exposure to weather conditions and adverse climatic events that are largely outside their control. At the same time it should be noted that in terms of risk irrigated farmers tend to highlight the reliability of their irrigation equipment and prices, which suggests that although the natural environment is more “controlled in such systems, economic stress may be heightened because of the intensity of farming and the capital involved.

The discussions with individuals in the district as part of the study indicated a degree of confidence and optimism associated with a buoyant economy and an influx of individuals into the area. While we cannot attribute this to the Opuha scheme, there is little doubt that individuals in the area do associate the irrigation development with an improvement in the area. The building of social capital that goes with this optimism and confidence may be an important benefit from the scheme, but is not one we can attribute on the basis of the study we have undertaken.

8 Environmental Impacts

8.1 River and Dam Impacts

The flow regime for the river was developed around an average flow at SH1 of 6 cumecs. The flow is altered throughout the year to reflect the need to keep the river mouth open and to enhance the fishery. The flows are set out in Table 24 below.

Table 24: Opihi River Environmental Flow Regime (cumecs at SH1 bridge)[16]

Month	Flow at SH1 Bridge (m^3/s)	
	Dam above 375m	**Dam 370 – 375m**
January, February	3.5	3.35
March	7.5	5.5
April	8.0	5.6
May, August	4.5	3.85
June, July	4.0	3.6
September, December	6.0	4.6
October	8.5	5.85
November	7.0	5.1

The dam has changed the river and the general river environment in a number of ways.

- Flows are more reliable.
- The storage dam encountered some problems arising from having flooded fertile farmland. There were occasions during the early part of its operation when the lower part of the lake became anaerobic, with elevated levels of nitrates and manganese. This resulted in poor quality of released water from the dam because water is drawn from the lower part of the reservoir. An aerator has been installed by the dam operators to combat this.
- The lack of flushing flows in the river associated with operational issues in the dam[17] have resulted in a build up of algae in the river. The operators have received some advice on the need to add sediment to the river, and further

[16] Source: Opihi River Regional Management Plan, Environment Canterbury

[17] Problems with the dam meant that the lake had to be kept at least 2m below its maximum, which precluded the use of the spillway to generate flushing flows.

studies are being undertaken on the flow regime needed to enhance the water quality whilst maintaining the fishery. The problems with the ability to provide flushing flows are now resolved.

- The trout fishery was initially reported as excellent, but has dropped off as a result of the algal build up.
- The salmon fishery has improved markedly with the greater number of days when the mouth is open and better flows in the river for salmon migration. It is too early to determine whether the development of algal problems will impact on the salmon fishery.

The Opihi is a significant salmon and trout fishery. In the last season (2004-2005) more salmon were reported caught on the Opihi than all the other major salmon fisheries. Fish and Game reports that the mouth has been kept open for many more days per year than previously (4 – 5 days of closure per year compared with 100+ prior to the dam).

Lake Opuha itself has not proven to be successful as a wild fishery. Salmon are released into the dam, and this reportedly provides good fishing. However the trout fishery has not established all that strongly, and Fish and Game considers that this may take some time to develop. The lake also provides hunting opportunity, and has proven a good location for duck, Paradise duck and Canada goose hunting. The lake also offers other recreational activities including swimming and boating. The numbers of users has not been established, but the lake is reportedly popular in peak summer.

8.2 Impacts associated with intensification

The development associated with irrigation has seen a significant increase in the intensity of agricultural operations. This includes increased stocking rates and increased applications of N and P fertiliser. As noted above, the Olsen P levels are significantly higher on irrigated properties than on dryland properties, which indicates that soils have higher fertility on irrigated properties than on dryland.

Applications of N fertiliser average approximately 37kgN/ha on the dryland, and 86 kgN/ha on irrigated land. Even dryland associated with irrigated properties saw substantially higher applications of N (58kgN/ha) than the straight dryland properties.

The intensity of land use and application of N and P have the potential to be associated with water quality issues. Data on water quality is not widely collected, but the Opihi River is included in the National River Water Quality Monitoring Network. A recent study using this data for the period 1989 – 2001 on periphyton growth using paired sites (upstream and downstream) indicated that the downstream site on the Opihi had "similar periphyton cover to the upstream paired site, indicating that changes associated with land management between these sites have been not large enough to cause increased periphyton growth".[18] The Opihi also reported a decreasing trend in filamentous algae and total cover for that period, indicating that irrigation development to 2001 had not had an adverse impact on the river. These results may differ with recent algal bloom problems.

Data from ECan (2002) shows that the average nitrate concentrations in the area between Timaru and the Rakaia River are generally in the range of 2 to 8 mg/L (Figure 4.2). Higher concentrations are found in localised areas, especially in areas where dairy and meat packing industries discharge waste effluent to land. Lower concentrations are found along rivers, in deep wells, and in a few shallow wells that are not close to rivers. Trend information from wells monitored by ECan suggests that there is no increase in nitrate levels in the lower plains, but a well in the Ashwick Flat area does show an increasing trend of nitrate concentration. As for the surface water monitoring information, these results may have been too early in the uptake of the Opuha scheme to have solid trend information related to the intensification from the Opuha scheme.

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[18] Quinn, J. and Meleason, MA. 2005. "Trends in nuisance periphyton at National River Water Quality Network Sites 1989 – 2000." http://www.niwascience.co.nz/ncwr/nrwqn

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Annex 1 : Detailed Results

Table 25: Attachment: Detailed Financial Summary Table

	Dryland		Irrigated	
Revenue	**%**	**$/ Eff ha**	**%**	**$/ Eff ha**
Sheep Sales	37%	320	15%	302
Wool	9%	77	3%	59
Cattle Sales	17%	144	12%	250
Dairy Produce	0%		23%	472
Deer	5%	46	2%	31
Feed	3%	22	3%	55
Crop	24%	211	39%	814
Hort / Vit / Other	5%	42	5%	91
Total Revenue		**862**		**2073**
Expenditure				
Livestock Purchases	26%	168	16%	234
Wages	6%	37	12%	177
Animal Health	4%	24	2%	36
Breeding	0%	1	1%	12
Shed Expenses	0%	-	1%	9
Electricity	1%	5	2%	35
Feed	7%	44	8%	122
Fertiliser	12%	77	13%	194
Freight	2%	13	3%	49
Seeds	4%	25	6%	88
Shearing	5%	33	1%	17
Weed & Pest	7%	45	7%	107
Fuel	4%	23	3%	51
Vehicle	6%	41	3%	49
Repairs & Maintenance	7%	48	6%	92
Rates	2%	12	1%	22
Communication	1%	8	1%	8
Insurance	1%	10	1%	18
Acc Legal Cons	1%	9	2%	23
Admin	1%	8	1%	17
Irrigation	0%	-	4%	55
Other	4%	24	6%	89
Farm Working Expenses	**76%**	**655**	**73%**	**1503**
Cash Farm Surplus	**24%**	**208**	**27%**	**570**
Interest		68		238
Rent		71		61
Depreciation		60		145
Tax		14		41
Total Overheads		**213**		**484**
Net Trading Profit After Tax	**-1%**	**- 5**	**4%**	**86**
Drawings		66		132
Principal Repayment		4		56
Capital Expenditure		67		51
Disposable Surplus		**- 142**		**-153**

Table 26: Place of residence of people engaged in farming for Total Area

Employees	Dryland	Irrigated

Small Centre / Rural	74	151
Timaru	0	32
Out of Area	0	0

Owner /Operators	**Dryland**	**Irrigated**
Small Centre / Rural	120	139
Timaru	10	19
Out of Area	0	0

Table 27: Highest Educational Qualification

% of respondents in each category	**School Certificate**	**UE**	**Bursary**	**Polytech diploma**	**Polytech degree**	**University diploma**	**University Bachelor degree**	**University Masters**	**University PhD**	**None**
Dryland	35%			10%		5%	10%	5%		35 %
Irrigated	19%	13%		9%		13%	31%	3%		13 %

Table 28: Years since last significant change.(yrs)

% of respondents in each category	**1 to 5**	**6 to 10**	**11 to 15**	**>15**
Dryland	70%	15%	15%	0%
Irrigated	91%	3%	6%	0%

Table 29: Sources of Information

Source	**Dryland**	**Irrigated**
Newspaper	80%	25%
Accountant/lawyer	0%	3%
Farm Consultant	5%	34%
Books	0%	3%
TV	15%	13%
Farm Papers	90%	63%
Farm journals	0%	31%
Specialist provider	0%	16%
Scientific journals	0%	0%
Seminars	10%	25%
Internet	45%	22%
Neighbours	0%	9%
Agents/Merchants	0%	0%
Vets	5%	3%
Farm Discussion Group	5%	0%
Ag Research	10%	25%
Monitor Farms	0%	3%

Table 30: Sources of Risk

Source	Dryland	Irrigated
Climate	50%	4%
Irrigation reliability	0%	18%
Pests	0%	0%
Disease	15%	4%
Flooding	5%	4%
Drought	35%	4%
Prices	35%	25%
Costs	0%	0%
Interest rates	15%	4%
Regulation	20%	0%
Biosecurity	0%	11%
Debt	5%	4%
Environmental	0%	0%
Personal Health	5%	18%
Small size of farm - limits options	50%	7%
Access to children's education	0%	0%

Annex 2: Interview Questionnaire Irrigated

Opuha Benchmark Project – Individual Interviews

Interviewer_______

Interview No:_______

1. What is the total area that you farm?	_________ha	
2. What is the effective area that you farm?	_________ha	
3. What area do you hold shares to irrigate from the SCFIS/Levels Plains?	Shares	Area (ha)
SCFIS		
Levels Plains		
4. What area are you able to irrigate from other sources?	Source ___________	Area ha ________
5. What area is reticulated to be irrigated?	_________ha	
6. What area do you typically irrigate each year?	_________ha	

(Check against postal survey data and ask about any differences)

7. Soils – what soil types are present on the property?

Soil Type	Average soil test status (Olsen P only)	Irrigated area (ha)	Dryland area (ha)

8. Land use and winter stocking rates (if estimates not available record actual stock separately and convert afterwards)

Land Use		Number (opening June 03)	Productivity estimates
Sheep		su	lambing%
Beef		su	calving
Dairy Production		cows milked	production/cow
Deer		su	fawning and/or velvet production/ha
Feed for sale (grown or grazed)		area	yield (t/ha)
Cropping	Grain	area	yield (t/ha)
	Process Vegetable	area	yield (t/ha)
	Small seed	area	yield (t/ha)
	Other (specify)	area	yield (t/ha)
Horticulture		area	type
Viticulture		area	yield
Other (Specify)		area	

9. Farm system (discuss and summarise on separate sheet if necessary – particular emphasis on integration of dryland and irrigated where appropriate)

10. Ownership structure____

11. Number of years in current ownership? __________years

12. What changes to the farm and farm system have occurred over the period of your ownership (discuss and summarise on separate sheet if necessary)?

13. What was the pre irrigation system and production levels (where known) (discuss and summarise on separate sheet if necessary)?

14. Average Fertiliser application (if necessary record actual application rates separately and convert to N and P for recording here)

Fertiliser	Irrigated area	Dryland area
Nitrogen (kgN/ha)		
Phosphatic (kgP/ha)		

Financial Data

15. Revenue

Item	$03/04	$02/03	Destination (%) (Area = Timaru district and Fairlie Basin)		
			In area	Out of area	Total (%)
Sheep sales store					100%
Sheep sales finishing					100%
Wool					100%
Cattle sales store in. dairy					100%
Cattle finishing inc. dairy					100%
Dairy product					100%
Deer					100%
Feed/grazing					100%
Crop (specify)					100%
					100%
					100%
					100%
Horticultural (specify)					100%
Grape sales					100%
Other (specify)					100%
					100%
					100%
					100%
					100%

16. Expenditure

Item	$03/04	$02/03	Source (%)			
			Small centre or rural incl Fairlie	**Timaru town**	**Out of area**	**Total**
Livestock Purchases						100%
Wages						100%
Animal Health						100%
- chemical						
- vet						
Breeding						100%
- herd testing						
- AI						
- materials						
- other						
Shed Expenses						100%
-chemical						
- rubberware						
- other						
Electricity						100%
Feed						100%
- contractor						
- purchased off farm						
- grazing						
- other						
Fertiliser						100%
- material						
- freight						
- application						
Freight						100%
Seeds						100%
Shearing						100%
- contract shearers						
- shed						
- groceries + materials						
Weed and Pest						100%
- materials						
- application						
Fuel						100%
Vehicle						100%
Repairs & Maint						100%
Rates						100%
Communication						100%
Insurance						100%
Acct, Legal,Cons						100%
Administration						100%

Item	**$03/04**	**$02/03**	**Source (%)**			
			Small centre or rural incl Fairlie	**Timaru town**	**Out of area**	**Total**
Irrigation (describe)						100%
Drawings						100%
- Groceries						
- Clothes						
- Furnishings						
- Schooling						
- Entertainment						
-Other						
Others (please specify)						100%
						100%
						100%
						100%
						100%
						100%
						100%
						100%
						100%

17. Overheads

Item	$03/04	$02/03
Interest		
Rent		
Depreciation		
Taxation		
Principal repayment		

18. Capital Purchases

Item	$03/04	$02/03	Source			
			Small centre or rural	Timaru	Out of area	Total
						100%
						100%
						100%
						100%
						100%

19. Capital Structure

Item	$2004 (at book value)
Farm and buildings	
Plant and machinery	
Stock Valuation	
Shareholder equity	

20. Estimated cost of irrigation development

Item	Cost ($)	Year developed/purchased
Shares		
Structures, pumps, piping electrical etc		
Application method (e.g. centre pivot, border dyking)		
Operating costs annually excluding depreciation (including electricity)		
Depreciation		
Extra hours worked annually by farmer and family associated with irrigation		

21. What changes in financial performance have you seen as a result of the move to irrigation?) (discuss and summarise on separate sheet if necessary)

22. Employment

Item	Full Time Equivalents (FTEs)	Total number	Where do they live		
			Small centre or rural	Timaru	Out of area
Those in wages bill (not contractors)					
Owner/operator and household unpaid					

23. What age is the interviewee?

20 – 40	40 – 50	50 – 65	65+

24. How many years of formal education did the interviewee receive? ________________

25. What was the interviewee's highest educational qualification? ___________________

____

___

26. Where does the interviewee's immediate family normally reside (exclude children over 18)?

Location	No. of Pre school	No. of Primary school	No. of Secondary school	No of Children under 18 not at school	No. of Adults up to 65	No Over 65
On farm						
In district						
Out of district						

27. Where does the immediate family of your permanent employees reside (exclude children over 18)?

Location	No. of Pre school	No. of Primary school	No. of Secondary school	No of Children under 18 not at school	No. of Adults up to 65	No Over 65
On farm						
In district						
Out of district						

28. What sources of information do you use to keep up to date? ____________________

____

____

____

____

29. What was the last significant change you made to your farm management system?

____

___

____

___

30. How many years ago was this? _____________years

31. How uncertain or insecure is the long term stability of your farm business on a scale from 1 to 5 (circle)?

Not secure				Very secure
1	2	3	4	5

32. What are your key sources of risk? ____

____

____

____

____

33. Is there anything else we haven't asked which might be important to this study?

Annex 3: Interviewer Notes

Opuha Dam Benchmark Study:

Notes for Interviewers

Background

The study aims to assess the impact of the irrigation development associated with the Opuha Dam on farms, businesses and the community. There are numerous problems with attempting to do this through comparing the situation before the dam with that after the dam, primarily because so many other things have gone on in the meantime. Our main means of assessing the impact is therefore going to be by comparing the current situation on irrigated farms with that on completely dryland farms. The assumption we are making is that the difference can be attributable to irrigation.

However we also wish to record the anecdotal experiences of farmers and how they feel that irrigation has impacted on them and their operation. We would like as many examples and quotes as we can get to flesh out the quantitative data which we have generated. This more qualitative information will hopefully also allow us to get a feel for how the irrigation development has changed farmers' behaviour and outlook. There is space in the questionnaire for both qualitative and quantitative information, so please use it.

The information on income, expenditure, overheads, capital purchases, and irrigation costs is essential to modelling of the dam impacts and of the local economy. Please be as detailed as you can with these items. The farmer will need to have the farm accounts to go through this with you. In some cases they may be happy to give you a copy of the accounts, which is very handy and speeds up the interview immensely.

The study area is the Timaru district and Fairlie basin.

If you have any questions as you go through the interviews, just give me a ring:

Simon Harris 0274 356 754.

Good luck.

Notes on Questions

1 – 6 We want to identify where their irrigation water is coming from so we can attribute results to the Opuha, and to determine what area is being irrigated with the Opuha water. It would be useful if this can be checked against the postal data at the time of the interview to determine whether there are any issues in the way people responded to the postal questionnaire.

7. List only the main soil types.

8. If the interviewee does not have a figure for stock units, record the actual stock and undertake your own conversions. It would be useful if you can record the types of process vegetable and horticultural crops.

9. Hopefully this question will follow on from the previous. We would like a brief discussion of the farm system, how they use their irrigation, and how this is integrated with the dryland.

10. Trust, company, partnership etc. Also note whether the interviewee has an ownership stake.

11. Record only substantive change of control – i.e. if the current ownership has changed its structure from a partnership to company this wouldn't be regarded as a change of ownership. We are looking for changes of ownership which would make them behave differently. This may include bringing a family member in as a partner.

12 - 13. Record discussion briefly. We are looking to understand how irrigation has changed investment and management of the property. However any other changes, such as introduced genetics to a flock to increase lambing % should be noted.

14. We need N and P only in this section.

15. Revenue – record last two year's data from accounts if possible. Where the accounts don't match up exactly, add an item in a new row. Note the in and out of area definition – note that the study region is the Timaru district and the Fairlie basin. Note also the need to have the numbers add to 100%

16. Expenditure – As for 15, but in this case there are three definitions. With the extra category of "Small centre or rural" - trying to differentiate the impact on the rural area as opposed to the Timaru main centre.

This part of the study is used to model expenditure flows into different sectors of the economy. For some expenditure categories there is more than one sector involved – for example weed and pest control will involve the chemicals (chemical manufacturing sector) and applications (agricultural contracting). This means that for some expenditure categories we need a further breakdown. The questionnaire gives typical breakdowns in the table. Ultimately we need $ figures in here, but you could record %ages and convert this later. If the interviewee has no idea of the breakdown, just record the total for that category and we will apportion this using generic estimates.

18 – Record major capital purchases associated with the farming operation over the last two years. This is likely to would include new vehicles, plant, machinery etc.

19. Take capital structure from the latest farm accounts.

20. Irrigation development costs. This may not be appropriate for landholders who purchased the property already developed. However where the current owner undertook the development, these figures may be useful. If the interviewee has difficulty recollecting, leave this question.

21. Some landholders will have good records of the change in profitability as a result of moving to irrigation. This is useful information for us to access, so please record as succinctly as possible. Also record any information about how it has enabled them to take up new opportunities, invest with more confidence, etc. Look for quotes in particular.

22. Employment. Convert all data into Full Time Equivalents (1 person working full time = 1FTE, as does 2 people working half time), but also record the number of people involved. Get best estimates for the Owner/operator and family.

26 - 27. Location of residence – we are trying to get a feel for the extended impacts on the community. Please record, as best possible, the numbers of family members in each category and where they normally reside. Children at boarding school, who participate in local community activities and use local facilities such as healthcare, should be regarded as resident with the family. Where they only come home occasionally and don't use local facilities or activities they are not resident for our purposes.

28. Record the major sources of information relating to farming.

29 and 30. Record only major changes on the property or to the farming system. We are trying to get a feel for the relative "innovativeness" of dryland vs. irrigated farmers.

31. This will be a difficult question. We are trying to get a feel as to whether irrigated farmers have a different sense of security to dryland farmers. Please also

question the respondent about why they answered as they did, and record issues and key sources of risk in Q32.

33. As part of the thank you please ask if there is anything else we should have asked. Contact me if something comes up that you think is worth including in all the interviews.