Economic assessment of water charges in the Peel Valley

Report to the Department of Land and Water Conservation

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1. Introduction

1.1 Background

In 1995 the NSW Government endorsed its commitment to the principles of full cost recovery pricing as agreed to by COAG. The package resulted in the introduction of interim rural water charges for NSW irrigators in the 1995-96 season and referral of the rural water pricing issue to the Independent Pricing and Regulatory Tribunal (IPART). IPART subsequently undertook an inquiry into bulk water pricing in NSW and has made bulk water price determinations for each irrigation season from 1996-97 onwards.

IPART's last determination was released in July 1998 in which it set maximum prices to be charged for bulk water services for the 1998-99 and 1999-00 irrigation seasons. IPART is continuing its role in determinations and is currently involved in setting water prices for 2000-01 and 2001-02 irrigation seasons.

As part of the IPART process, the Department of Land and Water Conservation (DLWC) was concerned about the effects that proposed price increases may have on users. The DLWC contracted NSW Agriculture to undertake an evaluation of the impact of proposed water price increases on irrigators in the Lachlan and Peel Valley, as two case study catchments. This report focuses on the Peel Valley.

1.2 Objectives

The objectives of this study relate to the impact of increased water price charges on irrigators in the regulated river section of the Peel Valley. The terms of reference for the study are built around describing these impacts by addressing the following three areas:

i) The importance of water to total farm costs as well as its importance to enterprise costs;

ii) The adjustment responses irrigators are likely to make in response to changes in water charges; and

iii) The impact of increasing water charges on the viability and profitability of farms.

1.3 Approach

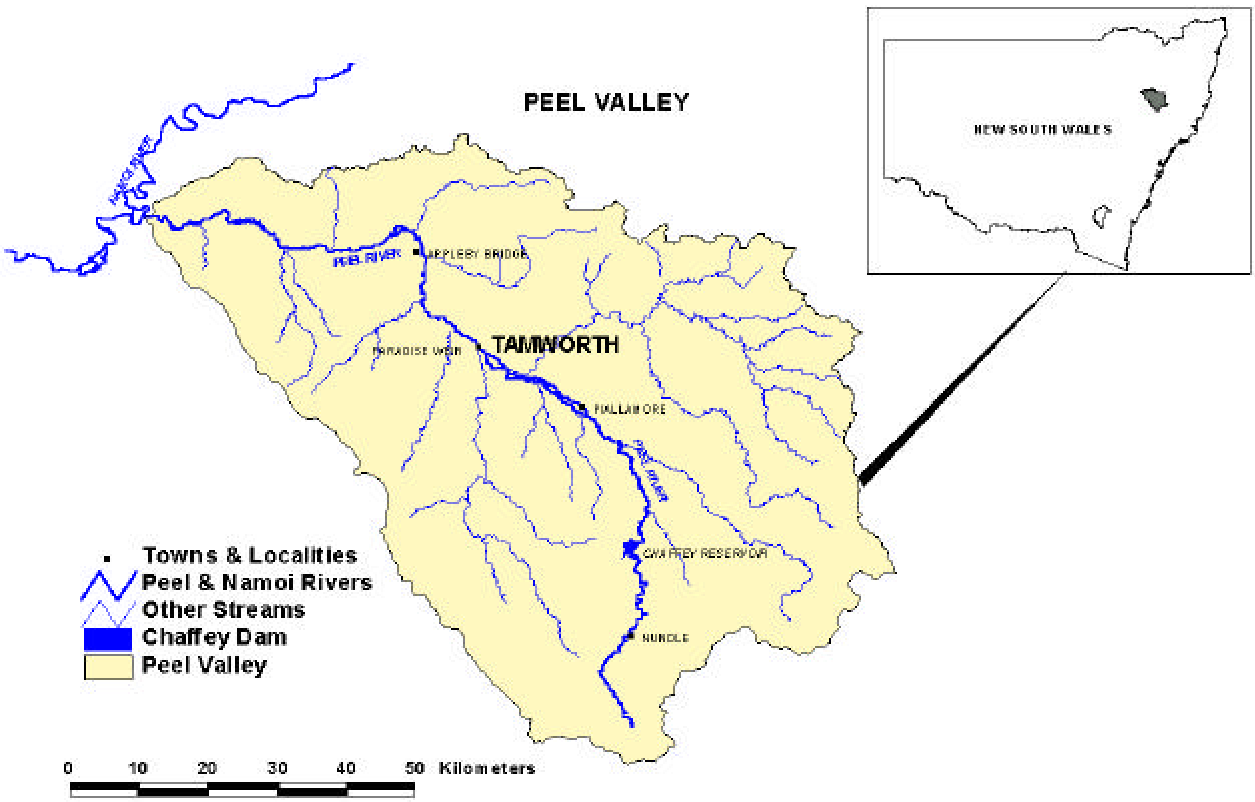
NSW Agriculture adopted a representative farm approach to the assessment of impacts of water price increases in the Peel Valley. This involved the development of whole farm models to represent the key physical and financial characteristics of irrigation farming along the Peel Valley. For the analysis undertaken, the regulated section of the Peel River was broken down into four zones consistent with the availability of hydrology data from the DLWC. The impacts of proposed bulk water price increases were assessed on each of these representative farms under average climatic conditions and allocation availability.

2. *Description of the Peel Valley*[1]

2.1 Overview

The Peel Valley is located in Northern NSW (see Figure 1). The Valley is defined from the headwaters of the Peel River at Ben Halls Gap above Nundle, through Woolomin, Dungowan, Piallamore and Tamworth to the junction with the Namoi River close to Lake Keepit. The Peel catchment covers approximately 4,670 square kilometres.

Figure 1 : The Peel Valley



The Peel Valley contains the entire Tamworth and Nundle Local Government areas and a major proportion of the Parry Local Government area (see Appendix 1). There are a total of 848 agricultural holdings in the Peel Valley[2]. Agriculture is a significant contributor to the local economy with a total value of production in 1996-97 in excess of $142 million (ABS, 1998). Around 60 per cent of this value is derived from the intensive livestock industries (poultry, pig and dairy production).

[1] This discussion draws on a Situation Statement produced by the Peel & Upper Namoi Valley Irrigation Project Team (1989).

[2] For the purposes of the discussion, the whole area of the Parry shire has been included in the Peel Valley.

The contribution of irrigated agriculture to the total value of agricultural production is not directly attainable. NSW Agriculture undertook satellite imagery and aerial photography analysis as part of this project and the results indicate that there is approximately 3,500 ha of irrigated crops and pasture in the area. Data from DLWC suggests that around 2,000 ha of this can be attributed to irrigation from regulated supplies out of the Peel.

The main agricultural activity in the upper reaches of the Peel River Valley is the grazing of sheep for wool, though this is often supplemented by poultry raising and dairying. Around Tamworth, extensive irrigation is carried out for the production of lucerne fodder and grain crops with dairying and pig raising still having some importance. Below Tamworth, extensive areas of wheat, lucerne and fodder crops are grown together with the grazing of cattle and sheep for meat and wool.

The major water storage in the catchment is Chaffey Dam located some 43 km upstream of Tamworth on the Peel River. The dam was completed in 1979 with a capacity of 62,000 megalitres and has a catchment area of approximately 420 square kilometres. Chaffey Dam was constructed for the dual purposes of irrigation and for Tamworth City water supply.

Landslopes in the Peel River Valley are predominantly mountainous with approximately 51% of the total area of the valley having slopes of 15 degrees or more. Undulating to hilly and hilly to steep areas of the valley comprise 11% and 5% respectively of the total area while flat areas comprise the remaining 33%. The Peel Valley has extensive areas of highly fertile irrigable land located along alluvial river flats. This land is occasionally inundated with flood waters bringing sediments from higher reaches and contributing to soil fertility.

Average annual rainfall in the Peel Valley increases with elevation. The annual median rainfalls over the headwaters of the river above 920 m are between 890 mm and 1140 mm, the greater values are recorded in the high peaks of the Divide. Closer to the junction of the Peel and the Namoi Rivers, the annual median rainfalls are approximately 580 mm. January is the wettest month of the year and May is the driest.

2.2 Irrigated agriculture

2.2.1 Regulated and groundwater supplies

The construction of Chaffey Dam increased the irrigation potential of the Peel Valley, which was previously restricted by unreliable water supplies. Information from DLWC's hydrology model show that irrigation supplies from the Peel River are very secure compared to other Northern Valleys. Under current levels of development, irrigators can expect to receive their full allocations in 92 years out of 100 (see Appendix 1). Simulated announced allocations for the Peel Valley, using historical climatic information from 1891 to 1998, yielded an average announced allocation of 94 per cent. Actual announced allocations show marginally lower, but still relatively high, allocation reliability. Between 1981 and 1996 irrigators received their full allocations in 80% of years[1].

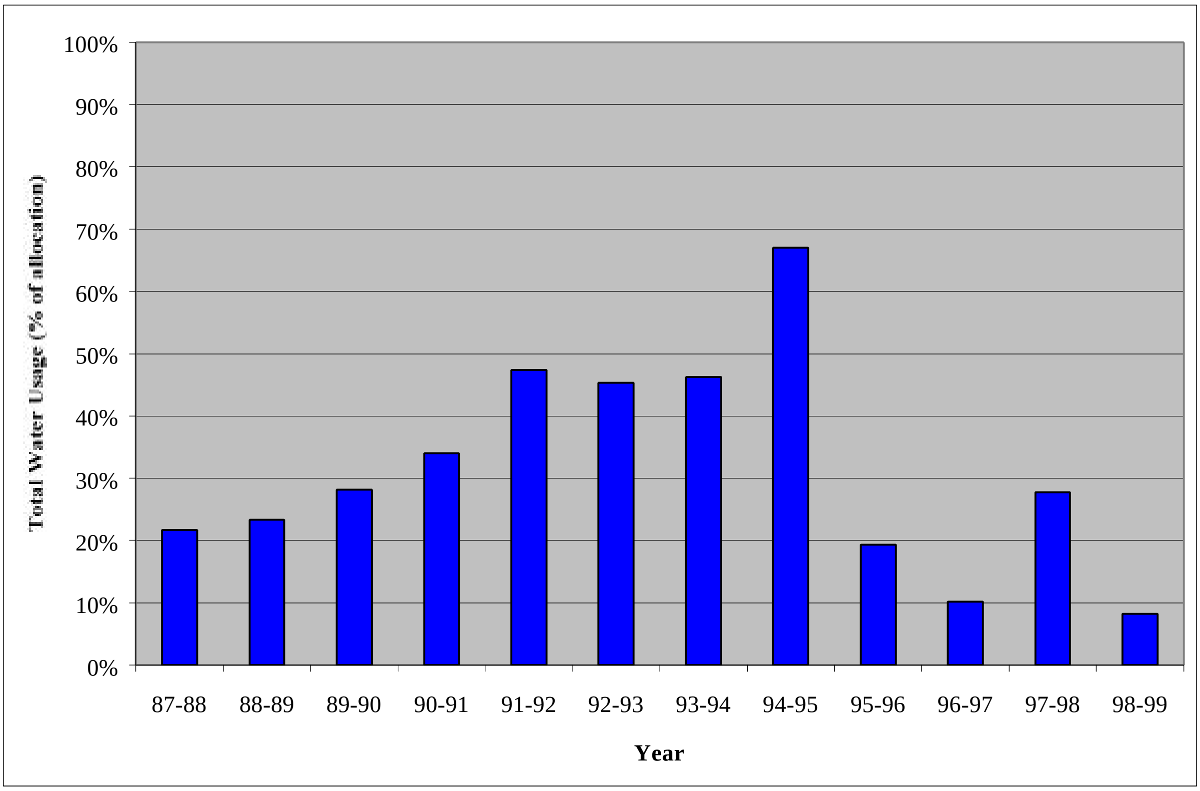
[1] Up until 1997 the announced allocation was calculated using a utlisation factor reflecting less than 100% entitlement usage. Since 1997 DLWC have changed the method used to calculate allocations, now based on full utilisation of entitlement through temporary trading. As a consequence, allocation announcements will now be lower than previously and more active irrigators may now have to use the temporary trading market to maintain water usage.

The Peel Valley is relatively underdeveloped compared to many other valleys, with usage commonly below half of total entitlement. The annual use of regulated irrigation entitlement averaged just 34 per cent over the last 12 years. This is strongly climatically related, with usage ranging from 8 to 67 per cent over the 1987-88 to 1998-99 period. Figure 2 plots total irrigation diversions in the regulated section of the Peel Valley as a proportion of irrigation entitlement.

Many irrigators in the Peel Valley also have access to groundwater reserves. The bulk of the Valley's groundwater is contained within the alluvium of the river's flats. The flats have significant groundwater potential and irrigation is undertaken along the Peel River and Tributaries from wells[1], bores and excavations[2]. The greatest development in groundwater use is in the central part of the Valley near Tamworth downstream to Attunga. It is here that flats are at their widest, and fairly intensive irrigation is undertaken.

The alluvium in the Peel is typically between 10 to 20 metres thick with a porosity of 10%. Therefore, under each hectare of river flat there would be 10 to 20 ML of stored groundwater. There is a close connection between river levels, rainfall and groundwater levels. However, in times of drought, groundwater reserves are a more reliable source of irrigation water.

Figure 2: Irrigation diversions in the Peel Valley



Source: Data provided by DLWC, Tamworth

Like surface water availability, groundwater allocations to irrigators on the Peel far exceed actual use. Table 1 provides information on groundwater allocation and use in the Peel Valley in 1998-99.

[1] 95% of irrigation from groundwater in the Peel is out of wells (pers comm Binks, 2000)

[2] An excavation is a pit dug in the ground until the groundwater table is reached. These are located close to the river and are usually 5-6 m deep. There are only 3 – 4 excavations in use in the Peel Valley.

It indicates an average usage of between 10-11 per cent for both the Upper and Lower Peel sections. For those farms extracting groundwater in 1998-99, average entitlement usage was between 15-16 per cent in both sections. It is likely that both the total and average figures presented are likely to underestimate long-term average usage of groundwater entitlements in the Peel Valley, with 1998-99 being a wetter year than average.

Table 1 Peel Valley Groundwater Allocation and Use in 1998-99

	Allocation (ML)	Use (ML)
Peel		
- Total	41,957	4,455
- Average per farm	160	29

Source: Data provided by DLWC, Tamworth

2.2.2 Irrigated agricultural enterprises

Lucerne hay grown under spray irrigation is the main irrigated crop in the Peel Valley, accounting for more than 50% of the irrigated area in the late 1980s (Peel & Upper Namoi Valley Irrigation Project Team, 1989). More recent information from DLWC indicates that lucerne accounted for 65% of irrigated crop area in 1996/97, 64% in 1997/98 and 76% in 1998/99 (Table 2). The average contribution of crops to total irrigated area over the last three years is provided in Figure 3.

Table 2: **Recent agricultural production in the Peel Valley**

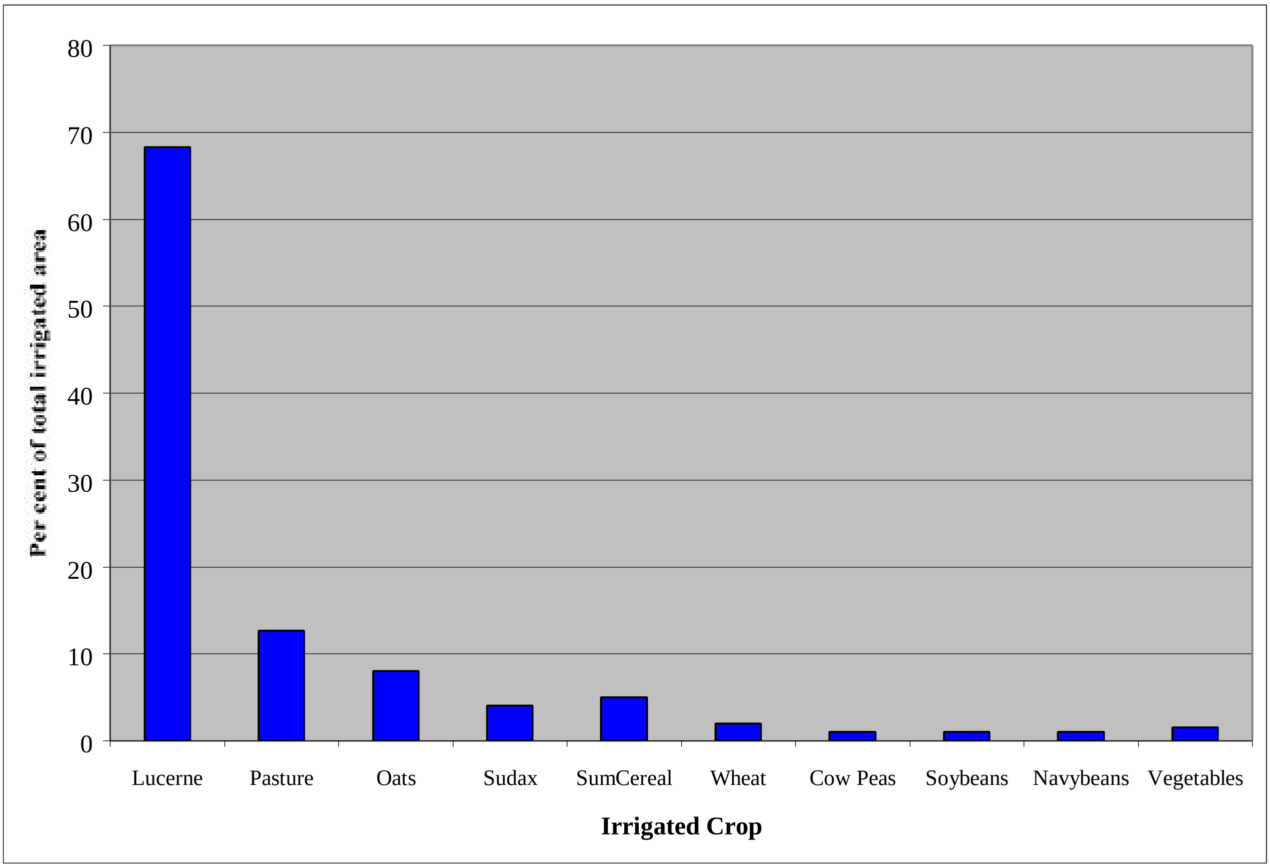
Crop	1996/97 (ha)	% of irrigated area	1997/98 (ha)	% of irrigated area	1998/99 (ha)	% of irrigated area
Lucerne	1,069	65%	1,234	64%	970	76%
Pasture	177	11%	303	16%	145	11%
Oats	198	12%	131	7%	65	5%
Sudax (forage sorghum)	37	2%	91	5%	60	5%
Summer cereal	105	6%	134	7%	20	2%
Wheat	38	2%				
Cow peas			16	1%		
Soybeans			20	1%		
Navy beans	18	1%				
Vegetables	10	1%			20	2%
TOTAL	**1,652**		**1,929**		**1,280**	

Source: Data based on return card information provided by DLWC, Tamworth

Lucerne is a perennial crop which produces its highest yields during the second year of growth. In climates of mild winters, lucerne is grown for 3 to 4 years continuously. Following seeding, the lucerne crop takes 3 months to establish. The number of cuts for a crop varies depending on the climate (warm and dry with sufficient irrigation has more cuts) and ranges from between 2 and 12 per growing season. Lucerne hay can grow under a wide range of climates. The optimum temperature for growth is 25°C with growth dramatically inhibited when temperatures are below 10° or above 30°C.

The majority of lucerne producers in the Peel Valley utilise spray irrigation systems. A small number of irrigators use flood systems and there has been more recently some uptake of subsurface drip irrigation systems.

Figure 3: Average contribution of crops to total irrigated area (1996/97 – 1998/99)



3. *Methodology*

3.1 Outline of approach

The purpose of this analysis is to provide information to the DLWC on the magnitude of financial impacts on irrigators in the Peel Valley of increased irrigation water prices. A clearer picture of the likely impacts of price increases can be incorporated into the DLWC's assessment of proposed increases, and ultimately, would place IPART in a better position to make its overall price determination.

A number of techniques could be used for the assessment of on-farm impacts of water reforms. These techniques range from simple budgeting methods to formal optimisation models. An evaluation of financial impacts from water price increases can be undertaken in a reasonably straightforward manner using a standard whole farm budgeting framework.

Where there is significant homogeneity amongst irrigation farms in terms of allocations, irrigation systems, enterprise areas, productivity and overhead cost structures, a single agricultural model of the region or a single representative farm model may be adequate. However, in the case of the Peel Valley, there are significant differences between farms, suggesting a more disaggregated approach is required. While the majority of farms irrigating from the Peel River grow lucerne, key farm characteristics such as farm size, areas of lucerne grown and cost structures vary.

Representative farm models were developed for use in the evaluation of water price increases. The models are spreadsheet-based and attempt to capture the key characteristics of irrigation farming in different zones in the Peel Valley. The models are set out as a whole farm budget with key farming decisions based on information elicited from irrigators and local technical experts. Consequently, the representative farm models differ from formal optimisation models such as linear and dynamic programming models in that they are based on key decision rules rather than profit maximisation objectives.

3.2 Developing the representative farm – data collection

Developing representative farm models can involve extensive data search, local consensus data workshops, and direct community consultation. While a full survey of irrigation farms was not possible, DLWC, ABARE, NSW Agriculture technical staff and local irrigators provided input into this analysis. The key inputs to the representative farm modelling are discussed below.

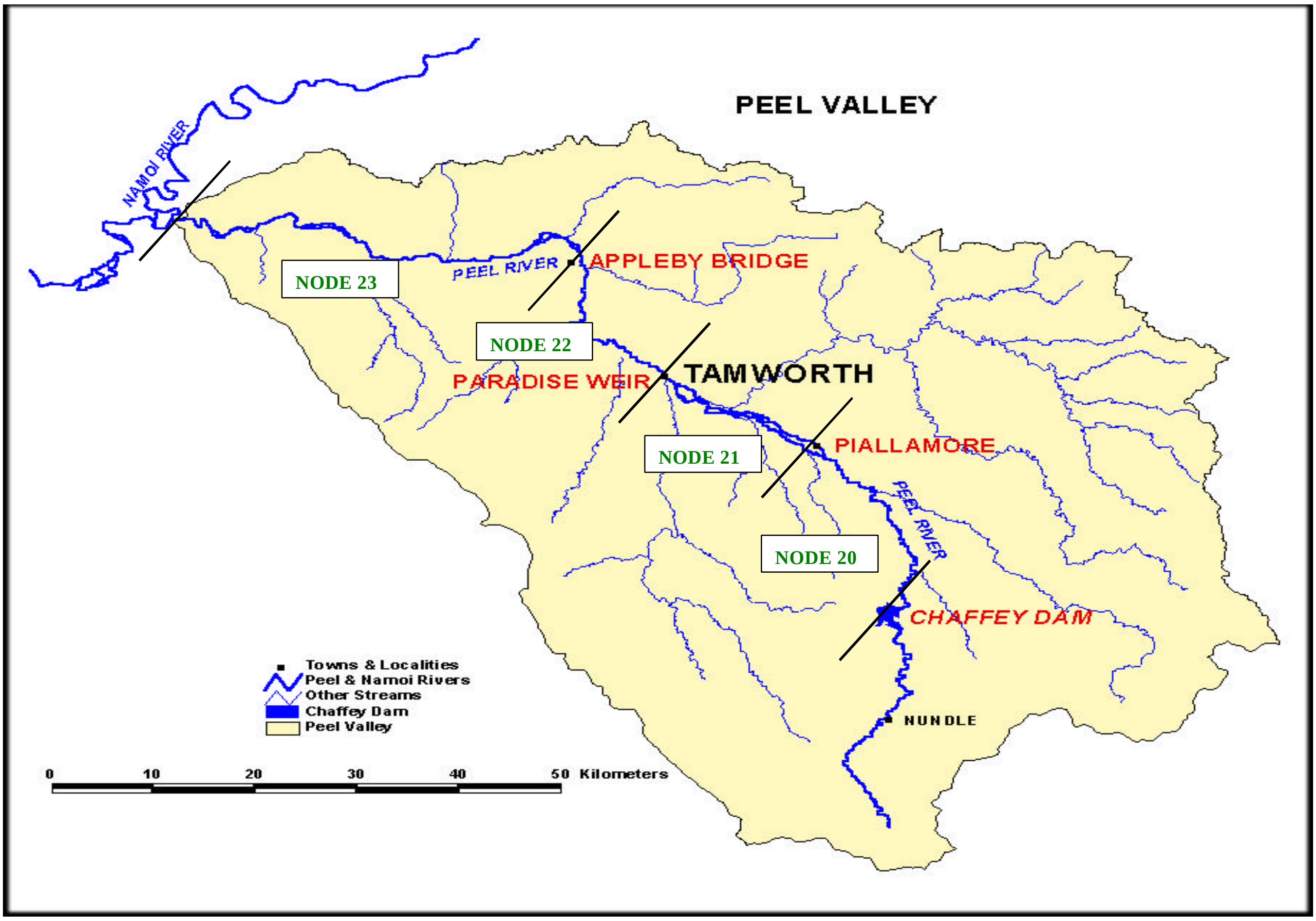
3.2.1 Base physical characteristics

To determine the base physical characteristics of farms in the Peel Valley, information was collected on water entitlements, water usage, property size and extent of irrigated areas. Water allocations and historical usage information for the Peel Valley were obtained from DLWC at Tamworth. The data were provided on an individual licence basis for the last twelve years with licences allocated to a particular subcatchment as per the DLWC's hydrology model. Data for the Peel Valley was broken down into the following four 4 sections (see Figure 4), referred to as nodes:

- Chaffey Dam to Piallamore Water Use (Node 20)

- Piallamore to Paradise Weir Water Use (Node 21)
- Paradise Weir to Appleby Bridge Water Use (Node 22)
- Appleby Bridge to Namoi Junction Water Use (Node 23)

Figure 4: Location of Nodes in the Peel Valley



Information on property size and irrigated areas were obtained from a geographic information system (GIS) database established using ARC/INFO software. Information on property sizes were originally gained from an existing cadastre overlay obtained from the Land Information Centre. This was modified in accordance with topographic maps illustrating each property provided by the DLWC and further refined on the basis of data provided by the Valuer General's Department. Irrigated areas were obtained by the interpretation of 1998 colour aerial photography of the Peel Valley provided by DLWC and interpreted by NSW Agriculture's local technical staff. These data were digitised as a layer of the Peel Valley GIS.

With the assistance of DLWC technical staff and the Resource Information Unit of NSW Agriculture, individual data on properties was compiled into a database of irrigated agricultural production on a node by node basis. A description of the nodes in terms of the number of licences, property areas, irrigated areas, allocation size and water usage is given in Table 3.

	Unit	Node 20	Node 21	Node 22	Node 23
Farm numbers					
No. of irrigation farms		35	28	35	29
No. of irrigation farms that used water in 1997-98		25	16	19	16
Farm area and irrigated area					
Average irrigated area of all irrigation farms	Ha	28	21	38	53
Average property size of all irrigation farms	Ha	108	60	82	388
Water allocation					
Average base allocation	ML	171	113	176	386
Range of base allocation	ML	12 – 753	12 – 390	12 – 972	18 – 1,359
Water use					
Average use of all irrigation farms	ML	62	30	28	100
Average use of irrigation farms that used water in 1997-98	ML	90	56	52	182

Water usage information is reported on a farm basis rather than an individual licence basis, given that some farms have multiple irrigation licences. For the purpose of discussion the water use figures are based on the 1997-98 irrigation season. 1997-98 was a reasonably typical rainfall year with 436 mm received over the main growing season (September to March). The average growing season rainfall over the last 30 years in Tamworth (1968-98) was 463 mm.

3.2.2 Financial characteristics

In order to fulfill objectives one and three of the study, variable and overhead costs for the representative farms were required. Overhead costs are those costs incurred regardless of the enterprise mix. ABARE was the primary source of financial information for the representative farm. ABARE extracted farm physical and financial data from their 1996/97 survey of irrigation farms for a "cluster" of five sample points relating to farms in the Peel Valley predominantly involved in pasture/lucerne production. Key characteristics of survey farms reported by ABARE were checked against existing data sources to assess suitability. Further financial information was provided by the Valuer-General's Office in terms of land values. Land values were used to determine local government rates on land and to provide a basis for equity calculations.

3.2.3 Lucerne Enterprise Information

As discussed in Section 2, lucerne is the major irrigated enterprise in the Peel Valley. To gain a picture of the enterprise costs and returns of lucerne, data from the 'Haymaker' project (NSW Agriculture 1994) was assessed. The 'Haymaker' project was developed by NSW Agriculture in 1989 and funded by the Rural Industries Research and Development Corporation (RIRDC) after ABARE statistics indicated that average lucerne hay yields in the Peel Valley in 1986/87 were as low as 9 tonnes/ha/year. This was despite previous trials with irrigated lucerne growers which found that around 21 tonnes/ha/year was not unrealistic in the Peel Valley.

The 'Haymaker'program identified inefficient irrigation management, poor agronomic management of lucerne and inferior hay making techniques as causes of the low average yield. The program aimed to combine the practical knowledge of growers, scientific principles and research results to address the problem of continuously low lucerne yield. For comparative analysis, the 'Haymaker'program required lucerne growers to record production and physical inputs of a lucerne stand over the growing season. Key performance indicators such as yield, costs and gross margin were provided back to farmers.

Lucerne gross margins for each node are derived[1] from the data recorded from the 'Haymaker' project. This was the only data set available that had some measure of returns and costs for lucerne in the Peel Valley. Owing to the low sample numbers in each node, gross margins for node 20 and 21 were amalgamated, as were those for Nodes 22 and 23 and these are displayed in Table 4.

Table 4: Representative Lucerne Gross Margin Characteristics

		Node 20 & 21 **Full production**	**Node 22 & 23** **Full production**	**All Nodes** **Establishment**	**NSW Ag Handbook** **Full production**
Income	($/ha)	$2,203	$1,682	$1,435	2,810
Yield	(t/ha)	15.00	12.00	10.00	15.4 t/ha
% prime		56%	39%	48%	
% medium		28%	42%	35%	
% poor		16%	19%	17%	
Seed cost	($/ha)	na	na	$93	
Fertiliser cost	($/ha)	$26	$8	$33	
Chemical cost	($/ha)	$23	$8	$17	
Water use	(ML/ha)	2.7	3.7	3.0	6.25
Water pumping cost	($/ha)	$119	$155	$130	
Harvest cost	($/ha)	$395	$367	$291	
Total costs	($/ha)	$562	$538	$607	1,041
Gross margin/ha		**$1,641**	**$1,144**	**$828**	1,769
Gross margin/ML		**$608**	**$309**	**$276**	283

The returns per megalitre for Nodes 20 and 21 are quite high due to relatively low water use per hectare. Also reported in Table 4 are lucerne returns from budgets published by NSW Agriculture from the Farm Enterprise Budgets series. The returns provided are not dissimilar to the Haymaker data with the exception of returns per megalitre which again relates to low water use per ha of nodes

[1] After discussions with NSW Agriculture officers involved with the Haymaker project, yields were revised downwards to reflect more average district yields. This was considered necessary given the likelihood that the 'Haymaker' group probably consisted of better producers and therefore may have biased the yield estimates upwards.

21 and 22. This low level of water use may in part relate to lucerne accessing some of its water requirements directly from shallow groundwater aquifers lying close to the Peel River.

Information on other agricultural enterprises were taken from NSW Agriculture's Farm Budget Handbooks for the North West. This included dryland wheat and livestock gross margins and information on machinery costs for different size plant and equipment. The extent of livestock run on properties was taken from the 1998 Rural Lands Protection Boards' (RLPB) Association Annual Report.

3.3 Representative farm models of the Peel Valley

Four representative farm models were developed to represent irrigated agriculture in the Peel Valley, one model for each node. After an assessment of water use data for the Peel Valley, it was decided that the analysis should focus on commercial-sized farms rather than small hobby farms. For the purpose of this study those farms which had a water use of greater than or equal to 20 ML and an irrigated area of greater than or equal to 10 ha were considered to be commercial farms. The characteristics of the commercial farms were averaged for each node and this average was used as a basis of the representative farms[1]. The physical characteristics of the four representative farms are summarised in Table 5.

Table 5: Representative Farm - Key Physical Characteristics

	Number of all farms	No. of farms meeting size criteria	Base allocation ML	Irrigated area ha	Farm area ha	Water use (1997/98) ML	Water use per ha (1997/98) ML
Node 20	35	18	253	37	151	103	2.8
Node 21	28	7	126	24	78	65	2.7
Node 22	35	11	314	34	111	86	2.6
Node 23	29	12	471	50	502	184	3.7

Information from the 1999 ABARE "Grains Access" database indicated that for farms around Tamworth, 39.6% of total farm area was cropped. As discussed in the previous section, irrigated area per farm was estimated from maps, aerial photographs and local knowledge of DLWC and NSW Agriculture staff. The irrigated area was subtracted from the total crop area, and the remainder of the crop area was assumed to be sown to dryland wheat, the most common dryland crop option. The rest of the farm area was assumed to be under pasture for livestock.

Consultation with NSW Agriculture staff indicates that carrying capacity on farms in the area can be estimated at 5 DSE (dry sheep equivalents) per hectare (I. Collett, pers. comm.). Enterprise costs and income for livestock were drawn from NSW Agriculture Farm Budget Handbooks, using the budgets for 'inland weaners-stores' from Davies et al. (1999) and for second-cross lambs from Webster (1998). Proportions of sheep to cattle were estimated using the gross livestock figures listed for theTamworth RLPB district in the RLPB Assoc. Annual Report for 1998. These figures indicated

[1]The focus of the study was on farms predominantly involved in lucerne hay production. Dairy farms were identified in the database and their effect removed from the calculations for representative farms reported in Table 5.

that, on a number of livestock basis, 34% of the district carries sheep and the other 66% cattle. Hence these proportions were used for the pasture area in the whole farm model.

The key financial characteristics of the four representative farms are provided in Table 6. Further information on financial assumptions can be found in Appendix 2.

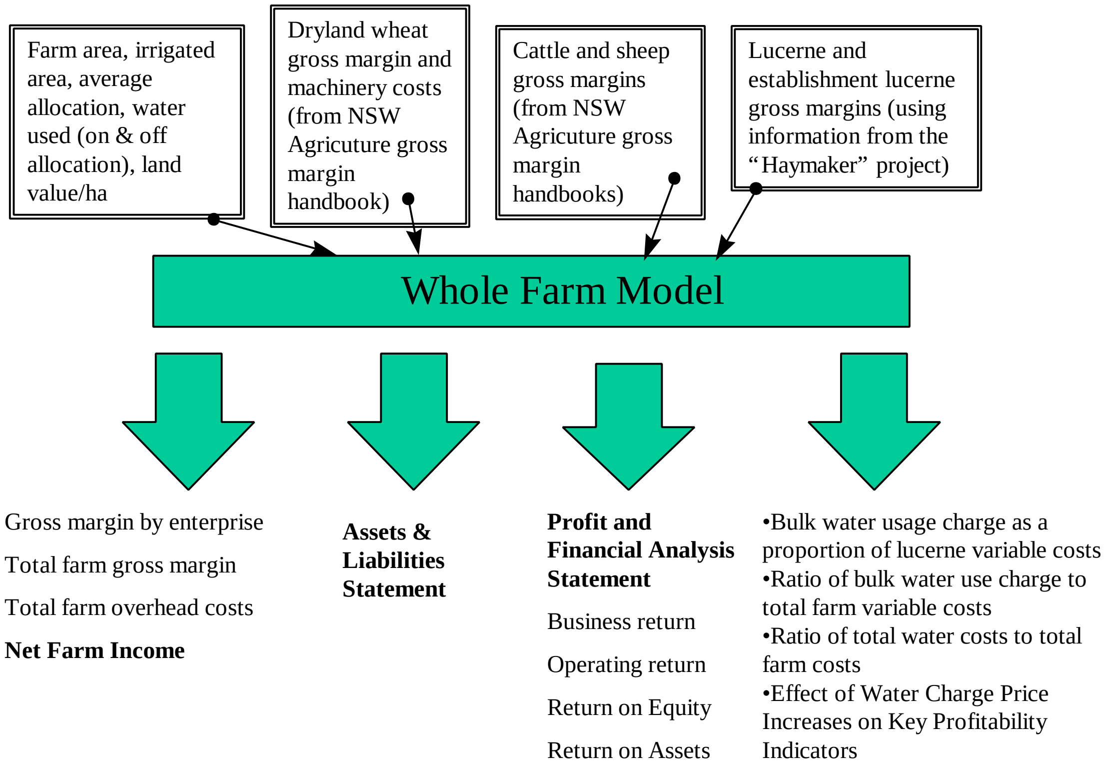
Table 6: Representative Farm – Key Financial Characteristics

Overhead Costs	**Node 20**	**Node 21**	**Node 22**	**Node 23**
Administration expenses	$1,461	$755	$1,077	$4,862
- bank charges	$120	$120	$120	$120
- insurance	$1,349	$697	$995	$4,491
- workers compensation	$636	$329	$469	$2,117
Loan repayments	$2,186	$1,130	$1,612	$7,276
Labour	$6,359	$3,286	$4,690	$21,166
Fuel and oil	$1,693	$1,054	$1,494	$3,860
Electricity (not including pumping costs)	$900	$900	$900	$900
Repairs and maintenance				
- plant and equipment	$3,931	$4,115	$4,001	$3,921
- structures	$238	$238	$238	$238
Depreciation				
- tractor 1	$2,229	$1,353	$1,895	$3,790
- tractor 2	$0	$0	$0	$5,051
- other plant and equipment	$9,947	$9,071	$9,613	$12,768
- structures	$1,250	$1,250	$1,250	$1,250
Rates				
- land	$1,084	$1,060	$1,017	$1,931
- water	$1,108	$553	$1,380	$2,069
Equity	95%	97%	97%	91%

With this data, the representative farm model determines the area of irrigated and dryland crop planted, calculates irrigated crop yield and outputs farm performance data such as water use, gross margin and financial indicators. A graphical representation of the model structure is provided in Figure 5.

Profitability indicators used to calculate the impact of increasing water charges on the viability and profitability of farms were net farm income, business return, operating return, return on total assets and return on equity. For all results, the issue of tax has been excluded, since different business structures have different tax levels, and time and resources prevent an exhaustive study of business structures in the region.

Appendix 3 contains the full details of the representative farm models.


Farm area, irrigated area, average allocation, water used (on & off allocation), land value/ha
Dryland wheat gross margin and machinery costs (from NSW Agricuture gross margin handbook)
Cattle and sheep gross margins (from NSW Agricuture gross margin handbooks)
Lucerne and establishment lucerne gross margins (using information from the "Haymaker" project)
Whole Farm Model
Gross margin by enterprise
Total farm gross margin
Total farm overhead costs
Net Farm Income
Assets & Liabilities Statement
Profit and Financial Analysis Statement
Business return
Operating return
Return on Equity
Return on Assets
•Bulk water usage charge as a proportion of lucerne variable costs
•Ratio of bulk water use charge to total farm variable costs
•Ratio of total water costs to total farm costs
•Effect of Water Charge Price Increases on Key Profitability Indicators

4. *Assessment of bulk water price increases*

This section reports on the analysis undertaken to address the three key objectives outlined by DLWC. They include the importance of water costs to enterprise and farm costs, the impact of increasing water charges on the profitability of farms and the adjustment responses irrigators are likely to make to changes in water charges.

The price scenarios used in the analysis are given in Section 4.1 together with a discussion of what the increases mean in terms of effective prices paid. The importance of water costs to enterprise and farm costs are assessed in Section 4.2. Finally, Section 4.3 discusses both the impact of water charges on the profitability of farms and the types of adjustment responses that irrigators are likely to make. These two elements are discussed together because of the integral role that responses can play in determining impacts.

4.1 Pricing scenarios and effective prices

Information on the estimated increases in bulk water charges were supplied by DLWC in March 2000. The increases are based on DLWC's 1998 submission to IPART and are provided in Table 7 below. These estimated prices may change in the final determination.

Table 7: **Estimated bulk water charges**

Year	1999/2000	2000/2001	2001/2002	2002/2003	2003/2004
Est. usage charge ($/ML)	$ 5.12	$ 7.81	$ 10.50	$ 13.19	$ 15.88
Est. entitlement charge ($/ML)	$ 4.39	$ 6.50	$ 8.61	$ 10.72	$ 12.83

Source: Natural Resource Pricing Unit, DLWC, 2000

Previous submissions from irrigator groups to the IPART Inquiry into Bulk Water Pricing has raised concerns about the impact of fixed entitlement charges. One of the concerns has been in respect to the significance of fixed charges at times of low water availability. Fixed entitlement charges become more significant as utilisation of entitlement falls. Consequently, the balance between variable and fixed components of water charges has a differential effect on water users depending on their level of entitlement utilisation. The costs of water to less active irrigators increases as the reliance of cost recovery moves away from water usage charges towards fixed entitlement charges and vice versa.

This has been raised as a particular issue for Peel Valley irrigators given that the average utilisation of regulated water supplies in the Valley has averaged just 34 per cent of entitlement over the last 12 years. This low level of utilisation raises effective water prices (charges per ML of water actually used) paid by irrigators. To guage the significance of this issue, effective prices per ML have been calculated for each of the representative farms and are presented in Table 8 below.

The effective prices per ML used differ for each representative farm depending upon the utilisation of entitlement. The results indicate that effective prices paid by less active irrigators can be significant even under current price levels. However, while effective prices per ML are of interest they tell us little about the contribution of water costs to farm costs and ultimately little about the impacts of price increases on farm profitability. The following sections focus on this issue.

Table 8: Water prices in terms of effective prices per ML used

	Utilisation of allocation	Years				
		1999/2000	2000/2001	2001/2002	2002/2003	2003/2004
Node 20	41%	$15.87	$23.73	$31.58	$39.44	$47.30
Node 21	52%	$13.63	$20.41	$27.19	$33.97	$40.75
Node 22	27%	$21.21	$31.63	$42.05	$52.47	$62.90
Node 23	39%	$16.34	$24.43	$32.51	$40.59	$48.68

4.2 Relative importance of water charges to farm costs

The importance of water charges in farm costs is analysed using the four representative farms identified in Section 3. Water use for each representative farm is based on actual usage in 1997-98 which rainfall records suggest is a reasonably ‘average’ year. The importance of water charges to farm costs is expressed in terms of the contribution of water to enterprise (lucerne) variable costs and total farm costs. Water charges in the current year (1999/2000) and the final determination year (2003-04) are used to provide an assessment of the relative importance of water costs.

In considering the importance of water charges to farm costs it is important to compare like cost items. Water charges are made up of both variable and fixed components. Usage charges are the variable component of total water charges in that they vary with the amount of water applied. Irrigators can attempt to minimise these costs through changing water application rates, modifying enterprise mix, adopting water use technologies etc. Entitlement charges on the other hand are fixed costs which cannot be avoided. These costs affect overall farm profit but are not allocated to any individual enterprise because they cannot be avoided and remain the same (by definition) irrespective of the nature and level of enterprises run on a property. In making comparisons, variable water charges should be assessed in terms of their contribution to enterprise variable costs while total water charges should be considered in their contribution to total farm costs. This approach is followed below.

4.2.1 Contribution of water usage charges to enterprise costs

Table 9 presents results on the contribution of water usage charges to the variable costs (eg. fertiliser, chemicals, hay making costs, freight etc) associated with growing lucerne. Also reported is the contribution of water usage charges to water variable costs (bulk water use charges plus pumping costs[1]) incurred in lucerne production. The ratios presented are based on water use information for the 1997-98 irrigation season. Water use per hectare for lucerne production is estimated at 2.7 ML/ha for Nodes 20 and 21 and 3.7 ML/ha for Nodes 22 and 23.

Table 9: Bulk water usage charge as a proportion of lucerne variable costs

Node 20 & 21	1999/00	2003/04

[1] Pumping costs per megalitre have been drawn from the Haymaker Project records from the early 1990’s, and are estimated at $43.23 per megalitre for Nodes 20 and 21, with $41.82 the estimated pumping cost per megalitre for Nodes 22 and 23.

Ratio of water use charges to lucerne variable costs	3.1%	9.7%
Ratio of water use charges to lucerne water variable costs	10.6%	26.9%
Nodes 22 & 23		
Ratio of water use charges to lucerne variable costs	3.5%	10.9%
Ratio of water use charges to lucerne water variable costs	10.9%	27.5%

In Nodes 20 and 21, the contribution of water use charges to lucerne variable costs increases from 3.1 to 9.7 percent over the 1999/00 to the 2003/04 period. Over the same period, the contribution of the water charges to the water variable costs increases from 10.6 to 26.9 percent (assuming pumping costs remain unchanged).

The proportion of variable water charges to lucerne variable costs in Nodes 22 and 23 increases from 3.5 to 10.9 percent from 1999/2000 to 2003/04. Over the same period, the contribution of usage charges to the variable water costs increases from 10.9 to 27.5 percent (assuming pumping costs remain unchanged).

The results suggest that the proposed water usage charges will in the future make a more significant contribution to enterprise variable costs and water variable costs than they do now. While the rate of increase in importance is significant, the increases come from a relatively low base.

4.2.3 Total farm costs

The proportion that total water costs (water use charge plus the water entitlement charge) contribute to the total farm (variable plus fixed) costs is displayed in Table 10 below. Given the estimated price increases, the proportion of total water costs to total farm costs approximately triples in all nodes from 1999/2000 to 2003/04. However, the contribution to total farm costs from water charges after the price rise again remains relatively small.

Table 10: Ratio of total water costs to total farm costs

	1999/2000	2003/2004
Node 20	2.6%	7.4%
Node 21	2.0%	5.9%
Node 22	3.5%	9.8%
Node 23	2.2%	6.5%

From the results presented above, it can be concluded that the price paths for water charges result in a significant rate of rise in their contribution to farm costs. However, the overall contribution of both water usage and entitlement charges to enterprise and total farm costs remain relatively small. These results support past IPART studies and some submissions which concluded that water charges are a small proportion of farm business costs. The significance of these price changes on farm viability are discussed in the next section.

4.3 Impact of increasing water charges on the profitability of farms and likely adjustment responses

4.3.1 The elasticity of demand for water

A major determinant of the impact of water charges on the profitability of irrigation farms relates to the elasticity of demand for water. The price elasticity of demand for water is defined as the percentage change in quantity of water demanded for a one percent change in the price. This is a derived demand based on the value of water as an input into agricultural production. As a consequence, the value of water is dependent on the profitability of the crops to which it is applied.

The sensitivity of water demand is a key issue in looking at water charges. If water demand is found to be inelastic, indicating that adjustment to higher water prices is limited, then the burden of any price rises falls on farm incomes. If demand is elastic, indicating potential for adjustment, impacts on farm incomes will be less severe as farmers modify their production systems to mitigate impacts.

A number of studies have estimated the demand for irrigation water. Some examples include Briggs-Clarke, Menz, Collins and Firth (1986), Collins, Hall and Scoccimaro (1996), Hall, Poulter and Curtotti (1994), Read, Sturgess and Associates (1991) and Jones and Fagan (1996). These studies have largely relied on the use of short run models[1] and have focused on southern portion of the Murray-Darling Basin. Collins et al. (1996) found that irrigation water demand is highly inelastic in the Southern Murray–Darling Basin over water delivery prices consistent with prevailing temporary transferable water entitlement prices of $20–30 per megalitre. Jones and Fagan (1996) also found that water demand remained inelastic for the MIA up to $45 per megalitre. The implications of these results for these areas suggest that increases in water prices within a reasonable range is unlikely to greatly affect water use or cropping areas, but are more likely to impact on farmer incomes and possibly farm viability.

There have been no studies undertaken in the Peel Valley on the elasticity of demand for water. However, an indication of the elasticity of demand for water can be gained by looking at the various adjustment options available to farmers and whether these are likely to mitigate some of the impacts of price rises. Possible responses to increased prices may include reducing water use on current enterprises, changing enterprise mix, substitution of groundwater for surface water, improvements in irrigation efficiency and water trading. These adjustment responses are discussed below.

i) Reduce water use on current enterprises

In theory, farmers would continue to apply the same amount of irrigation water to lucerne as long as the variable cost of water (bulk water usage charge plus pumping costs) is less than or equal to the marginal return at that level of use. The probability of farmers adopting this option partly depends on the lucerne yield response function to water. Unfortunately, there is limited information on what that yield response function might look like for the types of lucerne production systems in the Peel, making it difficult to form judgements about the rationality of this option. It is apparent that lucerne yields are not constrained by water availability, given a history of under-use in the Peel Valley, but are more likely to be associated with irrigation and agronomic practices and the possibility of other constraints on lucerne yields (such as labour involved with irrigations).

[1] Short run models are broadly defined as those models which are constrained to a time period that does not allow for all factors of production to be varied. For example, short run models commonly do not enable farm capital investment.

ii) Change enterprise mix

Some change to alternative enterprises may be justified depending on the magnitude of price change. The most likely change in enterprise mix would be the increase in double cropping of irrigated crops such as wheat or beans (L. Hyson, pers comm). There would appear to be ample water resources (at current levels of development) for most farms to support a shift into these enterprises but land and labour resources may be constraining. Additional crop management skills and possible changes to irrigation infrastructure may also be required.

From the information presented in section 3.2 on the relative profitability of lucerne hay production compared with other enterprises, there would appear to be little grounds for changing enterprise mix. Per ML returns from lucerne hay compared quite well with other enterprises based on both the 'Haymaker' data used in this study and the more general gross margin information from NSW Agriculture's farm budget handbooks. Anecdotal information suggest that changes away from lucerne hay production are more likely to be associated with the availability of farm labour than water prices. For comparison, Appendix 2 contains information on irrigated crop gross margins for Northern NSW published by NSW Agriculture from the Farm Enterprise Budgets series.

iii) Substitute surface water with groundwater use

Some irrigators in the Peel Valley have access to both surface water and groundwater. Information from DLWC on ownership of irrigation licences suggests that this varies from 0 to 23 per cent of irrigators between nodes. Substitution of surface water with groundwater may be feasible if the cost of using surface water (the bulk water usage charge plus pumping costs) was greater than the cost of using groundwater (groundwater charge plus pumping costs) and on-farm irrigation infrastructure was capable of making this change. Looking at the costs involved in utilising groundwater rather than surface water, there would appear to be some merit in this option.

Additional pumping costs associated with accessing groundwater (due to slightly greater depths of water extraction) have been estimated at just $3 per ML, whilst usage charges for groundwater are $0.30 per ML compared to $4.39 ML for surface water (1999–2000). At current prices, the substitution of groundwater for surface water is marginally preferable. If the price paths for surface water supplies (outlined in section 4.1) are not matched by the price path for groundwater charges, then there will be increasing incentives for irrigators, with access to both resources, to substitute supplies.

iv) Improve irrigation efficiency

Increased water prices may provide an incentive for irrigators to assess their current irrigation system for efficiency. The most likely efficiency responses would be ensuring that pumping pressures are correct and perhaps introducing irrigation scheduling. The 'Haymaker' project demonstrated that there are potential improvements in irrigation efficiency that could be made relatively easily at little additional cost to farmers.

In the longer term, increased water prices may be partially offset by the introduction of more efficient irrigation technologies such as subsurface drip irrigation. Subsurface drip irrigation systems can potentially decrease the water used by 30% and increase lucerne crop yields by between 20 and 30% (L. Hyson, pers. comm.). As well as using water more efficiently and increasing yield, subsurface drip irrigation requires less labour than traditional spray irrigation. However, implementing a subsurface drip irrigation system costs between $2,000 and $3,000/ha, suggesting that increases in water prices alone are unlikely to make these systems financially attractive to irrigators.

v) Trading[1]

Water trading allows water to move to areas where it can be most profitably used. This provides financial benefits to irrigators who decide to sell their water whilst also providing benefits to water purchasers by providing additional production opportunities. Trade is also likely to improve water use efficiency by making the opportunity costs of using water more transparent, in that irrigators are able to financially benefit from water that they choose not to use.

The transferability of water resources, particularly between the Peel and the Namoi Valleys, could have a major bearing on the nature, extent and efficiency of irrigated agriculture in the Peel Valley. Increase in water prices may make it more financially attractive for irrigators in the Peel to trade their allocation downstream to higher value users in the Namoi catchment than to use it themselves. However, even without any price increases, there is likely to be a significant transfer of water from the Peel to the Namoi if inter-valley trade is permitted. This is likely to arise in response to the relatively low levels of development in the Peel and the significant level of competition for water which exists in the Namoi catchment, largely driven by cotton production.

Currently there is no trade between the Namoi and the Peel rivers. However, this option is being discussed by the Namoi River Management Committee and there are more general moves to further free up trade as outlined in the NSW Government's recent White Paper on the proposed Water Management Act.

4.3.2 Analysis of the impact of increasing water charges on farm profitability

The previous section discussed the concept of elasticity of demand and looked at the possible adjustment options that farmers may take in response to increased water prices. Some of the adjustment options, like the adoption of new irrigation systems and the adoption of significantly different enterprises (requiring different machinery, irrigation infrastructure, etc.), are options that could only be implemented over the longer term.

The analysis undertaken in this study had a more short-term focus and was undertaken under the assumption that, within the relevant price range, the demand for water in the Peel Valley is inelastic. This assumption has some support from information provided earlier which indicated that returns per ML for lucerne hay production far exceed the marginal costs of water use. Previous analyses undertaken as part of the IPART Inquiry also concluded that water prices are generally only a small proportion of farm costs and increases would have a marginal impact, if any, on the farm enterprise. Consequently, the analysis assumes that irrigators continue with current farm operations and associated water use: that is, the irrigators bear price increases through higher water costs and lower net returns.

[1] Trading rules are in place that allow trade between regulated irrigators on the Peel River. However, at present there is very little water traded within the Peel. This is not surprising given the relatively secure supplies and the low level of activation on the Peel River. Current rules prevent trading from the Peel to the Namoi.

The impact of increasing water charges on the viability and profitability of farms is assessed in terms of their impact on a number of financial indicators including net farm income, business return, operating return and return on equity. Definitions of indicators are as follows:

- Net farm income: Total farm gross margin (income less variable costs) less overhead costs.
- Operating return: Net farm income less operators labour (valued at a base level of $10,000).
- Business return: Operating return less interest paid and rent on leases.
- Return on equity: The ratio of business return to equity.

Figure 6 provides an overview of the impact of water charge increases on net farm income, while detailed results looking at a number of financial indicators are presented in Table 11. In all nodes, the increase in water charges has a negative effect on the key profitability indicators. The impact in dollar terms is larger for Nodes 20 and 23 ($3,241 and $5,961 respectively). However, Nodes 21 and 22 have relatively lower net incomes, business return and returns on equity. This results in the relative impact on viability of water charge increases being higher for Nodes 21 and 22.

Figure 6: Impact of water charge increases on Net Farm Income

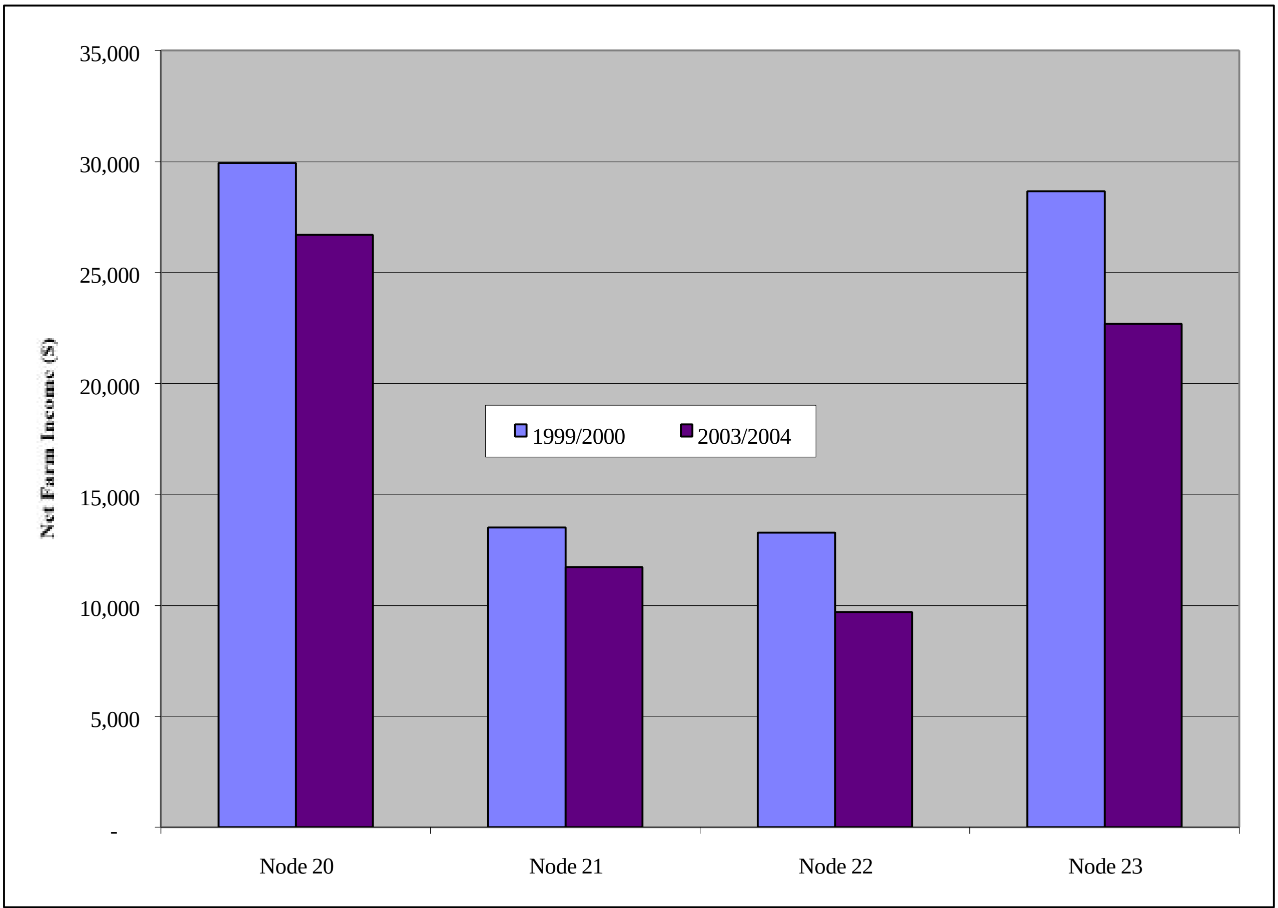


Table 11: Effect of Water Charge Price Increases on Key Profitability Indicators

	1999/2000	2000/2001	2001/2002	2002/2003	2003/2004	Amount of change	% change
Node 20							

Net Farm Income	29,943	29,132	28,322	27,512	26,702	- 3,241	-11%
Operating return	19,943	19,132	18,322	17,512	16,702	- 3,241	-16%
Business return	17,762	16,952	16,142	15,332	14,521	- 3,241	-18%
Return on equity	4.6%	4.4%	4.2%	4.0%	3.8%	-0.8%	-18%
Node 21							
Net Farm Income	13,505	13,064	12,623	12,182	11,742	- 1,763	-13%
Operating return	3,505	3,064	2,623	2,182	1,742	- 1,763	-50%
Business return	2,378	1,937	1,496	1,056	615	- 1,763	-74%
Return on equity	0.7%	0.6%	0.4%	0.3%	0.2%	-0.5%	-74%
Node 22							
Net Farm Income	13,289	12,395	11,501	10,607	9,713	- 3,576	-27%
Operating return	3,289	2,395	1,501	607	- 287	- 3,576	-109%
Business return	1,680	786	- 108	- 1,002	- 1,896	- 3,576	-213%
Return on equity	0.4%	0.2%	0.0%	-0.2%	-0.5%	-0.9%	-213%
Node 23							
Net Farm Income	28,653	27,163	25,673	24,182	22,692	- 5,961	-21%
Operating return	18,653	17,163	15,673	14,182	12,692	- 5,961	-32%
Business return	11,395	9,905	8,415	6,924	5,434	- 5,961	-52%
Return on equity	1.7%	1.5%	1.3%	1.1%	0.8%	-0.9%	-52%

NB: ‘Amount of change’ and ‘% change’ indicate the change from 2003/2004 compared to 1999/2000.

The results of the study indicate that farms in Nodes 21 and 22 will have more difficulty absorbing the proposed water price increases than Nodes 20 and 23. This largely because their net farm incomes under existing water prices are estimated to be relatively low to begin with[1]. Water price increases simply exacerbate their current financial position. Node 22 is particularly affected by the price increases and this can be partly attributed to the farm's low level of entitlement utilisation which increases the significance of fixed entitlement charges. The representative farm for this node is only irrigating a small area relative to its water entitlement and is not capable of generating sufficient income to meet price increases. With future growth likely in the water market in the Peel it is likely that this farm type would sell the unused portion of its entitlement (temporarily or permanently) or expand production to lift its income generation capacity. These options have not been considered in this analysis.

This analysis holds all other costs and income levels constant to assess the relative impacts of the water price increases. Agriculture in general has been facing declining terms of trade for the last 30 years, with costs increasing relative to income. While little data is available on farm cost increases in the Peel Valley specifically, it is apparent that prices for lucerne hay have remained fairly static for the last 10 years. Generally, lucerne prices do not appear to have increased significantly since at least the early 1990s (L. Pengelley, pers. comm.). The implication is that the increase in water charges will increase the rate of decline of terms of trade of lucerne hay producers in the Peel Valley. Farms in Nodes 21 and 22 appear to be under the greatest pressure if the overall trend is maintained in the future.

[1] The analysis excludes any sources of off-farm income. Information provided by ABARE using their 1996-97 survey of irrigation farms in the Peel Valley indicated that $13,070 of off-farm income was received.

5. Conclusions

The study used representative farm models of irrigated agriculture in the Peel Valley to assess the importance of water to farm costs and the implications of proposed price increases nominated by DLWC. The models are spreadsheet-based and attempt to capture the key characteristics of irrigation farming in different zones in the Peel Valley. For the analysis undertaken, the regulated section of the Peel was broken down into four zones consistent with the availability of hydrology data from the DLWC. The impacts of proposed water price increases were assessed on each of these representative farms under average climatic conditions and allocation availability.

The first part of the analysis considered the importance of water to farm costs. Results were presented on the contribution of water charges to enterprise (lucerne) variable costs, water variable costs and total farm costs. In each section, water charges in the 1999–2000 and 2003–04 are used to provide an assessment of the relative importance of water costs. The results indicate that, in all sections of the Peel, the proposed increased water prices almost triple the contribution of water use charges to per hectare water costs for lucerne growing, to lucerne variable costs and to total farm costs. While these percentage increases are large, they occur from a relatively low base. It is apparent that total water costs will continue to account for only a small proportion of overall farm costs for all sections of the Peel despite the proposed water price increases.

The second part of the analysis considered the impacts of proposed price increases on the viability of farms in the Peel Valley. The elasticity of demand for water was discussed as an important factor in determining the nature of the impacts from higher water prices. Possible adjustment responses by irrigators in the Peel to higher water prices were discussed also in the absence of previous work on demand elasticities in the area.

An analysis was then undertaken on the impacts of price rises under the assumption that demand for irrigation water was inelastic over a reasonable water price range. Across the nodes, the impact of the final year water charges (2003–04) found that net farm incomes would fall between 11–27 per cent, with farms in Nodes 21 and 22 most severely affected. These projected falls in farm profitability are sensitive to the level of entitlement utilisation and the overhead cost structure of farms. The latter is an area where data availability is particularly limited and some caution should be exercised over the interpretation of results.

The results indicate that the proposed price increases are unlikely to pose major viability issues for most irrigation farms in the Peel Valley. They will however add to the general picture of declining terms of trade common to many broadacre agricultural industries. This implies that, in the longer term, farmers in the Peel Valley will need to continue to improve the productivity and efficiency of their production systems to remain viable or gain other income beyond the operation of the farm.

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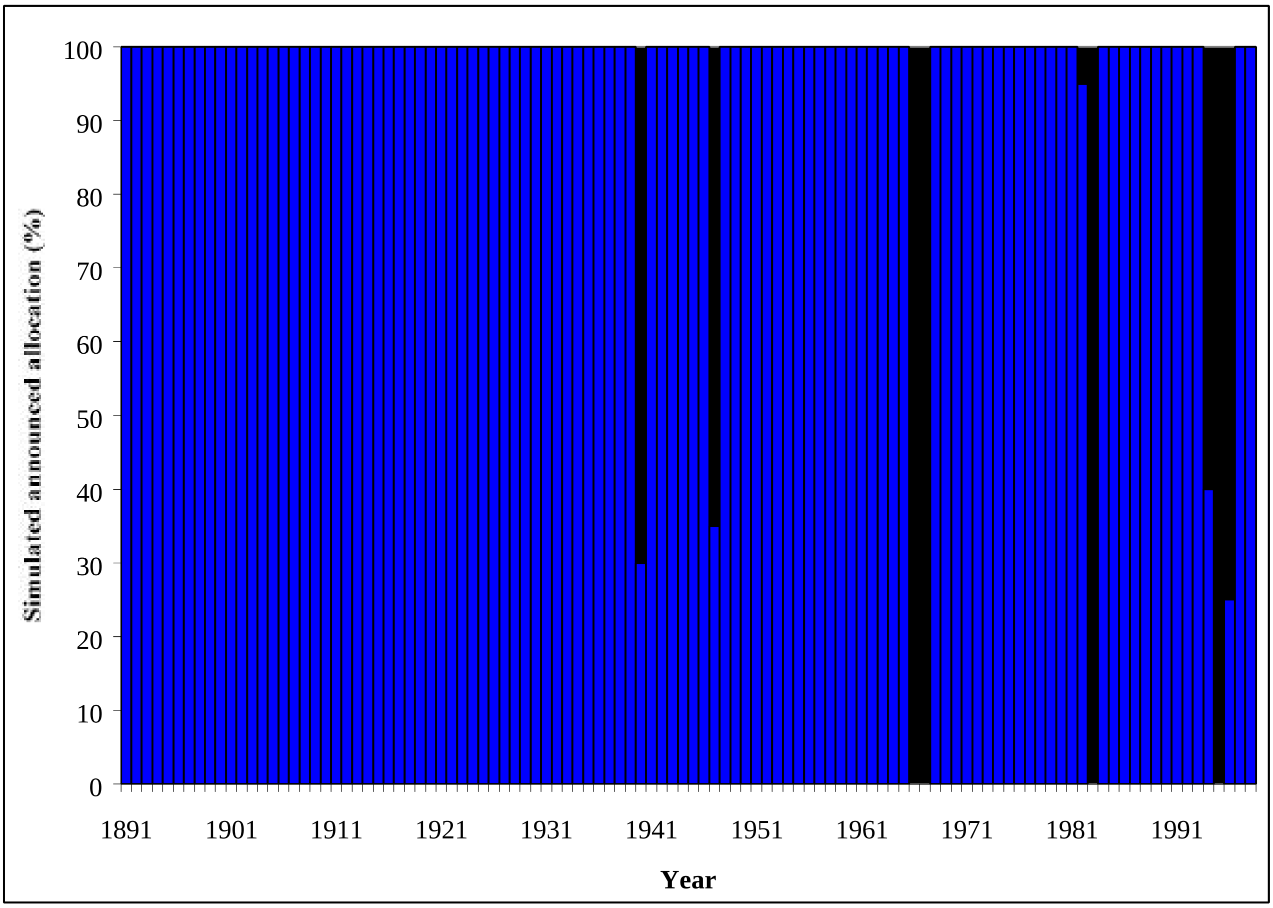
Appendix 1: Background information on the Peel Valley

A1.1 Local Government Areas in the Peel Valley

A1.2. Allocation reliability in the Peel Valley

Figure 7: Simulated announced allocation availability for the Peel Valley



Appendix 2: Irrigated crop gross margins in Northern NSW

Table 12 shows irrigated crop gross margins published by NSW Agriculture from the Farm Enterprise Budgets series. These crops are potential alternatives for lucerne, however some (e.g. cotton) are not suitable for the Tamworth/Peel district due to climatic limitations. These budgets are published to provide a guide for farmers to the relative profitability and an indication of management operations involved in different cropping enterprises. Budgets are calculated using crop yields for the region that are consistent with the operations given, forecast commodity price, current input costs and technical information provided by district agronomists. Therefore they are *not* regional averages.

Table 12: Irrigated crop gross margins for northern NSW

Crop	Yield	Income	Costs	Gross Margin per ha	GM / ML	Est. ML used
Mungbeans	1.5 t/ha	712	398	314	209	1.50
Maize	10.0 t/ha	1,200	828	372	52	7.15
Sunflowers	3.0 t/ha	840	463	377	75	5.00
Sorghum	8.0 t/ha	1,040	550	490	98	5.00
Soybeans	3.0 t/ha	960	457	503	84	6.00
Navy beans	2.0 t/ha	1,320	542	778	259	3.00
Cotton	6.75 bales/ha	3,065	2,004	1,061	221	4.80
Bread wheat	5.00	850	300	550	162	3.40
Durum wheat	5.50	1,045	350	695	204	3.40

Source: Scott, 1999 and 2000.

Appendix 3: Representative farm details for each node

WHOLE FARM BUDGET **NODE 20**

Farm gross margin	GM/ha	GM/enterprise
Hay (full production stand)	**1,637**	**47,900**
Hay (new stand)	**828**	**6,057**
Wheat	**189**	**3,305**
Cattle	**72**	**4,574**
Sheep	**95**	**3,126**
Off farm income		-
Other		
	Sub-total gross margin	**64,962**

Water costs		
Water usage charge	On allocation	413
	Off allocation	114
	Total Water Usage Costs	528
	Total Gross Margin	**64,434**

Overheads		
Administration Expenses		$1,461
- Bank Charges		$120
- Insurance		$1,349
- Workers compensation		$636
Loan repayments		$2,186
Labour		$6,359
Fuel and Oil		$1,693
Electricity (not including pumping costs)		$900
Repairs and Maintenance		
- Plant and equipment	3%	$3,931
- Structures	1%	$238
Depreciation		
- tractor 1	57 KW PTO (76 HP) & 63 KV	$2,229
- tractor 2	74 KW PTO (94 HP) & 83 KV	$0
- Other plant and equipment		$9,947
- Structures		$1,250
Rates		
- Land		$1,084
- Water entitlement (allocation) charge		$1,108
Other Overheads		$0
	Total overhead costs (excluding interest)	$ **34,492**

NET FARM INCOME	**29,943**

Depreciation	
Depreciation - machinery	12,176
Depreciation - structures	1,250
Total Depreciation	**$ 13,426**

Interest payments		
Loan 1	10.50%	**2,181**
Loan 2	10.50%	-
Overdraft	10.50%	-
0	10.50%	-
Total Interest		**$ 2,181**

WHOLE FARM BUDGET **NODE 21**

Farm gross margin	GM/ha	GM/enterprise
Hay (full production stand)	**1,641**	**31,154**
Hay (new stand)	**828**	**3,931**
Wheat	**184**	**911**
Cattle	**66**	**2,144**
Sheep	**96**	**1,608**
Off farm income		-
Other		
	Sub-total gross margin	**39,748**

Water costs		
Water usage charge	On allocation	253
	Off allocation	79
	Total Water Usage Costs	333
	Total Gross Margin	**39,415**

Overheads		
Administration Expenses		$755
- Bank Charges		$120
- Insurance		$697
- Workers compensation		$329
Loan repayments		$1,130
Labour		$3,286
Fuel and Oil		$1,054
Electricity (not including pumping costs)		$900
Repairs and Maintenance		
- Plant and equipment	3%	$4,115
- Structures	1%	$238
Depreciation		
- tractor 1	57 KW PTO (76 HP) & 63 KV	$1,353
- tractor 2	74 KW PTO (94 HP) & 83 KV	$0
- Other plant and equipment		$9,071
- Structures		$1,250
Rates		
- Land		$1,060
- Water entitlement (allocation) charge		$553
Other Overheads		$0
	Total overhead costs (excluding interest)	$ **25,911**

	NET FARM INCOME	**13,505**

Depreciation	
Depreciation - machinery	10,425
Depreciation - structures	1,250
Total Depreciation	$ **11,675**

Interest payments		
Loan 1	10.50%	**1,127**
Loan 2	10.50%	-
Overdraft	10.50%	-
0	10.50%	-
Total Interest		$ **1,127**

WHOLE FARM BUDGET	NODE 23	
Farm gross margin	**GM/ha**	**GM/enterprise**
Hay (full production stand)	**1,144**	**45,503**
Hay (new stand)	**832**	**8,277**
Wheat	**192**	**25,775**
Cattle	**75**	**15,659**
Sheep	**94**	**10,193**
Off farm income		-
Other		
	Sub-total gross margin	**105,406**

Water costs		
Water usage charge	On allocation	673
	Off allocation	271
	Total Water Usage Costs	944
	Total Gross Margin	**104,462**

Overheads		
Administration Expenses		$4,862
- Bank Charges		$120
- Insurance		$4,491
- Workers compensation		$2,117
Loan repayments		$7,276
Labour		$21,166
Fuel and Oil		$3,860
Electricity (not including pumping costs)		$900
Repairs and Maintenance		
- Plant and equipment	3%	$3,921
- Structures	1%	$238
Depreciation		
- tractor 1	57 KW PTO (76 HP) & 63 KV	$3,790
- tractor 2	74 KW PTO (94 HP) & 83 KV	$5,051
- Other plant and equipment		$12,768
- Structures		$1,250
Rates		
- Land		$1,931
- Water entitlement (allocation) charge		$2,069
Other Overheads		$0
	Total overhead costs (excluding interest)	$ **75,809**

NET FARM INCOME	**28,653**

Depreciation	
Depreciation - machinery	21,608
Depreciation - structures	1,250
Total Depreciation	**$ 22,858**

Interest payments		
Loan 1	10.50%	**7,258**
Loan 2	10.50%	-
Overdraft	10.50%	-
0	10.50%	-
Total Interest		**$ 7,258**

WHOLE FARM BUDGET **NODE 23**

Farm gross margin	GM/ha	GM/enterprise
Hay (full production stand)	**1,270**	**53,794**
Hay (new stand)	**1,002**	**10,609**
Wheat	**189**	**18,876**
Cattle	**75**	**13,229**
Sheep	**94**	**8,632**
Off farm income		-
Other		
	Sub-total gross margin	**105,142**

EXPENDITURES-VARIABLE COSTS		
Water usage charge	On allocation	754
	Off allocation	304
	Total Water Usage Costs	1,058
	Total Gross Margin	**104,083**

Overheads		
Administration Expenses		$4,086
- Bank Charges		$120
- Insurance		$3,774
- Workers compensation		$1,779
Loan repayments		$6,115
Labour		$17,788
Fuel and Oil		$3,731
Electricity (not including pumping costs)		$900
Repairs and Maintenance		
- Plant and equipment	3%	$3,921
- Structures	1%	$238
Depreciation		
- tractor 1	57 KW PTO (76 HP) & 63 KV	$3,790
- tractor 2	74 KW PTO (94 HP) & 83 KV	$5,051
- Other plant and equipment		$12,768
- Structures		$1,250
Rates		
- Land		$1,663
- Water entitlement (allocation) charge		$1,731
Other Overheads		$0
	Total overhead costs (excluding interest)	**$ 68,705**

NET FARM INCOME	**35,379**

Depreciation	
Depreciation - machinery	21,608
Depreciation - structures	1,250
Total Depreciation	**$ 22,858**

Interest payments			
Loan 1		10.50%	**6,100**
Loan 2		10.50%	-
Overdraft		10.50%	-
	0	10.50%	-
	Total Interest		**$ 6,100**

Additional financial assumptions for representative farms

- interest rate 10.5%
- debt/ha $145
- tractors are 6 years old and hay equipment 8 years old (no data is available on machinery age in the Valley, so this is an assumption)
- depreciation on other farm machinery & irrigation equipment is 5% per annum
- tractor time spent on full production lucerne- 8 hours/ha/year
- tractor time spent on establishment lucerne- 4.6 hours/ha/year
- tractor time spent on dryland wheat- 1.2 hours/ha/year
- Nodes 20, 21 & 22 use a 57 KW PTO (76 HP) / 63 KW engine (86 HP) tractor, Node 23 uses a 74 KW PTO (94 HP) / 83 KW engine (110 HP) tractor.