LIQUID GOLD

LIQUID GOLD

Written by Brian Cameron

Copyright © 2009 Brian Cameron
All rights reserved

No part of this book may be reproduced or distributed in any form, or stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, microfilming, recording or otherwise without prior written permission from the Publisher.

ISBN 978-0-473-15346-5

Publisher
Brian Cameron
29 Catherwood Avenue
Ashburton, New Zealand
bk.nrcameron@xtra.co.nz

Bruce Print Digital

FOREWORD

From the earliest European exploration of the Canterbury Plain, the single most frequent diary records are of the dry treeless, waterless expanse of plain between the Rakaia and Hakatere (Ashburton) rivers.

Noted explorer Bishop Selwyn in his coastal journey south from Christchurch on 9th January 1844, records after crossing the Rakaia river near its mouth "We had a tract of twenty-four miles to pass without fresh water, over a dry gravelly plain. My Macintosh did extra duty being converted into a water skin. The want of water is so unusual in New Zealand that I think this is only the second or third time I have been obliged to carry it."

Liquid Gold is a worthy record of the 100 year struggle to turn that "vast treeless, waterless" expanse into the diverse food bowl of agriculture that it is today. The Pendarves Irrigation History is far more than one person's vision of what can be achieved. It is a chronicle of the struggle faced by visionaries and innovators across four generations.

Liquid Gold accurately establishes the pivotal role that irrigation has played in the economic wellbeing of the Ashburton District over the last seventy years, and the significant need to further develop and utilize the rich water resources with which this District is endowed.

The role of author Brian Cameron and wife Norma, is much more than that of a family wanting to improve their own economic situation. Brian Cameron possesses that rare mix of theoretical knowledge, practical ability and political nous, to demonstrate, promote and actively encourage others to follow. Not satisfied with proving that the vast underground water resources in the eastern sector of the District could be economically utilized to enhance and hugely expand farm productivity in that area, the Cameron's then challenged themselves to economically convert a dry land Mitcham farm to low cost border-dyke irrigation. Again their low labour input system, with its much improved water efficiency proved a catalyst for change on many existing outdated second generation border-dyked holdings.

Liquid Gold accurately chronicles the physical, financial and political struggles that have turned the virtual dust bowl of much of the Ashburton District of seventy years ago, into the flourishing oasis of farm production today. The list of

names involved reminds readers of the resourcefulness, dogged determination and true pioneering spirit that still prevailed in the latter portion of the twentieth century amongst our farming leaders. While acknowledging that there is still much to be done to sustainably expand our irrigation capacity, there's an old saying "Its difficult to know where you're going if you don't know where you've come from." A legacy of fact, experience, memories and history is a fantastic gift to future generations. Liquid Gold is just that.

L. John Leadley
Deputy-mayor Ashburton District Council 1998 - 2009

LIQUID GOLD

PENDARVES IRRIGATION HISTORY

I was eight years old and a well was being dug at Dundas Estate! I wanted to know what it was like in the well and was lowered down in a bucket. It became darker, wetter, colder and quieter and I became more and more frightened. Time stood still. The opening at the top seemed to become smaller and smaller and I became convinced that I may not get out again. I did, however, and thereafter had much more respect for people who did that job. And this was a relatively shallow well!

Ashburton County, situated as it is, on the eastern side of the Great Mountain Divide of the South Island of New Zealand is subjected to frequent and often severe droughts. The Plains area of the County extends from the mighty Rakaia River in the north, past the Ashburton River in the middle to the Rangitata River in the south, a distance of about 60 kilometres and also extends from the mountains to the sea, a distance of about 60 kilometres. The topography appears flat but rises to about 500 metres elevation at the foot of the foothills, giving a fall of about 8metres per kilometre. The plains are largely alluvial in origin and have been built up over millions of years by water erosion from the mountains.

Some soils are loess in origin, and have been built up by the actions of the severe north-west winds, and the resultant dust storms. The main precipitation comes from the irregular south-west storms that pass over the area. On other occasions heavy rainfall can occur from easterly storms of tropical origin

Further inland is a vast expanse of mountains, glaciers, and river basins, which have a profound effect on the plains climate. In contrast to the plains, rainfall mainly comes from the westerly direction The headwaters have a westerly induced belt of very heavy rainfall which, on occasions cause floods in the major Mid-Canterbury rivers and at other times maintain considerable flows in the rivers. For example the mean flow in the Rakaia River is in excess of 200 cumecs. So there is not a lack of water per se in the plains area. Ironically there are occasions when there is a drought on the plains and at the same time there is a flood in the major rivers! The Glaciers release most of their moisture during the spring.

The mountain range, the Southern Alps, have a major effect on the wind ferocity and moisture content of the prevailing westerly winds. As the winds flow up and over the mountains they lose their moisture and become very strong and exceedingly dry. Humidities of 20% are common and rapidly remove further moisture from the soil. Droughts are one of the main characteristics of the Plains area and strongly influence all aspects of life.

While the mean flows of the adjacent Rakaia and Rangitata Rivers are very large, (about 220 and 110 cumecs respectively), there is no natural surface water between the Rakaia and Ashburton Rivers. This lack or water has played a pivotal part in the development of the area. The problems associated with the lack of water, for domestic purposes, stock water and irrigation are woven into the history of the area.

Since the first settlement, there have been a number of significant events involving water that have made life possible for the inhabitants.

Prior to about 1880 hand dug wells were sunk on many properties, some as deep as 60 metres, and these provided much needed water for humans and animals.

Later, the water race distribution system, begun in the 1880s, was a major contribution to the development of the district. This was a major network of several thousand kilometres of small channels, which ultimately reached almost every paddock on every farm in the County. Also of importance was the building of the Rangitata Diversion race in the late 1930s and early 1940s period, with its ability to supply irrigation water to tens of thousands of hectares of parched farming land.

Official opening of the first water race in the Ashburton County at Pudding Hill 31st January 1881

Another more recent development has been the discovery and utilisation of the underground water aquifers, enabling good quality domestic and stock water and very extensive irrigation.

Today, water is generally available and contributes greatly to the economic, social and recreational welfare of the Ashburton District. However there is much work still to be done in order to provide for the increasing demand for water, its distribution and its efficient usage. This will involve improved irrigation efficiency, the provision of multi-purpose storage, different allocation systems, different distribution systems and governance, and better methods of pollution avoidance.

The transformation of this area over several decades has been staggering. Prior to the introduction of irrigation in the 1970s, the district was only capable of supporting sheep farming and a little bit of cropping. There was a saying that even the visiting rabbits brought their lunches! There was no through traffic in this corner of the County and people driving along State Highway One hardly knew it existed. Today it is a world-class vegetable growing, cropping and dairying area.

On one occasion I was in England in the 1990s and was talking to an English dairy farmer about farming in general. He was telling me that he had travelled a lot and believed that the best dairying area in the world was in coastal Canterbury. It had good soils, climate, topography, drainage, infrastructure, local services, good marketing and above everything else excellent irrigation. He was very surprised when I told him that I also knew the area and in fact was farming in the middle of it!

This is an account of the significance of water to the wellbeing of the people of the Ashburton District, between the Ashburton and Rakaia rivers, and with particular reference to the Pendarves and surrounding districts. I was closely associated with several phases of the irrigation promotion and these were the events as seen through my eyes.

The very early history of the Ashburton County is well described in this abstract from the work of P.D. Stewart. (" Landscape Evolution in the Ashburton Plains -1850-1950 – P.D.Stewart- (CUC thesis) 1986)

P15 " The 'Trans-Rakaia ' area remained a wilderness until the early 1850s. Ashburton was one of the last areas of Canterbury developed. The Rakaia and the Rangitata rivers were difficult to cross, being difficult and dangerous. The landscape was desolate, very flat and lacking in water and resources. There was little to attract markets, supplies, transport and society. The earliest form of farming consisted of running merino sheep on native pasture, restraining them by using boundary riders. The two earliest 'runs' were Acton, backing onto the Rakaia River and Wakanui, backing onto the Ashburton River. The homesteads were built next to the rivers. The earliest shelters were calico tents or simply sleeping under the dray. These were followed by cob or sod cottages.

Cob for a building was prepared by digging a large hole in the ground. Clay was then put in the hole and water added. A horse was ridden back and forth over it to get the required consistency. Tussock grass was added and further trampled on. The mixture was shovelled into place to form the first two feet of the wall and allowed to dry, and then the process repeated. Finally the walls were trimmed and whitewashed. Small openings to act as windows were added. The roof was either thatched or shingled. They were warm, durable and attractive.

Sod cottages were made from squares of soil dug up and placed on top of each other to build walls and then some form of roofing added.

Later as it became available timber was used more extensively.

The settlers had few possessions and only basic needs and these homes were acceptable.

Boundary riding was unattractive and eventually sod fences topped with gorse became more commonplace. Firstly the settler would ring fence his property and fence around his homestead to keep the stock out. Wire was also used. The first types being very heavy and in the case of the top one having barbs added by hand. The Nor'west wind swept across the plains, often pilling dust against houses, and fences and generally making life miserable. Tree planting became very important, particularly around homesteads."

(My father, R.C.Cameron, whose father A.C.Cameron owned and developed several properties in the Chertsey/ Newlands area, once related that in the early 1900s, the early Dundas homestead trees could be seen from just outside Ashburton, a distance of about 10 kilometres. There were no other trees in between. The lack of shelter resulted in very drying conditions and severe windstorms)

"Water supply---Fortunately the sheep used, the merino, were capable of living without water and survived on what they could get from dew and rainfall. However Charles Reed of Westerfield and Duncan Cameron of Springfield both developed water race systems for their properties. The Ashburton County Council was formed in 1876 and immediately became involved in water race planning. This was to become one of the most significant developments undertaken in the Ashburton County.

The 1860s saw the introduction of cultivation and the growing of wheat and eventually the use of better pasture species."

The above quotation from P.D.Stewart illustrates the realities of early settlement.

The Somerton Estate's water supply came from an 11,000-gallon concrete tank in which was stored both rain water and water drawn from a 170 foot well. This would be typical of many properties of this time. Among others recorded were the Chertsey Bellvue estate with a granary and storehouse built over a water storage tank, 20 feetx 16feet x 13 feet deep, supplied from rain water and a 200 foot well.

Several other 200 foot wells were dug in the Taverners Road area.

(A gallon is about 4.5 litres and a foot is about 30cm.)

I recall an occasion in the late 1930s when my father, R.C.Cameron (Bob) employed a well digger (Dave Dowdle) to dig a well at Dundas Estate. The cross-section was about 80cm by 200cm. The first three metres were dug using a pick and shovel, the soil and shingle being thrown out onto the ground. A windlass was set up above the well with a bucket attached to a rope and the rope was wound around the drum of the windlass. The windless had a large turning handle at one end. One person worked on top and would repeatedly lower the bucket into the well and the digger would fill the bucket with soil or shingle. When the bucket was full the top person would wind it up and empty it.

Periodically the well would be lined with vertical timbers supported by an internal frame. When the digger wanted to descend he would stand in the bucket and be lowered by his mate. The top person had to be careful that he did not drop the digger or that later, he did not let the bucket fall on the digger!

Sometimes there was a lack of fresh air at the bottom of the well. A technique used was to rig a sail above the well to divert air down the well.

The Dundas Estate well was only dug to about 20metres where perched water was found and the well used for drinking purposes for a number of years. To obtain water a bucket would be lowered on a rope and wound up on the windlass. The quality of the water was excellent and a big improvement on possibly polluted water-race water or rainwater.

Perched water is found where local rainfall has collected in a limited impervious basin over many years and could be quickly exhausted. The basin would be above and isolated from the permanent aquifer. This was typical of many relatively shallow wells dug across the plains in the early days. A few did reach the permanent static water levels either because they were very deep or were near the coast where the aquifers were shallower.

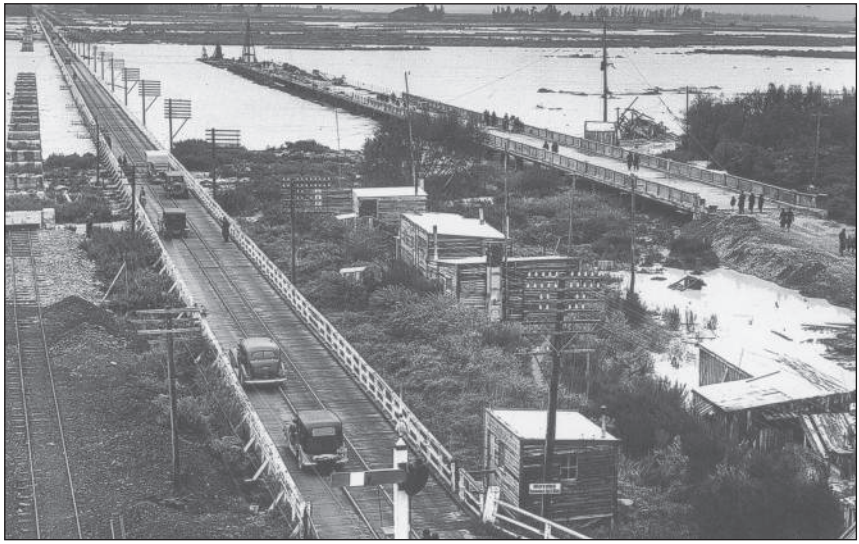
EARLY SETTLEMENT

Three of the earliest settlers were Peter Doig, John Copland and John Lambie. All arrived in the mid 1870s and John Lambie was probably the first to dig a well in the district, on his property at Kyle. This meant he did not have to transport water from the river and neighbours also benefited. Being near the coast, it is likely he would have found water at a shallow depth and would have penetrated the static water level and obtained a good permanent supply.

These three eventually became large landholders and were prominent in community affairs. Over the generations the three family names multiplied, as did the families of Watson, Cameron, Bruce, Long, Bird, Hampton, Ironside, Sprott, Hanrahan, Grice, Banks, Croy, and Kingsbury and others. There was a strong community spirit and a tendency to intermarry. My father and mother grew up on almost neighbouring farms and while they attended different local schools, they would have had frequent contacts through social and sporting events. Contact beyond the immediate district was difficult. Many people who lived in the district in the 1900s can trace relationships between many of these families.

The population of the Borough of Ashburton in 1900 was 2,322 and that of the County 11,342. This is in striking contrast to the Year 2000 figures of approximately 13,000 in the borough and only about 13,000 in the rural areas and townships. In 1900 most people lived on farms, which were highly labour intensive and largely self- supporting. The town was largely there to support the farming industry. Today's vastly increased agricultural productivity is being achieved by far fewer people. Agriculture has become very mechanised and the large number of farm workers is no longer needed. However this in turn has seen the need for support servicing industries in the urban area. The town is still predominately a rural industry town. However secondary industries have also developed and they provide diversity to the town's employment and opportunities.

Improved transport was crucial to development. The building of the combined Railway and Road Bridge over the Rakaia River and the extension of the railway line to Ashburton in 1872 opened up the area to the outside world. The Railways employed people who lived in small houses at either end of the bridge and their job was stop car travel when a train was due. Planking between the rails allowed cars to travel across the bridge at other times. Using extreme



Construction of new Rakaia road and railway bridges, replacing old combined road and rail bridge, late 1930s

care it was possible for drays, horse gigs and later cars to pass each other. As a small boy, I well remember the excitement of creeping across the rattling bridge in our parent's car in the 1930s and being fearful of a train arriving while we were crossing!

The advantages of the railway over other forms of transport of that time were huge and resulted in very rapid development of the Ashburton County. Road transport was slow and difficult. Further extension of the main railway line to the south quickly followed as did branch lines to Springburn and Methven.

These provided transport for both passengers and goods. Large quantities of wheat, other crops and sheep were transported in this way. Live sheep were transported to the freezing works and then the frozen carcases, ready for export, from the works, were delivered to the export ports. of Timaru and Lytellton The many small railway stations quickly became the social centres of the otherwise isolated districts.

P.D.Stewart noted that the original intention was to build the railway line south from Southbridge, across the Rakaia River at Dobbin's Ford and then through Dorie, Kyle, Seafield and Wakanui. It was decided, however, to take the direct Christchurch / Ashburton route.

Many people wonder why the main road from Christchurch to Ashburton has a bend at both Bankside and another at Dromore, (rather than being in a straight line). The reason is that after construction of the road begun it was realised that the banks of the Rakaia River were lower a further kilometre or so downstream and therefore easier to cross. The road was shifted accordingly. The fledgling township of Rakaia also developed further downstream.

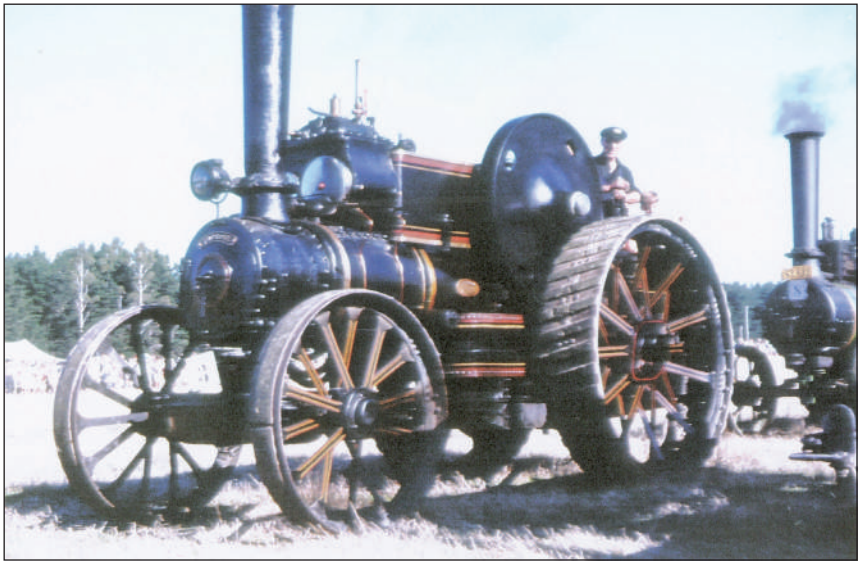
There was continuous improvement of roading with the local Road Boards playing an important part.

Originally each local district had its own Road Board, elected by the local community, and funded by local rates. These were often no more than a group of farmers and often the farm workers were used to do the work. In the original state the tracks quickly became rutted and progress was difficult. The object was to make roads passable in all weathers. This was done by employing workers with horses and drays to load up with shingle from the pits, which were dug every few kilometres alongside the track and then spread it on the surface to form an all-weather road.

Most of the plains area was no more than a shallow covering of soil on top of a great depth of shingle or gravel. This shingle provided a ready source of road material from a pit. These roads were always dusty when dry and wet and muddy when it was raining. With the wear and tear of passing traffic, potholes quickly developed and had to be periodically repaired. Later, where the water races crossed the road, the resultant ford was a convenient stopping point for horses to have a drink of water.

The modes of transport evolved over time but for many decades the horse was the main means of transport, (beyond the railheads), for both people and goods. Horses were ridden or drew spring carts or carriages for passengers. Drays with single or multiple horses were used to shift goods. Bullock teams were also used, usually for the very heavy haulage. Going to town to do the shopping was a big event and was planned well in advance. It was also a big social occasion.

Eventually traction engines, solid wheel trucks, and branch railways partly replaced horses and bullocks. The railways were able to carry large quantities of both inward and outward goods rapidly and became the backbone of the



Traction Engine 1880-1920 era

transport system. Traction engines, hauling several wagons, were capable of shifting many times the loads of horse drays and wagons and were used to transport crops to the railheads. In turn today's modern truck fleets became the means of transport in the rural areas, made possible by our tar-sealed roads. As road transport became more efficient, the branch railway lines disappeared.

The sheep numbers in 1900 were officially 738,816 and the area in crop was 397,653 acres.

The balance changed somewhat over time with relative produce prices. For example, when wool prices decreased in the 1880s and wheat prices increased, there was a swing to cropping.

The introduction of refrigeration for lamb meat in 1882,when the SS Dunedin sailed for England was highly significant. The Fairton (earlier called Fairfield) freezing works opened in 1899. For many years drovers or the farmers drove mobs of sheep to the works. It has only been recently that modern trucks have completely taken over this function. Whereas in the past, sheep farming was mostly for wool and tallow, there was now an additional market for meat. I remember, on one occasion driving a mob of recently weaned lambs to Fairton and in a moment of inattention having them break back on me and ending up back on the farm with their mums!

Water for humans and animals was tremendously important and a massively important development occurred in 1882 with the introduction of the water-race system.

The first County Council water race (the Dromore) originated at Pudding Hill and finished at Dundas Estate (a distance of 33miles) (A mile is 1.6 kilometres). The inauguration ceremony took place on 31st. January 1881. A large contingent of dignitaries from Ashburton travelled by train and horse traffic.

The event was an occasion for speech making and a ceremonial turning of the sluice to let the water flow into the race.

The large number of people attending was an indication of the importance that they placed on the event. Even so I doubt that they fully realised the long-term benefits that would follow from the use of water over the area. I wonder what they would think of present day irrigation developments? It was also a social event, (for the men), finishing with a champagne luncheon.

The cost of the races was Twenty Pounds per mile and a total scheme cost was Three Thousand, Nine Hundred Pounds. (a Pound is two Dollars) Most of the cost was in the intake structure. The race itself was made by a large single furrow plough, pulled by a team of horses and with some handwork at roadways and fences. The slope of the plains (approximately 30 feet to the mile) was sufficient for the water to flow readily. The engineers expected percolation losses and predicted that it would take three weeks for the water to reach Dundas. To everyone's surprise, the water took only 48 hours to cover the distance.

Shortly afterwards a second race (the Chertsey) was installed. A Chertsey resident, knowing that the water had been turned on at the new race and returning home at night saw water flowing across the road at the road crossing and wrote - " there in the moonlight was the water, slowly creeping down the channel. Earthy and carrying dry grass with it, and with dirty looking bubbles on the top, still it was the most beautiful and unforgettable sight."

The water race system was rapidly expanded to the whole of the County and was highly effective and had a massive effect on the development of the Ashburton County. It was an extraordinarily efficient system of suppling water to the farming areas. It is difficult to quantify the benefits of this system, which 120 years later, was still functioning as well as the day it was constructed.

It was also remarkably cheap. to operate. Each farmer was expected to maintain the water race on his property, but on occasions farmers neglected to keep them clean, resulting in impeded flows. Also in summer the evaporation from the water surface was considerable, further reducing flows. The Council maintained the intake. The flood of May 1883 required the replacement of the boulder weir.

Silt tended to block the races and in the summer dense weeds would grow profusely in the water, impeding the flow. Especially designed 'water race ploughs ' were used to clean the races. These had a prow like a boat and split the material and deposited it onto the banks of the race. These were great occasions for boys who delighted in getting a little bit dirty! The plough was usually pulled on a long wire rope with horses or a tractor. The water was undrinkable for some time.

The system was designed to supply water for human and stock consumption only but human nature being what it is, over the decades, there have been numerous cases, reported and not reported, of farmers illegally taking water for irrigating crops and gardens. This action quickly dried up the races, and the downstream farmer might need to shift his sheep some distance to other paddocks where there might still be a race with water. In summer the farmers at the end of the system were often without water, sometimes for considerable periods of time. The stress on these people was considerable and was source of anger towards the upstream offenders. The farmer would feel very annoyed! On occasions, in desperation, I have driven upstream to determine just how far away the water supply might be and to identify the culprit.

A large flow had to be introduced into the system at the top in order to sustain the flow throughout its length. Often farmers at the top end, observing a large flow through their properties did not appreciate the importance of the water to farmers lower down.

The Council employed "Water Rangers" whose job was to police their area and endeavour to maintain the water flow. They had to have thick skins! The best ones were strict and kept on top of the situation by early intervention. In summer, once the flow had stopped and cracks had formed in the race bottom, it took a long time for the flow to resume, often many days.

One ranger, in the mid 1900s, used a pushbike to do his rounds. He was thus able to easily follow the entire length of races and closely observe the state of the

race. On occasions he would arrive at the farm homestead from the back of the farm and possibly reprimand the farmer for having a dirty race or even worse give him a stern talking to because he was quietly watering a potato patch out the back of the farm! He became much feared by some people in the district. However he was very popular with farmers lower down the system, who were now getting a water supply.

About half a cumec of water in total was used in the County system and was, literally, the lifeblood of the Ashburton District.

I recall my father, R.C.Cameron, describing the situation before the advent of the water race system. He said that in these early times Dundas Estate, like other farms away from the river, would send a workman with a horse and dray and a four hundred gallon tank to the Rakaia river each day, where the workman would fill the tank using a bucket before returning home with the water. The round trip would be about 30 kilometres. In a dry period this could be a full time job. Trees were difficult to establish and sometimes this precious water was used to keep them alive.

Water was used sparingly and it was an art to wash with a small amount of water!

Duncan Cameron of the Springfield Estate (Between Ashburton and Methven) developed a private water- race system from the Ashburton River, at an early stage, for household and stock water and also for irrigating some crops. By 1880 he had 40 miles of races running to all parts of his farm.

From the earliest days of settlement, there was the realisation that lack of water was the limiting factor in agricultural production. There were concerted efforts by many organisations and groups interested in irrigation. For example, in the 1880s, William Baxter, the engineer for the Ashburton County Council, suggested a tunnel from the Rakaia River by which water could be delivered for irrigation. This tunnel was to be 8.5 miles long and was to have the intake near the Gorge Bridge. Costing and designs were calculated by Sir.A.Dudley Dobson in the 1890s. This would have been a very expensive exercise.

Dobson also suggested that the County should tap Lake Heron to augment the South Ashburton flow.

A third suggestion was to take water from the Rangitata River from a site lower down than the present Rangitata Diversion Race intake at Klondyke.

In 1886 the Ashburton County Council discussed irrigation and in the following year (1887) decided to carry out an experiment to measure the value of irrigation.

"It is advocated that the council should experiment to demonstrate beyond all doubt that irrigation will pay and so secure the support of the rate payers for a complete system applicable to the whole county" An experimental farm of 94 acres was established at Elgin, a few kilometres east of Ashburton. In the ensuing year samples from the Elgin farm were displayed in Friedlander's store in Ashburton. The farm was run for a further year. In 1889 it was reported that " the benefits to be derived from irrigation, having been clearly demonstrated, the council is of the opinion that further experiment is unnecessary and that all business with the farm was to be wound up by 31st. July next."

In 1891 Willliam Baxter, Council Engineer, put forward a submission proposing a series of irrigation schemes. None were adopted. Presumably the Councillors did not see the benefits or immediate need. Land was still plentiful and large-scale farming was possible and profitable.

In 1893 a further report was submitted in response to a petition from the settlers at Kyle, who were demanding an irrigation scheme to be set up in their area. Kyle is close to the Rakaia River and near the coast. The study was very comprehensive and included a survey establishing suitable levels for the proposed races to serve the scheme. Baxter also stated in his report that ' this proposal at all events would have the merit of introducing experimental irrigation over a considerable area near the river, free of cost to the ratepayers, and the comparatively small amount of work necessary would be completed in time for the water being supplied for the coming summer and autumn This was the greatest opportunity yet provided for the practical application of irrigation, particularly as the Elgin experimental farm had been a success and there would be no cost to the rate payers, and therefore no complaint that all farmers were paying for only a few to benefit". Still nothing was achieved!

*Ref -"ACC stock water races" - R.L.Lindsay - County Engineer - April 8th. 1946

The importance of stock water is illustrated by the fact that there were 12,000 horses in the County in 1920. These required large quantities of drinking water, as was 35,000 acres of oats for chaff to feed them!

It is interesting to note that the Canterbury Petroleum Prospecting Company in their efforts to find oil at Chertsey, (shortly after the First Would War), did not report any water. However it is likely that water was found because we now know that there are several aquifers at about 100-200 metres depth. They found some evidence of oil at 1600 feet but at 2170 feet a stream of sand was encountered which proved too difficult to cope with and the company ceased operations in 1921.The promoters were still confident that oil would have been struck a little further down if funds had allowed working a twenty four hour day and getting through the sand quickly. With only an eight-hour shift being worked the hole filled up with loose sand over night and this then had to be removed the next day. The pile of sand at the top got bigger but the hole did not get deeper!

In the 1970s there was another attempt by an oil company to find oil at Charing Cross, Seafield. They drilled to a considerable depth, but did not report any oil. However they did report a considerable flow of water at about 70 metres and when they decided to abandon the well they suggest to the farm owner that he should take it over as an irrigation well and even offering to help. The farmer only had a couple of days to make up his mind and did not take up the offer and the well was capped with concrete.

Irrigation has been one of the most studied subjects in Ashburton County yet we have a long way to go to have full development. Not surprisingly farmers' interests in irrigation tend to strengthen in times of drought and wane when weather conditions improve. Until about 1970 irrigation tended to be used as drought insurance and with this philosophy progress was slow. The complications and cost of development are deterrents to a relatively radical proposal such as irrigation, especially if it involves large areas and many farmers.

In 1885 Mr Allen (manager) of Acton Station developed a small private irrigation scheme from the Rakaia River and was reported in a local paper as having some difficulty in distributing his water over his somewhat uneven country. His farm had wind blown Loess soils and was humpy. His intake was

near the Rakaia Township where the banks were low and it was possible to run the water out onto the plains. Small channels were dug to spread the water but essentially it was wild flooding. However the results where the water had been applied was most satisfactory. In contrast to neighbours, he had an abundance of feed for his stock.

The Ashburton Guardian March 24th. 1900 and Ashburton Mail February 28th. 1901 reported.

"He can hardly see his stock for clover that is growing on his irrigated paddocks. Wheat was yielding 14 bushels per acre instead of 7 bushels. The only implement used was a single furrow plough and the estimated cost 50-pound per annum. Lambs were sold at 10/6 from irrigated areas instead of 5/- per head off dry land. The dry land pastures only lasted for about two years whereas the irrigated pastures lasted for quite a number of years."

There was a large gap between these pioneering efforts and the next substantial move.

With these results and the cheapness and ease of taking water from local rivers it is surprising that more irrigation was not attempted. It was not until the 1930s,when there was a severe depression and there was unemployed labour available that some progress was made. At this point the Government showed interest in creating both employment and agriculture development.

Main Rangatata Diverson Race (1000 cusecs capacity)

In the 1930s the Canterbury Progress League was instrumental in renewing interest in irrigation .A further experimental farm was set up at Seafield (near Charing Cross), utilising unemployed men to prepare the land under the direction of the Agricultural College at Lincoln. Prof. Albie H.Flay and R.L.James of Lincoln College did considerable research work in conjunction with The Lands and Survey Department. Other investigations were carried out including a soil survey by Dr Grange, a farm management survey by J.R.Fleming and an irrigation survey by T.G.Beck. The Ashburton County council enlarged the water race in the area to provide enough water to irrigate the farm.

As a result of these works the Public Works Department became involved leading to the construction of the Rangitata Diversion Race (the RDR as it

became known as), with a capacity of 1000 cusecs. (28 cumecs) It was 42miles long, 25feet wide, 9.5 feet deep, and had a fall of one foot per mile. The canal finished at the Highbank Power station and had a generating head of 342 feet. (A mile is 1.6 kilometres and a foot is 30 cm.)

The concept was that water would be used for irrigation in summer and for hydro electricity generation in the off-season. This was a massive undertaking, particularly with the tools available in those times. A great deal of the early work was done by hand or with horse scoops. Later large draglines came into use and speeded up the work considerably.

New Zealand was still in an economic depression in the late 1930s and the Minister of Works, Bob Semple, saw it as an opportunity to create work for the unemployed. He also saw the economic merit in the RDR scheme. In the MOW publication " Water put to work for Power and Irrigation" he said:

"I have always been impressed with the advantages which irrigation offers in this respect, especially in the vast open spaces of Canterbury and Otago. When it is possible, as in this instance, to generate electric power as well, a double blessing is conferred upon the land. For the last thirty years the rural production and population of the Canterbury Plains has remained practically stationary.

We as a nation cannot afford the continuous idleness of such extensive resources, not only for the good of the nation, but for the benefit of the world at large."

And from the same publication:
"In the early days when the county was occupied by thirty four run-holders settled along the banks of the rivers, water was the limiting factor to production on the plains.

Just as the development in the past of these thirsty plains was based on adequate water races for stock, the future development depends almost entirely on water for crops and pastures and on the change-over to new irrigation farming management."

This is still true today.

Progress was slow due in part to the size of the project and the intervention of the Second World War. The Highbank Power Station was officially opened

"Main distribution race - Ashburton/Lyndhurst scheme (note fall of the land)"

on the 16th. of June 1945. Even with today's equipment this would have been a massive undertaking. For many decades the RDR system has been the lifeblood of the Ashburton District.

The irrigation proposal was for there to be five areas, Ashburton /Lyndhurst, Mayfield/Hinds, Valetta/ Tinwald, Barrhill and Rakaia. The first three were immediately established. The Barrhill scheme was to be added later, being supplied from the RDR. The Rakaia scheme was to be supplied from the Rakaia River. The Mayfield /Hinds scheme was to later have a separate intake from the Rangitata River.

The Second World War intervened and the original concept was modified. At the moment only the Mayfield/Hinds, the Ashburton/ Lyndhurst and the Valetta Schemes are serviced by the Rangitata Diversion Race. The Rakaia and Barrhill schemes were put on hold.

If all five had been completed, these schemes would have covered nearly all the lower three-quarters of the Ashburton County except the deeper and wetter soils of Wakanui and the area south of the Ashburton River towards the sea.

In 1937 the Winchmore Irrigation Research Station (W.I.R.S.)was established by the Department of Agriculture.

It rapidly established the value of irrigation (eg carrying capacity raised from one sheep per acre to six sheep per acre and giving security of production). Over the years the Station did a tremendous amount of irrigation research, perhaps most importantly the automation of border dyke irrigation.

Border dyke (or border strip) irrigation consisted of a series of races strategically placed around the farm so water could be flooded, in a controlled manner, onto the levelled fields. Originally the workers had to carry around a heavy canvas sheet on a pole and place it in the race to allow the irrigation of a group of "borders". These borders were levelled strips of land running down the slope and confined by ridges of soil about 12 metres apart. After about 60-90 minutes the canvas would be shifted to another spot and the routine repeated. It was difficult to fit in other work in between shifts and the job was not very popular, but enabled about 50 hours irrigation per week. Night irrigation was not feasible.

Because of these problems, many farmers were reluctant to irrigate and most only did so as a drought insurance. Water was supplied on a roster system with a farmer receiving a flow of eight cusecs (0.23cumecs) for possibly one or two days a week, depending upon the size of his farm. The scheme was designed to irrigate two/thirds of the farm.

In the 1950s / 1960s the station devised a system involving constructing a headrace so that each group of 'borders' was at a level that was at least 20 cm higher than the group below. A permanent concrete dam was placed in the race at the bottom of each group with a fitting, which would support a tin 'gate' (approx. 80cm x 100cm) and a timing devise that would close off an opening in the dam.

This was a classic piece of original research and involved Anthony Taylor, Russell Lobb, Derek Aldridge, John Hayman and others. This largely overcame the problems that were experienced earlier and resulted in more rapid development.

The farmer would have possibly a dozen gates and twice a day would set these up in a horizontal position by means of a bracket set above the dam and controlled by an alarm clock set at a time when that group was to be watered. The lowest groups would be watered first.

(Dave Bissett, an Ashburton engineer, modified the standard 12-hour clocks to release the dam gates and serviced them for many years.)

When the alarm went off the bracket allowed the gate to drop and shut off the flow of water through the dam. This in turn allowed the water to flow out onto the next, higher group of borders. The land would have been carefully levelled to give a uniform flow of water down its length. The borders would have levees to control the side-ways flow of the water. The outcome was that the farmer only had to attend to the irrigation twice a day, taking about 30-40 minutes each time, and being able to easily irrigate for 24 hours a day and in that time covering possibly 50-60 acres (20-30 ha.).

In 1953 Jim (J.D). Stewart from Lincoln Agricultural College was commissioned to do a survey of irrigation profitability in the Ashburton/ Lyndhurst community irrigation scheme. He concluded that under the economic conditions of the time and the systems used, irrigation was not profitable to the farmer. Automatic irrigation systems as developed by the Winchmore Irrigation Station, were not being widely used in 1953. At the time most farmers were only using irrigation as drought insurance and were still farming as dryland farmers. They had not adapted farming systems to suit irrigation. This came later.

Jim.Stewart also made the point that the community was the greatest benefactor from the follow-on activity that the extra production generated from the use of irrigation. Unfortunately a lot of farmers ignored the qualifications and accepted that irrigation was not profitable. Even the community schemes, with virtually free water did not adapt. Irrigation development, in this period, was very slow.

Jim Stewart's conclusions were correct but he did receive a lot of flack from many people who failed to read the qualifications carefully.

BARRHILL EXTENSION IRRIGATION PROPOSAL

In the early 1950s the farmers in the area between the existing Ashburton Lyndhurst irrigation scheme and the Main South Railway become interested in the concept of extending the preposed Barrhill scheme (from the Rangitata Diversion Race) to cover their area. (This was described as the Barrhill Extension Irrigation scheme) The first meeting recorded was on the 10th.April 1954 when a motion was passed that they ask the Minister of Works to proceed under the conditions put forward in 1952. (The conditions preposed in 1952 were more favourable to the farmers than those proposed in 1954)

Another letter of the 21st April 1954 was a further request to proceed –saying they had done everything the Minister had asked them to do. (Presumably this refers to the committee having got 90% of the farmers in the area to sign a paper saying that they wanted irrigation). They also said, as this was an extension of an existing scheme it was not in the same category as a new scheme and made reference to the Dry Creek problem as being solved. Dry Creek was a normally dry waterbed that flooded occasionally and extended into this area and could have caused problems with damage to races and structures. I think the intention was to divert floodwaters from the stream into the main RDR race and spill it into the Rakaia River.

A meeting of 4th. May1954 reported that a deputation had met Mr Holland (Prime Minister) and he was favourably inclined to having more work done. They also met the District Engineer (McKinnon) who said he had the staff available for a survey once he had authority from Wellington. The meeting recorded the main benefit would be to the country, not the individual farmer.

The next meeting was on 15th May1954 and elected W.W Wilkinson as chairman and L.J. Chilton as secretary. McKellar (MAF) and McCormick (MOW) were in attendance. Bob Burnett of Burnett's Transport said he had the equipment and could do the contract work. Other names mentioned in the correspondence were G Scarth, J Mounsey, McLauchlan, Dickie, D Perry, Honeywell, Leatham, J Crozier, T, V, Wilkinson, C Ward, W.H.Wilkinson, T Flynn, K Scott, R Bebbington, S Knight, L.J.Duncan, R.H.Middlemas, S Stewert, and R.Doig.

A further meeting on 3rd June 1954 agreed to push the matter further. Nothing further was recorded but an attached note suggests that while 90%

of the farmers were prepared to support a survey, this was not 90% of the land area as required by the Government.

It would appear that the matter was taken no further.

A new policy was formulated however and announced by the Prime Minister on the 20th of October 1954 as follows:

"Owners of 60% of the irrigable area agree to a rating on an acreage basis sufficient to cover operating costs and at least one-quarter of the capital cost (spread over 40years and including a ten year development period) This would instigate a preliminary survey sufficient to provide reasonably accurate costs upon which the farmers would vote to form an irrigation area. The area would then be defined and a detailed survey and design would be done and submitted to the farmers for a final vote. After the development period the charges were likely to be about 18/6 per acre per annum. During the development period the charges would increase about 10% per year."

"Mowing lucerne for hay -1962"

RAKAIA /SEAFIELD IRRIGATION SCHEME (1950s era)

At this time the "Canterbury Progress League Inc." (Based in Christchurch) were very aware of the value of irrigation to the community and one of their projects was to promote irrigation. In 1952 they were working with Mr Gooseman (Minister of Works) on the subject and arranged a visit by him to Canterbury to discuss irrigation. Mr R.G. Gerard, M.P. for the electorate was also involved.

As a result of several years' discussions with Government Ministers, the farmer understanding was that water would be made available at a flat rate. The Ministry of Works did a broad survey of the district and departmental officials expressed enthusiasm for irrigating the area.

In 1952 a canvas of farmers was carried out, revealing that 135 were prepared to support irrigation under favourable terms and 14 farmers were not interested: i.e. 90 % were in favour of investigating irrigation.

Subsequently, as mentioned above, the Government backed off on this promise and devised a more complicated system. This involved a rating district with an annual charge based on construction costs, operating costs, and financing a quarter of the capital cost. It also involved a payment reduction in the first 10-year development period.

By this time the local farmers had formed themselves into a committee to promote irrigation development in the general Rakaia /Seafield area, (the Rakaia/ Seafield Irrigation scheme.) The area was 129,000 acres and covered the central flat land area but excluded the more rolling soils near the Rakaia River and the deeper soils near the Ashburton River.

In September 1952 the committee wrote to Ashburton Electric Power Board, Canterbury Federated Farmers, Ashburton Agricultural and Pastoral Association, and the Ashburton County Council asking to appoint representatives for the committee and to sign a supporting petition. They also wrote to the Progress League seeking support. Appointees were H.R.Wilkinson, P.C.Curd, P.J.Hanrahan and Cr. J.J.Johnson respectively.

Unfortunately the minutes of the committee cannot be found but names mentioned in the correspondence include E Buckingham, A.C.Rankin,

C.T.A.Ward, and J Crozier. Other committee members may have been Eric Croy, Gordon King. A.P.Bruce, Andy Driscoll and Jarvy Martin. J.P.McDonnell (an accountant) was the professional secretary.

The petition was duly prepared but not proceeded with because Minister of Works (Hon W.S.Goosman) wrote to them in July 1953, stating that the Government was considering the needs of irrigation schemes in the Canterbury Province and the methods by which any schemes should be financed and undertaken. Legislation meeting the approval of Government was needed.

A letter was written to the Prime Minister (Hon S G Holland) on the 16th. September 1954 from a combined meeting with the Barrhilll Extension scheme, and reported an unanimous resolution that "This meeting, while favouring irrigation, rejects any rating system" and "That this meeting feels that the cheaper the cost of water the greater the success for any scheme, and consider that the former petition favouring a flat rate and guarantee, which the farmers supported should receive careful reconsideration."

A reply was received from the Minister of Works on the 12th. of November 1954 reporting on an announcement of Government policy in regard to irrigation schemes in Canterbury. Copies of the policy were attached.

A further combined meeting was held on the 31st. January 1955 where the following resolution was carried unanimously:

"That the Minister of Public Works be written to asking him to accept the previous petitions covering 90% of the area in the Barrhill Extension and Rakaia/ Seafield Irrigation schemes and now ask him to prepare an estimate of costs as outlined in section 3 of irrigation schemes of Canterbury"

A reply was received from the Minister of Works as follows:

"So far as the Rakaia scheme is concerned, I have pleasure in advising you that I am prepared, under the circumstances, to accept the results of the previous canvas of the area as compliance with the first step of the approved procedure recently laid down for the initiation of irrigation schemes.

Arrangements will now be made, when staff is available, for the preparation of the preliminary assessment of costs. When this is supplied it will be the time when farmers will have to give serious consideration to the terms of the next step in the procedure, viz:

Carting lucerne hay for drought reserves at Dundas Estate 1960

If the farmers, having received these estimates of probable cost per acre, confirm that they wish to have the proposal proceeded with, it would be up to them to appoint representatives charged with the task of obtaining the necessary percentage of agreements to the setting up of an irrigation rating district i.e. 75% of the irrigable area, (the farmer's representatives would no doubt act pro tem for what would later become the controlling authority of the irrigation rating district)

Incidentally, he said, the official name of the proposed scheme is to be the "Rakaia Irrigation Scheme" Over the years the names of schemes tended to change with monotonous regularity! He indicated that the Barrhill Extension would not go ahead until a satisfactory scheme for diverting Dry Creek was devised and approved.

On October 19th. 1955 a letter was written to the Minister inquiring about progress. A reply said that progress was being made but the problem was staff shortages.

On January 20th.1956 a letter, prompted by the current drought, was written requesting a progress report and incorrectly referring to the construction of the scheme. The Minister replied that the immediate discussion only referred

to the next step of providing costs and a farmer vote, and not cabinet approval for the construction of the scheme.

In May 1956 the Government Interdepartmental Irrigation Committee advised farmers that in their opinion, out of the whole of Canterbury, the Rakaia area offers by far the best prospects for the successful development of an irrigation project. Water would be drawn from the Rakaia River by means of an intake some seven miles above the Main South Highway Bridge at Lockheads Cutting. From this intake a main diversion race with an initial capacity of 1,500 cusecs (0.42 cumecs) would strike across country in the general direction of Ashburton and would feed an initial reticulation network commanding a gross area of 120.000 acres, in the first stage, with the possibility of a further 20,000 acres of the deeper and more uneven land adjacent to the Rakaia being added at a latter stage.

The preliminary assessment of cost for the first stage was 33 million pounds or 27.5 pounds per gross acre. (0.4 hectares) Allowing for a ten-year development period the annual cost to the farmer would be about 18 shillings and six pence per acre after the first ten years, up to which time the charges would be gradually increased. This would cover interest on one quarter of the interest, operational, maintenance and renewal costs, and amortisation of interest plus accumulated losses during the construction period.

Owners of 75% of the irrigable area in the irrigation district had to be in favour.

In reply to farmers concerns at the proposed cost structure, the Minister said that the subsidy of 3 for 1 on capital costs was liberal and fair and that the farmers would have to meet the other costs.

Over the next three months the Ministry of Works and the Department of Agriculture gave considerable assistance to farmers by way of technical advice. The Minister of Works remained firm on the cost sharing arrangements.

Marginal Lands Board funding would be considered on an individual basis, particularly for uneconomic units. Suggestions that tax concessions might be possible were turned down.

An information meeting of interested farmers and Government Agencies was held on the 27th September 1956. A letter from the District Commissioner

of Works dated the 28th. February 1957 enclosed copies of ballot papers and indicated that a roll of eligible voters was being prepared.

The voting rule was 75% of the LAND area had to be in favour

Voting took place in early June1957 and as only 60% of the land area votes were in favour, the ballot was lost.

The larger farmers generally were not in favour but carried a big voting power. Subsequently there was considerable debate about the fairness of this system. Many considered a fairer system would be to have one farmer/ one vote An analysis showed that if the voting had been on the basis of ONE farmer /ONE vote it would have been carried. On that basis over 75% of the farmers were in favour and the scheme would have gone ahead. Here we have a small difference in wording but a massive difference in outcome! Such is life.

Possible reasons for the lost vote could be:
Some farmers lacked the confidence or desire to adopt the vastly new technology. Not much information was available to the farmers, with the vote-taking place one month after the announcement of the scheme. Older farmers, understandably, were reluctant to drastically change their style of farming at their stage of life.

There was considerable concern about the perceived economics of irrigation with existing technology, coupled with the apparent high cost of the scheme.

The large landholders were probably financially well off and enjoying an easy life style and did not have the economic need that smaller farmers may have had to increase production. The analysis done afterwards showed that the owners of larger farms tended to vote against the scheme. Irrigation at that time was very hard work and this obviously was an important issue.

There were fears regarding increases in weeds (eg Californian thistle), footrot in sheep, more intestinal worm problems in stock, and poorer wool quality.

It has been said that opposition came from Corriedale breeders and dealers, who did not want to see a shift from their breed of sheep to e.g. Romneys. Corriedale sheep were better suited to harsher dry farming conditions whereas Romneys were thought to be superior with irrigation.

Opposition also came from existing irrigators in other schemes who saw increased competition for their crop products.

As a result of this " undemocratic " voting system, the Government subsequently changed the policy to one farmer/ one vote, above a minimum size of holding and with only 60% needing to be in favour.

All community projects of this type are faced with the problem of people diversity. Some are young and enthusiastic, have mortgages, commitments they want to reduce; some are willing and able to work hard to improve their lot, others may be near retirement, be financially secure and possibly reluctant to adapt another farming system. Some may simply not like irrigation. Interest in a community project varies greatly between individuals, particularly with their stage of life, and there is no correct time to suit everyone.

History has shown about 40% of farmers sell out within several years of a scheme's introduction. For this reason, development, once begun, always seem to be faster than originally thought. However the vote is still in the hands of the existing farmers and they decide the future of a potential scheme.

Akeringa - Top dressing fertilizer with Munro Box 1964

The disappointment of farmers resulted in a general waning of interest in irrigation. However the committee persisted, and confirmed their enthusiasm for irrigation and determination to find a modified workable scheme. Buckingham and Andrew Driscoll flew to Wellington in March 1958 to meet the Minister of Works who promised to set up a select committee to investigate the whole subject of irrigation, including policies, subsidies, and priorities.

The local committee made submissions to the select committee saying the community rather than the individual farmer was the main beneficiary of irrigation and should pay the off farm capital costs. Also because of the high farmer development costs the development period should be more than 10 years. Irrigation was the best way to bring about closer settlement and increase productivity.

There was also the view that dryland farming and irrigation farming were complimentary on the same property and that there was merit in only irrigating part of each farm. This is true up to a certain point and a slow development programme was understandable.

Among the rank and file farmers there was still some doubt about the profitability of irrigation farming. There was unlikely to be any capital gain as a result of having irrigation at that time.

These views would not be put forward today. Farmers would opt for full irrigation immediately and would adopt accepted irrigation practises quickly. Today there are significant capital gains made even before irrigation development is started. Water availability is usually capitalised into land values.

It is fair to say that interest in irrigation never died, with a core of citizens who could see the long-term benefits to themselves, the local economy and the nation as a whole. Although it was easy to become disheartened over delays in Government action, and at times farmer apathy, the hard-core supporters persevered. Irrigation promotion never progressed as fast as people would have liked. This is particularly so with changes of Government and their policies; with a mixed farmer population and in particular with the complexities of irrigation.

The Parliamentary Select Committee on irrigation met during 1958 and at one stage visited Canterbury to see first hand.the situation. The local committee and others hosted them but no further action has been noted at this time.

The next activity noted was a letter from District Commissioner of Works to Mr A.J.McArthur, in 1965, acknowledging receipt of a letter from him, saying that he would advise him as soon as more positive steps can be taken on the question of investigation and preparation of new proposals for the irrigation scheme.

FIRST IRRIGATION BORE (1968)

The late 1960s and early 1970s were unusually dry. The prices received by farmers for lamb, wool and crops were poor. As a result, the interest in irrigation increased. Some farmers saw irrigation as a means of overcoming drought problems and improving farm performance.

Norma, Brian, oldest daughter, Helen and dog "Jo" 1968

Considerable interest was generated when we (Brian and Norma Cameron) installed an irrigation bore in the middle of the district in 1968. We had approached the hydrology experts who were of the opinion there would not be sufficient water for irrigation purposes and strongly advised against the idea. It created a great deal of interest and discussion in the district, with many people questioning the wisdom of the move.

At that time we had explored various dryland-farming techniques, but with increasing input costs and falling produce prices we were struggling to make ends meet. We had done considerable budgeting and research and saw irrigation as one way of increasing profitability.

The risks of not getting water were high but our budgets were robust and our confidence high and being natural risk takers we went ahead.

The bore was drilled by McMillan Water Wells, a local well drilling company, using an old percussion plant which alternately used a large crowbar, which was dropped into the well to loosen material, and then using a special bucket to grab and lift the material out. On today's standards the bore was very small, being only 6 inches (150mm) in diameter. It was a slow process and took about three and a half weeks to reach a depth of 72 metres. At 60metres we were still in bone dry material and the driller, Stan Maw, was getting concerned and suggesting we stop. However we desperately wanted irrigation and persevered.

I arrived at the site one day and knew water had been found because Stan, usually a quiet person, was grinning from ear to ear and jumping around madly. His enthusiasm was contagious and we both spent some time jumping around madly. I think we both realised something momentous had just happened. We had penetrated the aquifer at about 68 metres, with the water rising up the bore to a static level of 50 metres.

Some time later I revisited the Hydrological Service and told them the outcome of the exercise. Even then they did not believe me.

The well was only 150 mms in diameter and the maximum abstraction rate was 200 gallons per minute. (about 15 litres per second). It is not possible to abstract more than this amount from a 150mm hole. The largest available submersible pump which would fit down the hole could only lift the water to the surface so a surface booster pump provided the extra pressure needed for the spray irrigation system. Water was distributed by 150 and 100 mm underground mains over a catchment area of 70 hectares.

Two hand-shift spray lines of 200metres were used and shifted twice a day. The pumps ran continuously. I would arrive at one sprayline, turn the hydrant off, shift the sprayline, (two pipes at a time), turn the hydrant on and then repeat with the second one. Each time I would need to shift some of the sub main and periodically shift the entire submain to the next hydrant. This would take about 40 minutes and was usually the first and last jobs of the day. At weekends our children often accompanied me and had lots of fun playing in the water and drinking "irrigation fizz."

(Today a typical well would be 300-350 mm in diameter and deliver 30- 90 litres per second. It could be much deeper and accommodate a much larger pump.)

There was little knowledge and experience about this type of equipment and installation problems were experienced. A major problem developed a few days after we began pumping. The installers did not realise that the riser pipe had a straight thread and the pump had a tapered thread and did not hold tightly. The grub screw could not do its job properly and as a result the pump slowly unwound itself off the bottom of the riser pipe. Eventually the pump dropped off! As it dropped down the well it broke the cable, which landed in a tangled heap on top of the pump, 70 metres down! *&:#ih !!!

For several days before I had been puzzled because the electrical cable connected to the pump was disappearing down the well. As the pump revolved off the riser pump it pulled the cable with it and wrapped it around the riser pipe.

We were faced with the situation of a pump with a diameter of 140mm, in a well of only 150mm diameter and being 70 metres down the hole and with a tangled mass of cable sitting on top of the pump. The pump was probably damaged. There was considerable discussion about what should be done. Responsibilities, liabilities and insurance were debated. There were thoughts of writing off the bore and drilling another. It was decided, however, that the best thing to do was to attempt to remove the pump and cable.

This required the construction of special tools. First a grab-tool was made and used to tear the cable to pieces, which was then lifted out bit by bit. The tool had to be modified several times in order to get it to work but eventually we ended up with a pile of shredded electric cable which was definitely passed its use-by-date. A tapered pipe, slightly larger than the top of the pump, was then constructed and hammered tightly over the remains of the pump. The theory was that it would fit tightly and the friction generated would enable us to lift it out. Every seven metres or so a length of pipe was screwed off and the hoist reattached before the next length could be lifted. This was done very carefully. Several hours later there was great joy when the last length of pipe and remains of the pump appeared and was safely pushed aside. It worked but the operation was very stressful! No one was breathing in case that caused the pump to drop! The total recovery took about three weeks and fortunately was covered by insurance. The pump was a total write off.

The first water was applied just before Christmas when conditions were very dry. It was a very emotional occasion. There was the sound of irrigation sprinklers

1960s drought at the Cameron farm "Akeringa" Pendarves

clicking away and the sight of water disappearing into the parched ground. Down wind there was a significant drop in air temperature. A tremendous feeling of satisfaction was experienced at the thought of all the things which could be achieved with irrigation. All was well in the world. History was being made and the district would be transformed forever, in a very spectacular manner. The block soon became an oasis in the district.

The total irrigation capital cost of $12,500 was recovered within three years from increased profits.

A group of local farm advisers visited the property, being unsure what to think, but apparently going away believing that there was a future in this form of irrigation. They all eventually became strong irrigation advocates.

Several field days were held and while most farmers were impressed with the economic returns, they were not impressed with the large amount of work involved, which involved two shifts a day and taking about 30-40 minutes in total.

The water duty was only 1.5litres /second / hectare and was intended to cover 75hectares. The rotation adopted was to have the non-irrigated portion of the

farm (125ha.) largely in lucerne for in situ grazing and the irrigated area being in winter wheat (low water demand), linseed (late water demand), red clover (high production, good fattening feed and late water demand), fodder beet (high winter feed production) and some lucerne (lamb finishing feed and low water requirement).

This mix maximised the use of the very small amount of water available, and enabled an average of four irrigations over a five months period. We only had a small duty of water and the rotation adopted enabled us to maximise production. The crops selected required water at different times of the season. The crops were also complimentary to the dry land in situ lucerne.

John Leadley, of Wakanui, drilled an irrigation bore in the following year and in due course others followed. Since then the rate of development has speeded up until today there is very little land not irrigated in the area.

IRRIGATION SYSTEMS

Prior to this irrigation in Mid-Canterbury had been by the community border-dyke schemes or by individual farmers who had access to surface water and had mobile, diesel driven irrigation pumps, temporary aluminium mainlines and handshift spraylines.

Application systems slowly improved during 1970s and 1980s. Angle-tows became popular. These were spray lines mounted on small two-wheeled structures, one per pipe. If the spray line was pulled in one direction it would shift at an angle, laterally and when pulled back in the other direction would shift further in the desired direction. It would then be reconnected to the submain.

Older type rig bucketing out debris (Note: heavy bar [monkey] used to smash rocks above operators head)

Siderolls were spraylines mounted through the centre of large aluminium wheels and were usually manually rolled to the next position. Some had motorised units to roll them sidewards.

Large, high-pressure guns, with a soft drag hose, soon appeared and apart from spray drift and high running costs performed well.

Hard hose irrigators also had their place.

Lyn Kingsbury of Dorie experimented with pumping underground water from a well, storing and accumulating it in a pond, and then using it for border/dyke irrigation.

Towards the end of the 1970s Les and Don Briggs, who afterwards formed Briggs Irrigation, (now Rainer Irrigation) were looking for something better than what was then available. I was also looking for a less labour intense system. Together we did a worldwide patent search to see what had been done overseas. Eventually the Briggs brothers found a design in South Australia and obtained the New Zealand manufacturing rights. It was known as the Briggs Rotorainer and became the most common mobile irrigation system in New Zealand for many years. It had a large chassis with a very long rotating arm on the turntable. Centrifugal force from backward pointing jets of water drove the rotating arm,

Carting Irrigated pea straw for sheep fodder 1970s

which was connected to a winch by a wire rope attached to either a tractor or a large post at the other end of the run. A large diameter hose was laid out and had one end attached to the back of the irrigator and the other to a hydrant in the middle of the run. The hose would be dragged behind the irrigator. It would irrigate a width of about 100 metres and could comfortably irrigate a length of about 400metres.

Taking a different approach I decided to build a100 metre long boom irrigator, mounted on a pair of chassis with a diesel motor to winch the machine across the paddock. The design chosen was a modified Warren Truss, and was a compromise between minimum weight and maximum strength. We tried to picture where the greatest strength was needed and used larger pipes there. Weight was minimised by using lighter pipes where less strength was required. Theory was tested by jumping up and down on the structure! I had no welding experience and learnt on the job. The welding was not pretty! The work was done at the welding point in the shed and I had to progressively shift the structure out of the way as I worked from one end. Eventually two yard- fences had to be dismantled in order to allow it to pass out into the paddock.

At the same time, Bill Dodge, an employee, was building the two chassis at an engineering shop in Ashburton. Each had four old truck wheels and had two axle steering and a drawbar. One had a small diesel motor mounted on it and this drove a drum which was geared down many times and very slowly wound up two wire ropes, which had been attached to posts at the other end of the paddock. The chassis had turntables on top and the 100metre frame was mounted on top of this.

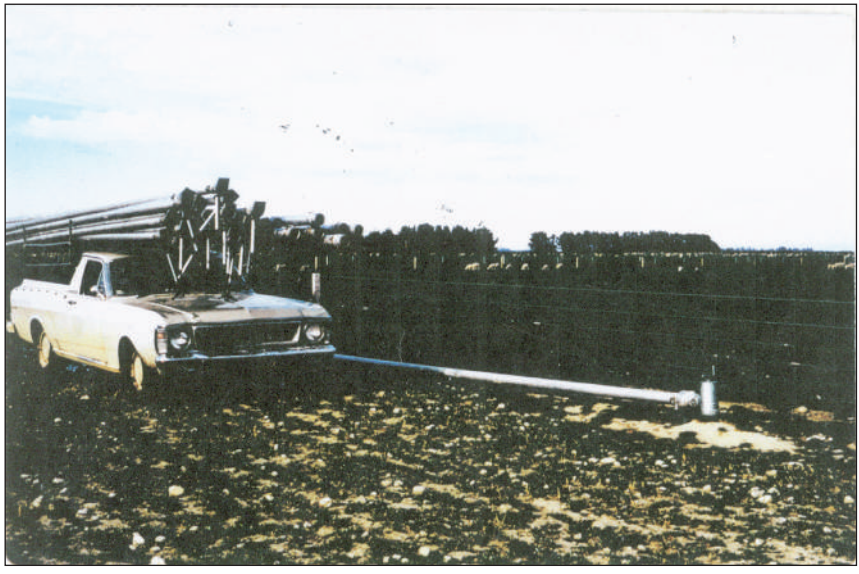
The Agricultural Engineering Department at Lincoln College heard about it and were curious and interested. They came to have a look and decided that in spite of the evidence in front of them, it could not work. Apparently it was not possible to have a span as long as we had. We must have been stretching things to the limit.

Two tractors were required to shift it and the two drivers needed to be very co-ordinated. We used it for a short period but was very difficult to shift. Also the design was too top heavy and eventually it blew over in a Nor-west gale. We were almost underneath it at the time and we immediately decided to write it off. It was dragged to the side of the paddock and left there for several years.

Eventually we broke it down and used some of the steel for other purposes. Some years later we managed to sell the remainder and one buyer took a 10metre section, tying the front onto a utility vehicle, and the back onto a car trailer and then driving it home, via Highway One and the Rakaia Bridge!

About 1980,Andrews and Beaven, a machinery firm, imported a centre pivot irrigator for John McArthur of Pendarves. This machine of five spans had been built with a lot of experience and design work in the USA and operated very well for about 25 years. John was able to shift it to three different sites and it gave minimal trouble.

At the time the Government policy was to protect local industry. Andrews and Beaven saw an opportunity and applied to the Government to prohibit imports of irrigators of this type, saying that they could build them (unofficially using the imported one as a pattern.) They duly manufactured three of them and sold and installed them. John Driscoll bought one. However they had many faults and it needed most of a mechanic's time to keep them operating. They were scrapped fairly quickly but unfortunately the centre pivot's reputation suffered and delayed the further introduction of this form of irrigator for some time.



Akeringa - Handshift irrigation 1968-1972

Over the last 15years there has been a rapid and dramatic increase in the installation of modern centre pivots and laterals. These mostly have complex computer controls and can apply exact and often small volumes of water, giving very good water efficiency. Little or no labour is required and they can give excellent control over water requirements. Very short return periods (time between irrigations) are a feature and this can significently increase production. Used properly there should not be any leaching of nutrients into the subsoil (unless there is heavy rain). They operate at low pressures and use relatively little energy. This trend is likely to continue. The main concern is they are very large and require large areas of land without any trees and the resultant loss of shelter and shade is a concern.

Many farmers are still using and are happy with their Roto-Rainers. Except in special situations most of the other older types are being phased out.

"Hand shift irrigation 1971"

REAWAKENING OF INTEREST. 1970

The idea of re-promoting irrigation arose through the Pendarves branch of Federated Farmers in 1970. A committee from the Branch and some members of the 1965 Committee was established and did preliminary investigational work, and made submissions to the Irrigation committee of the Water Allocation Council.

In May 1971,submissions were made to the Minister of Works (the Hon P.G.Allen), in part, as follows:

"On the evening of the 28th.April 1971, a Public Meeting was held in the Pendarves Hall to discuss irrigation. This meeting was a follow up of many committee and several public meetings over the years, and emphasised the genuine interest in irrigation that we have in the area. Over 200 people attended the meeting. Of these 25 were observers, and the balance were farmers who would be entitled to vote in a possible scheme. With 10 apologies this represents very heavy interest. There are between 200 and 220 farmers concerned."

Four guest speakers addressed the meeting:

Selwyn (S.G.). Hamblett, Irrigation Engineer, Ministry of Works.

Russell (W.R). Lobb, Winchmore Irrigation Research Station.

Ron (J.R.). Cocks, President Mid-Canterbury Federated Farmers.

Bruce (G.B.) Henderson, Irrigation farmer.

These four speakers gave the meeting a clear idea of the advantages and disadvantages of irrigation.

Local farmers have observed and discussed irrigation over many years and are well informed on the subject. The tone of the meeting was rational and the types of questions asked indicated a clear understanding of the implications and benefits of irrigation."

Some of the points made by the speakers were that a new approach by farmers was needed, overall planning of water resources was required, and farmers should pull together and present a united front. Ron Cocks and Bruce Henderson emphasised the value of irrigation and offered support and congratulations. $195 was collected to defray expenses.

The outcome of the meeting was a resolution:

"That we ask the Minister of Works to give urgent attention to updating designs and costs for the Irrigation Scheme for the Rakaia, Pendarves, Seafield and surrounding districts. and to presenting this for voting on at a poll"

This was carried unanimously. The meeting then elected a committee as follows:

B.K.Cameron, C.H.Brand, A.J.McArthur, R.J.Martin, J.G.King, J.R.Bruce, G.W.Ward, I.J.R.Harrison, L.R.Kingsbury, S.Ansell, A, Harcourt, I.Thompson W.Prebble, and W.Hood.

Over time the composition of the committee changed. Other farmers who were involved at times included R. West, C McArthur, D.B. Thomas, W.J. Mckimmie, A.J.Lambie, R. Tarbotton, C.S. Leadley, R.J.King, W.A. Hood, L.J.Chilton, A.R. Wilkinson, S. Jackson, L Innes, C Simpson, P. Crouchley, N. Allen, and K Rushton.

At the next committee meeting I was elected Chairman, Clem Brand ViceChairman, At. McArthur Secretary and Lyn Kingsbury Treasurer. Submissions were prepared for the Minister of Works and the Opposition Labour Party. The Minister wanted no action until the release of the report from the Water Allocation Council. The committee put in considerable work with the Labour Party on irrigation policy and this was to pay dividends later. Colin Moyle and other Labour Party M.Ps were shown around the area and had in-depth discussions with the Committee.

Although we had attended Lincoln College together and were good friends, at one stage I crossed swords with the Head of the Economic unit of MAF (Eric Stonyer) over the Van Asch Report, which put very little value on irrigation. The report was based on an attitude study of a group of dryland farmers and an examination of past performances of older manual border dyke scheme running sheep and using it as drought insurance. Our committee believed that this did not give a fair picture of the future of irrigation and said so.

The committee prepared numerous submissions, approached many people with influence and suggested a great number of policy and engineering points. Between us we had considerable experience and ability in politics and technical matters. Members attended numerous committee meetings and went to

Wellington frequently. The committee had considerable influence on ultimate policies and designs. Committee members put in a tremendous amount of time promoting irrigation.

On one occasion, the three country boys, Clem Brand, Lyn Kingsbury, and I were in Wellington visiting the Ministry Of Works, having flown up in the morning and booked to fly home late in the afternoon. We finished our business and tried to ring for a taxi, only to find that at five pm in Wellington in the 1970s taxis were in very high demand. We decided we would try to find a taxi rank down town and madly sprinted through the streets of Wellington and finally, after a few nervous minutes were lucky enough to find one. With the help of a good bribe the driver drove us to the airport, just in time to catch our plane.

In June 1972 the committee met with Ashburton County Council representatives, Selwyn Letham and Jack Brand with the submission that a short term plan would be to enlarge the existing Acton water-race intake and to put a larger race at approximately the 300 foot (100metre) contour. This would deliver a restricted supply of water to farmers in that catchment. This idea had considerable merit but other matters and developments overtook it.

A second Public Meeting was held in the Pendarves Hall on the 3rd.of May 1973.

The attendance was once again in excess of 200. Invited guests included representatives from Lincoln College, South Canterbury Catchment Board, North Canterbury Catchment Board, Canterbury Progress League, Ashburton County Council, Ministry of Works, Winchmore Irrigation Research Station, Ministry of Agriculture and Fisheries, and the Central Plains Irrigation Committee. Apologies were received from Mr Bruce Barclay M.P., Mr.Colin McLachlan M.P., Mr A.J. Johns, Director General of Agriculture, P.J.Reynolds, district Commissoner of Works, Jack Brand, Ashburton County Council, Alex.Begg and Gordon Humm, Federated Farmers and others.

In line with the agreement to adopt a new approach to irrigation, the committee and other groups such as the Ministry of Agriculture and Fisheries and the Ministry of Works had worked together and formulated some new ideas.

In the past few years a number of farmers in the general coastal area had sunk

irrigation bores and shown there was considerable and widespread groundwater. The idea that there should be distinct groundwater and river supply areas took hold and over the succeeding years there was considerable debate as to exactly where the boundary should be. The main factors influencing this were the pumping costs from wells versus the cost of suppling water from a surface source. The breakeven point appeared to be at about the 70 metre well depth and the 50 metre static water level. This roughly divided the area in half with the coastal area and the areas near the rivers with the shallower water being designated the ground-water area.

There was the acceptance that water was a finite resource with competing uses and irrigation efficiency was important. Support for spray irrigation systems was increasing and in particular for those with good distribution characteristics.

It was now accepted that the generation of income beyond the farm gate was very significant and community support was warranted. For every dollar generated on farm there were 3-4 times as many generated off farm, by way of increased processing, transport, marketing, sale of farm inputs, and follow on benefits throughout the rest of the community. To progress development quickly, improved subsidies were sought.

We were all familiar with the erratic flows of the Canterbury Rivers and realised that there was need for water storage in the foothills in order to fully service the entire area. As well farmers may need to be prepared to accept some restrictions on flows from the river system. It was also realised that storage might also open up the possibility of combining this with hydro-generation and recreational opportunities.

With the higher cost of irrigation farming, different crop rotations were required and as well higher value crops were possible. A completely different farming system needed to be adopted. Different crops and supporting industries would be necessary.

At the meeting there was a general feeling of urgency to get this new venture started. Interest was very high. Little did we know just how slow progress would be!

The following motion was moved by Clem Brand and seconded by Allan Kingsbury and carried unanimously, "That we commend the Government on

its interest in irrigation and ask the Minister of Works for the early release of their full irrigation policy."

Another motion was also passed unanimously. "That this meeting reaffirms its request to the Government for the early promotion of an irrigation scheme for the area."

By this time it was realised that a formal organisation would carry more weight. Graham Sinclair, (solicitor) who was in attendance, had already prepared some work for us in this direction and gave details of what was involved.

It was moved and passed that the committee take the necessary steps to form themselves into an Incorporated Society, the "Rakaia Irrigation Association". Mr Sinclair very generously did not charge for his services.

Subsequently many other irrigation groups formed themselves into Associations and most used our constitution as the basis for their own.

Homemade Irrigator - (100 metres long) 1974

During the 1970s the expansion of individual irrigation development accelerated and it became increasingly obvious that the utilisation of ground water was to become of major importance. The committee began to look at ways of combining the ground water resource and the river supply.

Over this period most of the ground-water development occurred in the 20,000 acres across the sea frontage and along the verges of the rivers. This was where the shallow and more plentiful water was situated. We began to look at the division of the area into a ground water and a surface supply area.

The Committee were very committed to the idea of irrigation development in the area and did a great amount of investigation and promotion. An illustration of this can be seen from a portion of a submission made in March 1974 on water allocation.

Committee Activities.
Education of rank and file members. Newsletters, meetings, field days and personal contacts plus our proximity to other schemes would make our farmers the best informed of any potential irrigation group in the country. Farming ability and interest in irrigation are very high. We are ready for irrigation.

Assessment of Interest
We have held two public meetings in the last three years. In both cases we have had attendances in excess of 200 local farmers and numerous apologies. Farmers do not attend meetings unless they are strongly motivated. Local farmers understand that we will have to pay a reasonable price for water and that we should develop quickly and fully. Our committee is extremely confident that we have almost unanimous support for irrigation development

Political
Our committee has assisted Government and Government Departments over many years in policy and other matters. We were largely responsible in 1971 in interesting the Labour Party in irrigation matters and helped them considerably in the formation of their policy.

Technical
(1) our committee is responsible in interesting Lincoln College in irrigation matters and in suggesting the direction of their research, notably the appraisal

of spray irrigation versus border dyking and an examination of the efficient use of smaller quantities of water.

(11) We have made suggestions of engineering designs to the M.O.W. eg multiple intakes, staged development, continuous flow systems, and mixed spray and border dyke systems etc.

(111) We have had the Agricultural Engineering Institute doing research work on race losses in our area.

Confidence
We have the full confidence of our members and are in the position to help with planning and designing and can easily inform and direct our rank and file."

The committee also presented a very strong economic argument.

BORDER-DYKE IRRIGATION

In the early 1970s Norma and I became interested in looking at the merits of border dyke irrigation. We were also interested in expanding our farming operations. This led to us purchasing a farm of 650 acres in the Ashburton/ Lyndhurst irrigation scheme.

Up to and including the 1970s period the assumption was that the best and cheapest form of irrigation was by border-dykes. In the Ashburton district this the only method used by the three schemes serviced from the Rangitata Diversion Race. With this system the paddocks were levelled, borders were installed to limit the sidewards movement of the water, and races were carefully installed to systematically distribute the water to the various areas of the paddock. This work was done almost exclusively by the Ministry of Works. The initial work would be begun by building up the proposed race area by scraping the area behind the race and depositing it onto the race area. Heavy scrappers were used, which, while being efficient, were expensive and also compacted the soil. The removal of this soil exposed the underlying shingle and these areas were very low producing. (We considered that this as wasteful and unproductive.)

The area intended for irrigation would then be marked out and graders would push up the borders at twenty yard intervals. Simple levelling instruments would be used to identify low and high spots, and the groundsman would place markers to show the grader driver where to take soil from between the borders and where to deposit it. The object was to have a uniform and smooth fall down the border to give full and uniform coverage of water. The grader driver would work up hill and would often push material considerable distances, taking the soil from the high spots and dropping it on low spots. The effect of the heavy machinery, the many movements backwards and forwards, and the cutting of the grader blade destroyed the soil structure and it was several years before full production was re-established. While the system was simple it was not very efficient and was very slow.

The property we purchased was largely unimproved but had irrigation water available on a roster system. This gave us a flow rate of eight cusecs (0.23cumecs) for about 50 hours per week. At this time extra water was available if other farmers did not want their allocation. We took the view that eventually there would be a water shortage and we must design the most efficient system

possible. To this end we employed Dr.Anthony Taylor, a specialist irrigation engineer to help us with the overall design.

The first problem identified was that the fall of the land was from corner to corner of the rectangular farm. The soils of this area are shallow stony loams on top of shingle and it is important to irrigate as fast as possible to avoid too much water leaching through and being wasted. Even so there can be big losses as the water drains quickly through the soil. The fastest irrigation can be achieved by watering down the line of maximum fall. Therefore it was decided that the borders had to be at 45 degrees to the boundaries and existing fence lines. This was a complication with some short runs and extra races but we thought it worthwhile. To achieve this the small amount of existing irrigation was written off. We began with a master plan for the whole farm.

The Ministry of Works teams did the first block but we were concerned at the damage done to the soil and decided to attempt it ourselves. A local engineer and farmer, Doug Philpott, was manufacturing machinery that looked interesting. We purchased a conventional two-yard scoop from elsewhere and a four-blade leveller, a border drill and a levee crowder from Doug.

The scoop was used with a 70 HP farm tractor and would pick up and transport soil and was used for bulk cartage. The leveller had four blades, each about three metres wide and placed about two metres behind each other. It was mounted on the tractor linkage and had a pair of wheels at the rear, and when lowered would accumulate soil from high spots and drop it in hollows.

The border drill consisted of two short rollers, in the form of an inverted Vee, and mounted on the three-point linkage of the tractor. It had a seed box and when the tractor was driven along the top of the race sides it would consolidate the soil form the race, and distribute pasture seed.

The crowder had two grader blades operating inwards and accumulated soil to form the borders.

Usually two of us would work together, each with a farm tractor and one of the implements. The plan was to do the work over about six years and fit it in with normal farm work.

The first task was the removal of fences in a 50-hectare block, then cultivation of the area during the late spring, after having used the spring pasture growth.

As time permitted we would survey the block and begin preliminary land formation and headrace building.

We would "rob" soil from any adjacent high spots to build up the headrace while trying to leave a reasonable depth of soil everywhere. Each headrace group (about 30 metres long and four metres wide) had to be exactly level and be at least four centimetres higher than the group below it and at least four centimetres lower than the one above. This meant that when the gate at the bottom dropped, the water would only spill over the sills in that group and then out onto the field. That group would take about an hour to water and then the clock on the next higher group would be released and the higher group would be watered and so on.

After the groups had been constructed a contract grader was used to split this material to both sides and form the race itself. This was very heavy work and on occasions the grader could tip over on its side. When this happened the driver would use his hydraulics to push the grader back onto its wheels. At a suitable time we would use the border drill to sow seed onto the race walls. This was an interesting job because the races were quite large and not consolidated and the tractor was often unstable. We experienced the odd near miss!

Border Dyke headrace construction - "Waimara" Winchmore

Bill Dodge, an employee from the home farm, and I did the work and became quite skilled at the various operations. During the winter we would construct the concrete dams at the bottom of each group and place the wooden or concrete sills in the race sides. The sills allowed the water to flow out and needed to be placed accurately to give a uniform flow. We used a theodolite and staff to do the surveying and placed pegs in the headrace to indicate the required heights.

The Ministry of Works technique in the field was to build the levees first (always very large) and then work only within that border with a grader. This meant they were pushing large amounts of soil long distances.

Our technique was to run up small levees as markers, set up the theodolite in the middle of a four-hectare block, and place identifiable markers at key points. The staff man would then move around in a grid pattern and the theodolite person would record height readings onto a plan in a notebook. We would then sit down with the plan and identify high and low spots and place arrows to indicate the shortest and best movements of soil. The tractor driver would have the notebook with him and would refer to it as he worked The object was to kill two birds with the one stone by simultaneously removing high spots and filling low spots with the minimum amount of work.

We did not confine ourselves to working within each border. If the plan indicated we would move soil across borders, providing that was the best option to minimise soil movement.

One object was to maintain production while construction was underway, so early in autumn we would plant a winter-feed crop for the sheep, which would be eventually fed off in situ. The technique also meant that with the light machinery and minimum disturbance of the soil we did not loss production.

In late winter/early spring, after the crop had been eaten off, we would resurvey the area and finetune the levelling work. Later in spring we would sow a cash crop, (for example, barley), and after it was harvested in the autumn the area would be sown down with a permanent pasture, which would be in full production in the next season. Alternatively we would undersow the barley with a pasture mixture.

The farm topography was one of the roughest in the area and at one point we came across a gully about one metre deep and we had to place one group one

Border Dyke irragation - Waimara

metre lower that the one above. This required very narrow borders along the side of the gully. These worked well for grazing but was impossible to harvest crops. As a result other possibilities in regard to border widths were considered. There was no reason to stay rigidly with 20yard widths. As we had the borders down the line of maximum fall, the cross sections were generally level and wherever possible, we began making the borders wider and therefore reducing the number of levees, which were always a nuisance. In some cases there was just one border across the entire group. Providing we maintained a high degree of workmanship the water would still flow evenly down the border.

The traditional very large levees were always difficult to travel over with vehicles and motorbikes. We found that with careful workmanship and accurate levelling we were able to reduce the size of the levees very considerably. They then became much easier to traverse. Also with small levees it is possible to operate harvesting machinery along the top and this enabled the whole paddock to be harvested.

Both of these techniques subsequently became standard practise in the district. Ministry of Works engineers became interested in our surveying techniques and tried to get their workmen to use it but the workmen were too set in their ways and would not do it.

The operation was completed in six years and the costs were very small. The careful design and construction was well worthwhile. The farm watered very well, and required minimum labour input. The usual routine was for one person to spend about 40 minutes, night and morning, to shift the "gates" to the next spot. Our allocation would permit us to water for about two and a half days a week. Only about three hours of work time a week was spent on irrigation. We deliberately built the races oversized which meant that we could irrigate very fast when we were able to obtain larger flows of water. This was very efficient and enabled us to cover large areas very quickly and irrigate more frequently. As more and more development occurred in the total scheme the occasions when we could do this became less and less. Subsequent Ministry Of Works irrigation schemes were designed for 12 cusecs (50% more) to take advantage of this feature.

We had considerable problems with water supply from the community scheme. Unfortunately our farm was the last property on a sub-race, which supplied five farms. We were dependant on the other farmers keeping their races clean and "remembering " to shut off their turnouts when it was our turn. The system did not work well if there was less than full flow and of course did not work at all if we were not receiving water. It was very annoying to go out in the morning and find that there had been an interruption of flow during the night. Tempers got a bit hot at times!

The system was satisfactory when there was an adequate supply of water. The purchase cost of the water from the community scheme was very small and the onfarm costs were obviously very cheap. However the system could be wasteful and in these days of water shortages and the desire to apply smaller amounts more often, the design has lost favour and sophisticated centre pivots and on farm storage are taking their place.

DROUGHT EFFECTS

To understand the interest in and need for irrigation, it is necessary to understand the effects of droughts in the area. The soils of the area are shallow and have low water holding capacity. Rainfall is low and while long-term averages are uniformly spread over all months of the year they can be very erratic. There are periods, often extending over several months, when the fall is well below average (eg 30% of the mean). This is effectively one month's rainfall over three months.

Canterbury is in the lee of the Southern Alps and is subject to severe winds with very low humidity and high temperatures. In periods of drought grass growth rates are likely to be in the order of 5 kilogram's of dry matter per hectare per day instead of 80 kilograms per hectare per day which would occur with good irrigation or adequate rainfall. Some droughts are cumulative with lower rainfalls over one or two years or extend over one or two seasons of severe rainfall deficits. Each has its own effects but similar in consequences.

Dairying is not possible without irrigation. Cropping is very risky and results are highly variable. Sheep farming is the only real option but then only with drought adverse programmes in place. Early spring or late winter lambing is necessary to utilise the short spring growing season. This enables stock to be sold before conditions become too dry. Conservation of large quantities of fodder is essential. Costs are high and production low and can only be done on extensive properties.

The 1960s, 1970s and the 1980s were droughty decades and included several exceptionally dry summers, with rainfalls being very small over several months. Profitability of farming dropped steadily over this period and farmers "had to run faster to stay still".

One-way of doing this was to increase stocking rates and take more risks. In previous decades, at lower stocking rates, there were usually reasonable amounts of "dry" feed which would carry the stock through. However with heavier stocking rates this was not so, and all available feed was consumed. Bare paddocks became common in times of drought. The adverse effects on the farmer and his family and the local community are severe and take several forms.

Financial stress

Incomes are considerably reduced in times of drought. Lambs or other stock need to be sold early at lighter weights or as stores when it is a buyers' market. Wool weights and quality will be down, both in the present season and in the next season. The lambing percentages will be significantly reduced in the following year. Sometimes capital stock has to be sold at poor prices and then replacements bought later in a seller's market. Crop yields and quality will be down and crops may even have to be sacrificed in order to feed the stock. Overdrafts will have increased and consequently servicing costs. Some farmers may be paying thousands of dollars a week just to keep stock from starvation. In extreme cases he may be borrowing money to pay interest. The farmer needs to be prepared for a drought at any time and ideally have permanent plans in place to anticipate problems and provide solutions.

High Costs

If he has not been able to build up a financial reserve in good years he will need to extend his overdraft further in order to fund his farming operation. As well, living expenses may be from borrowed money. The farmer does not have the comfort of a wage or salary coming in every week. There are not the finances for the necessary maintenance work, nor in some cases is capital development possible. The family holiday may have to be deferred and normal routines are disrupted. The soil may be too dry to sow winter-feed crops or new pastures. The cost of bought-in feed for stock is likely to be very high. Every last blade of grass has to be hunted down, even on the roadsides and supplementary feed will be difficult to source and be very expensive.

Mental health

While farmers generally are resilient and know the risks of farming, it is still very difficult to handle this situation. The farmer spends all his time on the farm, day and night, in full view of his deteriorating position, with possible loss of condition on his stock and wilting crops. He is probably seeing the loss of the profit that he has accumulated over the several years and a frightening increase in his overdraft.

In these circumstances, most farmers suffer some degree of depression, some very badly. He tends to blame himself and worries about his ability to support his family. If he is a male he will become withdrawn, not admit the problem and probably will not seek help. He is likely to isolate himself from family and

friends and does not make good business decisions. Every cloud in the sky will be watched closely in hope of some rain but cursed when it does not occur.

The wives or partners and families share the pain and generally do a magnificent job of supporting and helping the spouse or parent. They see that it as not the farmer's fault and usually place human relationships above farming success or profitability. Over this period wives or partners assist by becoming part of the farm management team and in many cases take over the farm book work, as well as some of the physical work on the farm. These partnerships have often become very strong and beneficial. Others take off-farm work in order to generate income.

Animal Welfare

Most farmers do not like to see animals suffer and will do their best to avoid it. This is difficult under drought circumstances when the last blade of grass has been eaten and the last bale of hay fed out. Some loss of condition is usually unavoidable and has to be accepted. In more extreme conditions ill-thrift type diseases occur, particularly when there is insufficient space at the freezing works and stock have to be held on the farm for considerable periods of time.

Soil Health

It is not generally recognised that soils suffer severely in a drought.
Mineralisation (the breakdown of minerals in the soil) continues and there can be temporary buildup of minerals in the soil, but heavy rain follows these can be washed into the groundwater. All of the available foliage is eaten and the digested food returns to the soil as mineral fertiliser. The build up of organic matter does not happen in the absence of water and growth and the heavy grazing further reduces it.

One of the great advantages of irrigation is that with continuous high growth rates the build up of organic matter is continuous and cumulative. High organic matter leads to high production, low disease factors, lower fertiliser requirements and an increase in earthworms and microbes in the soil. Produce from these soils is healthier. The higher organic matter levels in the soil means that the water holding capacity of the soil is greater and ironically less irrigation is required.

Soil Structure

Hoof damage occurs with grazing on bare pasture and the resultant loss of soil

structure can take many months to recover. Gale force winds are common in dry periods and dung and plant organic matter is blown away and lost.

Arable Farmer

The effect on cropping farmers is that they see their crops shrivel up and yields drop. The usual expectation may be that they might end up with only half of the yield, on average, of their irrigated neighbours across the fence. In some years they may get no yield at all, and the considerable amount of money spent on crop establishment would be wasted.

Community Effect

Towns which have rural support functions suffer badly in a drought. The farmer does not have the product to sell nor does he have the income to spend. Farmers do not buy replacement machinery, spend money in shops or on entertainment. The mercantile firms do not have produce to market, the transport companies do not have produce to cart and in turn these businesses do not have the money to spend and the whole town suffers. This multiplier effect flows on to other towns and cities in the greater catchment area.

Recovery

The problem is not over when adequate rain has fallen. Pastures have to be nursed if they are to recover and cannot be grazed for some time. In many cases pastures will have to be resown. Stock will need to be carefully reintroduced to a lush pasture diet and could take many months to recover. Wool production and lambing percentages for the next season will be adversely affected.

Human recovery also has to occur. The farmer may be still depressed and is wondering if it is all worthwhile and he may feel embarrassed about the way he has treated his family and does not know how to redress the situation. He needs to talk to his bank manager, accountant and farm adviser. He and his family will be trying to also re-establish more normal patterns of life and work.

This has been the experiences of the dryland farmers of the Pendarves (and other) area over many droughts and explains the interest in irrigation.

In contrast, an irrigation farmer has not had this setback and stress and has had a profitable year.

This benefit from irrigation is also expressed in the prosperity of the servicing towns and wider community.

LOWER RAKAIA IRRIGATION PROPOSAL

Before the discovery of ground water in the area it was assumed that community irrigation could only occur with a surface supply and community schemes by border dyking. As the supply of ground water and the success of spray irrigation were proven in the area it was realised that there were other possibilities. Other more flexible designs were considered with the emphasis being on supplying the water to the farm-gate and allowing the farmer to utilise it to his best advantage.

By 1975, and largely through the efforts of the Lower Rakaia Committee, under a Labour Government, there was a very generous subsidy system in place. The whole of the headwork costs and half of the off-farm structures were to be paid for by the State as a grant. Half of the on -farm costs would also be paid for by the State.

One group which took advantage of this situation was the South Rakaia Irrigation Company. These were four farmers on the banks of the Rakaia River who were able to easily access irrigation water by means of a simple intake from their properties. It was easy to get four farmers to agree and with the generous subsidies available the scheme proceeded rapidly, and was commissioned with great political fanfare. In contrast, the much larger Lower Rakaia scheme had the problem of handling about 200 farmers and much bigger technical and political problems and therefore progress was not as fast. Many of these 200 farmers did not have direct access to the river and were reliant upon a community scheme to access water.

In a way we were the victims of our own success. Farmers in other potential irrigation schemes areas also began to take notice. The Barrhill scheme saw the possibility of taking water from Lake Heron via a cutting to the Ashburton River and then through the Rangatata Diversion Race to their area were showing more interest. They later saw the possibility of getting water from the Rakaia River. A group of dryland Valletta farmers formed a group and sought information from our Committee.

The Lower Rakaia's greatest concern, however, was to come from the Central Plains area. This was an area of about 120,000 acres and required a vast amount of water, also from the Rakaia River.

The Lower Rakaia Association had lodged an application for 15 cumecs of water for their scheme but when Barrhill applied for another 15 cumecs and Central Plains added another 70 cumecs, considerable concern was expressed around the country. Save the Rivers groups were formed and together with the Fish and Game organization, became very vocal and active. The debate was fast and furious over the next few years. The conservation interests had and were able to source large amounts of finance and had considerable support around New Zealand. The local farmers were pictured as greedy capitalists who wanted to drain the rivers dry.

Ultimately the conservation interests took advantage of a provision in the Resource Management Act and put in an application for a Conservation Order on the Rakaia River.

One of the effects of this was to make Government and Government officials nervous about proceeding with irrigation development on the Rakaia River.

By about 1980 the Lower Rakaia Association had been given repeated assurances that we were the next major irrigation development planned by Government. Ministry of Works had spent about one million dollars on plans, consent preparation, and surveying for the Lower Rakaia Irrigation Scheme. A massive amount of planning had been done. Officials had done considerable liason work with farmers and everything looked very promising.

Behind the scenes, however, to sidestep the probable political problems with opposing groups, the Government was looking for ways to postpone the approval for the scheme. The way they did it was by advertising for farmer groups who were interested in irrigation development to register an interest with the Ministry of Agriculture and Fisheries. Approximately thirty replies were received, some large and some small. Some were spur of the moment efforts. None had done very much investigation or lobbying work. In contrast the Lower Rakaia Association had done a tremendous amount.

One application came from a small group of farmers in the Culverden district in North Canterbury. To their surprise and delight they were told that the Ministry would be starting on a scheme in their area very soon, taking water from the Waiau River. This happened, and by 1980 they were the proud owners of a heavily subsidised and very good irrigation scheme. Politically this was

safe, (there being no little competition for the water), and the area being away from the brewing political row on the Rakaia.

The Lower Rakaia Association protested loudly but to no avail. The disappointment was intense and the farmers felt gutted, particularly in view of the massive amount of work they had done in obtaining Government interest in irrigation, getting good subsidies, and developing knowledge in irrigation generally and having put in many years of work. The Ministry of Works had spent about a million dollars on advanced design plans for the area.

To add insult to injury, as the Waiau scheme (in North Canterbury) was being completed the Government decided to construct the neighbouring Balmoral scheme, telling us that it was really only an extension of the Waiau Scheme.

The Lower Rakaia Association was still being told they were next!

However the Lower Rakaia farmers did not give up. In due course the scheme design was completed and the District and the National Commisioners of Works signed the approval of the scheme. In theory the only remaining hurdle was the Government Approval in Principal and the signature of the Minister of Works.

LEGISLATION

Prior to 1982 water and soil matters were managed under the Water and Soil Conservation Act 1967. In 1981 an Amendment Bill was introduced to Parliament and in 1982 became the Water and Soil Conservation Amendment Act 1982. (" The Wild and Scenic Rivers Act")

There are three "readings" to progress a Bill until it is legislation.

The draft Bill was written by law drafters and introduced as a first reading and after discussion in Parliament was referred to a select committee where public hearings were heard. The Committee made submissions to this select committee and were reasonably happy with it. The main emphasis was on management of resources, and in several places there were actual references to "management."

The normal process then is that the Bill is altered as necessary on the basis of submissions made and accepted. It is then sent back to parliament as a second reading and may get some more fine-tuning. The next step in the legal process is for the bill to be sent back to parliament for a third and final reading, If passed the Minister in question (in this case Tony Friedlander) signs it into law.

Normally there is no change made at this stage. However in this case a whole new clause was added. This became No 2, which means it is of paramount importance. In effect it said this was a Conservation Act. It is hard to explain how this extraordinary event could have occurred, except that someone in a position of power wanted it to, and was able to get it changed.

The effect of this new clause was to have severe consequences for the Lower Rakaia scheme later on. The introduction of The Resource Management Act (RMA) in 1991 further complicated irrigation progress.

SUGERBEET

During the late 1970s a group of farmers saw merit in utilising the increasing irrigation scope in Mid Canterbury and to introduce an extra crop into the cropping rotation, by the establishment of a sugarbeet industry. A farmer co-operative was formed, (the Sugar Beet Development Cooperative) and over several years did considerable investigational work. Lincoln College had an experienced lecturer (John Dunne) who was familiar with the beet industry in England and he helped with research, particularly with growing techniques.

Crop trials were done over several years, mostly on our property. Very high yields were obtained and the crop was easily grown. The Company was very energetic and at one stage the company even had an option on a second hand processing plant in the U.S.A. Fred Newton was the enthusiastic Chairman. I was a director on the Board. The economics of the scheme looked very good and the Company was confident of getting it off the ground.

At this point the Colonial Sugar Company, which had a monopoly on the supply of sugar to New Zealand at that time, intervened. In those days' new enterprises of this nature needed to have Government Approval. The Colonial

Irrigated Fodder Beet - "Akeringa" Pendarves

Sugar Company used its political clout and convinced Prime Minister Muldoon we were not capable of doing what we planned! They offered to spend $1 million dollars on repeating our trials as a check on its soundness. These trials were successfully spun out for about eighteen months and successfully stalled the Co-operative's plans. Obviously the Colonial Sugar Company wanted to maintain its monopoly and considered this to be a good investment and money well spent. The results produced were, in the Cooperative's view, unreasonably conservative on yields and unnecessarily over-designed the plant. The Cooperative's plans were to service the South Island only, to use very good second-hand equipment, save on processing costs by selling raw sugar to South Island confectionary manufacturers, and thus save the substantial cost of bringing sugar from the Auckland, and to use farmer experience and common sense. The plant was going to be at Fairton and utilise the irrigation potential of the local district.

By this time, with the future being uncertain and finances short, the Co-operative could not proceed further and sugar plans had to be put on hold. We were disappointed but did not want to give up and were interested in utilising our knowledge and experience.

At this time (1972) there was an oil shock and petrol prices went through the roof. The production of fuel from biomass was the in-thing and we saw an opportunity. The Co-operative began to investigate the idea of ethanol production from either sugar beet or fodder beet. Both crops could be grown very successfully in our area and were very suitable for ethanol. This was big business and we needed more horsepower so looked around for support and found it in the Shell Oil Company, Dalgetys and the Rural Bank. All had specific interests in the process and a $1 million company was set up. The Shell Oil Company was already in the fuel industry. Dalgetys were interested as a rural support company and as an investor. The Rural Bank interest was in funding the venture and developing agriculture. The Co-operative's nominal contribution of $250,000 was in kind, being agricultural research that had been done, and farmer support. Together we had a pretty strong team. Over a few months, however, oil prices dropped back to more normal prices and the other partners dropped out. During this period I visited some Universities in the United States and was given VIP treatment because of my experience in growing beets and general knowledge of Fodder Beet. Ethanol was very much the in subject!

The Co-operative eventually wound up. It was an interesting and exciting experience for the farmers concerned. We were moving into new areas of business and we had to learn on the run. It was of some satisfaction that the Colonial Sugar Company took us seriously.

"Storm damage 1975"

LIASON COMMITTEE

From about 1979 to 1984, a large amount of the business of the Association was done at Liaison meetings involving Ministry of Works, Ministry of Agriculture and Fisheries, Rural Bank and Finance Corporation, Association farmers and sometimes others such as Ron Cocks of the National Water Resources Council. (Ron Cocks was a strong supporter of irrigation development and was a great help to the Association.).

In total there were 20 meetings held, some taking most of the day. Subjects covered included water charges, subsidy policies, scheme design, farm layout, contour surveys, economic reports, scheme boundaries, electricity demand, publicity, poll planning, wool-shed meetings, news letters, approval steps, ground water research, water charges, finance, new crops, farming systems and many other subjects. The Liaison committee set up two small demonstration blocks of border/dyking, using water from the Acton Water-race, mainly to test the suitability of the soils for this form of irrigation. Bus trips and field days were organised.

At the same time the Association met frequently to discuss policies and prepare submissions. The farmers were becoming increasingly concerned at the apparent decrease in interest from Government and officials. There were hints that levels of finance would be reduced, interest rates would be increased, that higher rates of return would be needed for approval, and the subsidy level would be reduced. It was also becoming obvious that costs were rising and that the water charges would be higher than originally thought. However the greatest concern was the pending hearing on the application for a Conservation Order on the Rakaia.

In the late 1970s a very important piece of research on ground-water resources in the area was being carried out by Dr.Hugh Thorpe and Mr David Scott. of the Ministry of Works.They were looking at the reliability of supply of the ground water under different irrigation abstraction scenarios. Over time the depth and flow rates of underground aquifers vary due to the amount of water removed and the amount replaced by rainfall and other sources. This is similar to what happens with rivers.

They used computerised mathematical models to predict reductions in static water levels under irrigation pressure and changes in recharge from seasonal

weather variations. They assumed full ground-water irrigation development in the area below the railway line except for a few thousand hectares below Dromore and with no ground-water irrigation above the railway line.

The draw down, (reduction in static water levels), from irrigation competition is least near the rivers and near the coast. Bore yields on the plains improve towards the coast, because the gravels further from the Alps are better sorted. Also the aquifers are thicker and contain more water and have higher hydraulic pressures. Along the river banks near the coast underground aquifers are supplemented by outflows from the rivers.

The worst effected spot identified was just below Dromore where the drawdown was calculated to be 8-10 metres caused by competition of other bores. Pumping from one bore effects the water levels of neighbouring bores and the effect over an area is cumulative.

At the same time there are seasonal variations, with a predicted drop in static levels of another 8-10 metres in a season of low recharge due to low rainfall in the preceding period. These two effects are cumulative. Thus with full irrigation development and in a dry season the level of water in the bores in this area could drop by as much as 20 metres. Under this scenario many wells would dry up. This was valuable research and today their conclusions have been proven to be very accurate.

In the early 1980s the North Canterbury Catchment Board prepared a River Management Plan for the Rakaia River. The view was taken that management was the best method to protect and enhance the river values and to manage any commercial abstraction from the river. The Board believed that local input was important and that a National Conservation Order was not necessary or desirable. The Association supported this view and made submissions accordingly.

However the Acclimatisation Societies disagreed and in June 1983 applied to the North Canterbury Catchment Board for a National Water Conservation Order on the Rakaia River. The Draft Order was publicly notified in April 1984 and on 1st October 1984, the Planning Tribunal commenced the substantive inquiry in Christchurch, with Judge Skelton presiding. Prior to this the Association leaders needed to collect money to finance it, prepare submissions and develop strategies with other parties. This involved many

weeks of Association Members' time and effort. The inquiry continued for 14 days, with 67 witnesses and hundreds of pages of evidence.

The original North Canterbury Catchment Board Draft Order had a reasonable low base flow, had a block allocation of water for abstraction and no sharing ratios. On this basis our scheme would have been possible.

However the Final Order from the Planning Tribunal had a very low base flow, no block allocation of abstraction water and a one for one sharing ratio. This changed the situation from being acceptable to being nearly impossible.

The Chairman closed the inquiry, on a legal point, without hearing all the witnesses, saying that Clause Two of the Amended Act said that this was a Conservation Act (referred to earlier) and that he had to give the Acclimatisation Societies everything they asked for. The clause read," The object of this Act is to recognise and sustain the amenity afforded by waters in their natural state" Even the applicants did not expect anything like this. Both sides expected a result somewhere down the middle.

This was very disappointing to the Lower Rakaia Association farmers as it meant that for 10% of the time no water could be abstracted. With the one for one sharing rule a considerable flow in the river was necessary before the full allocation of water could be used. A reliable supply of water is essential for an irrigation scheme and these tight restrictions would make this scheme too unreliable.

One bright spot, however, was that the Wilberforce and Harper river catchments and Lake Coleridge were excluded from the Conservation Order, allowing future diversion and storage possibilities in the lake. Judge Skelton said, " all is not lost for the irrigators ". However any action in this regard was well beyond the Association resources.

It is interesting to note that the opinions on the panel on the low flows was split, with Mr Dodd wanting a simple 90 cumec low flow. The Order was appealed on mainly legal grounds by Federated Farmers and others and heard in July 1985 before the High Court. This was upheld. The Acclimatisation Societies then appealed to the Court of Appeal in mid 1987 and this Court reversed this decision and upheld the original Order. The result was very close. This whole process took a lot of energy, and sapped the enthusiasm

of the farmers. Farmers were becoming tired of waiting and were starting to proceed with private schemes from ground water sources.

The Liaison Committee continued to function through this period and the scheme was ready for Approval in Principle. However interest rates had increased from 6% to 9% for agricultural development work and there was a tight restriction on the amount of money advanced for the irrigation budget. Eventually subsidies for irrigation were dropped completely. Altogether the situation looked pretty desperate.

The committee decided that a vote at that time could be counter productive and asked that this be put on hold. The committee agreed to keep the Association alive and in the short term hold an annual meeting. This later became a biannual meeting, the last one being in 1991.

The four key people in the Association, up to this time, were Lyn Kingsbury, originally as Treasurer and then as vice Chairman, At McArthur as Secretary, Clem Brand as the early Vice Chairman and myself as Chairman. Lyn had a political nose, technical knowledge and was a good report writer. At was the senior statesman of the group and exercised a lot of common sense. Clem was a strong advocate of farmer welfare and progress. I was team leader. (I have estimated that in total I had put in about 3,000 hours of effort.) No one received any renumeration or expenses except airfares to Wellington. Many other people served on the committee and made a significant contribution as well. What was achieved in this 20-year period? Was it worthwhile?

On the evidence available at any particular time, the best decisions were made but the situation changed often and the Association needed to adapt quickly and effectively. It was an excellent example of a group of dedicated leaders working for the common good of the local community.

In hide-sight we now know that there is approximately sufficient ground water to irrigate the area of land below the Main Highway providing there is no abstraction above the Main Highway. By inference this means the inland area should be supplied from a river source – so we were half -right. The original idea of border dyking everything was probably wrong. Modern irrigators have given the ability to control application rates and use water efficiently. This has led to very advanced farming systems.

The Association activities had a very beneficial effect on irrigation knowledge and development in other areas.

It illustrated the difficulties of coordinating a very large group of farmers for a community scheme of this nature. (In contrast individual farmers were able to develop rapidly but at a time that suited them.)

Projects of this nature take many years, even at the best of times. There are a great many people to consult or lobby and these in turn have to prepare reports (and these can take a long time). There are times when the leaders need to drum up a show of support and then at other times, because of the slow nature of the process, settle members down.

No one regretted the time and effort put into this community project.

The committee members learned a great deal from each other and other people, and were the better for that. We became one of the focal points for the district and helped deliver the cohesion that a country district needs. The prosperity of this corner of the County has improved vastly by the introduction of private irrigation schemes.

Did we have the right vision? The transformation of the district has been remarkable. It has gone from an extensive livestock producing area of low profitability to a very sophisticated intensive cropping and dairying area of great economic importance to themselves, the local economy and the nation as a whole. The only disappointment to me has been the loss of the previous community spirit and loss of identity.

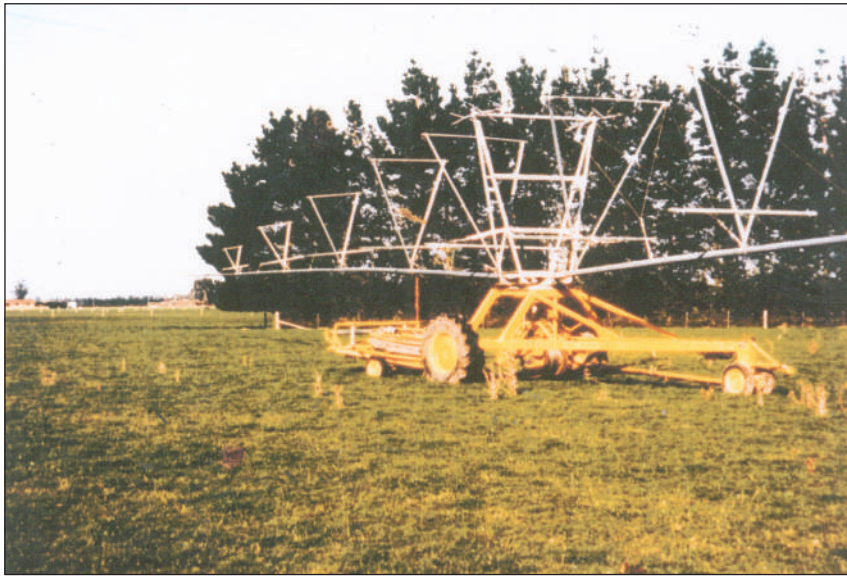
However we had a lot of fun.

1990--2000

There was only a limited amount of community irrigation promotional activity in the early 1990s. With the development of easier and cheaper well irrigation along the coast and along the two rivers, the river supply area was reduced and some of the original Association Committee Members, outside the community supply area, retired. Others who had been involved had retired from farming or had put in their own private schemes within the river supply area and were lost to the Committee.

We owned land in both the new groundwater area and the possible surface supply area and decided to carry on. Over this period I had been attending meetings of various organizations involved in water allocation and development. I realised that the sustainability of the coastal areas would be threatened by too much private well development in the upper regions of the Plains, and that the best protection for the coastal groundwater irrigators would be to have a river-supply scheme above them.

There was only enough groundwater for about half of the total area, and if the river scheme did not eventuate there would be very serious competition for the groundwater if all the farmers put down wells.



Briggs Rotarainer and hose trailer 1970s

This situation is occurring now (2009) and restrictions are being applied. A community scheme was difficult to achieve, and at best could be ten years away or possibly not eventuate at all. We accepted that farmers could not be expected to wait for a community scheme if they could do something for themselves in the meantime. Many farmers decided not to wait and put in their own irrigation schemes from wells and were able to do this in a short timeframe and be in production very quickly. This fragmented certain areas and reduced support for a community scheme.

From an economic cost point of view it was considered, other things being equal, that if the static water level was less than about 70 metres it was cheaper to pump from the underground aquifers. If it was deeper then the best option was to be within a river supply scheme. The cost of very deep wells is greater than the shared cost of a community river-supply scheme. Of course, other factors, such as time delays of a community scheme, possible unreliability of community river supply and farmer independence had to be taken into account.

Irrigation from underground aquifers is dependent upon continual recharge, usually by rainfall or percolation from external sources, and in some cases, from wastage from neighbouring irrigation schemes at higher elevations. In our case any water wastage from the preposed river-supply irrigation scheme would percolate down and recharge the aquifers. This water would then eventually flow downstream and benefit the coastal groundwater farmers.

So there was still a very strong case for promoting a river supply scheme in the higher and mid Plains area for the benefit of all. There had to be a sustainable balance between aquifer and river supply development.

Since the previous attempt to get irrigation, there had been a large shift in Government policies. Previously it was considered that infrastructure of this nature was beneficial to the nation and that the State had a responsibility to make this type of development happen. Selwyn Hablett, a Ministry of Works engineer, once said that they were there to see that things happened that would not otherwise have happened. The Rangatata Diversion Race would not have eventuated if the Ministry of Works had not been in existence in the 1930s and 1940s.

In the 1980s, the Government was moving away from subsidies and towards user pays. It was going to be a case of self-help. A new philosophy needed to be developed.

On the debit side we could see less Government support but this was balanced by the fact that private construction costs appeared to be considerably less than Ministry of Works costs. The MOW tended to over-design and build for a very long time and would not consider cheaper alternatives. As well 15% was loaded on for head office costs. It was becoming accepted that the ground–water area could be best developed by individuals at their own speed and they should do so.

A river supply scheme would need to be done privately.

GROUND WATER DEVELOPMENT (1968—2009)

Meanwhile, from the early beginnings in 1968 the rate of private ground-water development accelerated. In the first few years this happened almost exclusively in the shallower areas along the coast and rivers, where the static water level was less than about 50 metres. However, as time passed deeper and deeper wells were sunk, extending further and further inland. The pumps needed to lift and pressurise the irrigators became increasingly larger and required greater quantities of electricity.

In the expanding dairy industry, also, there was a high summer demand for electricity to heat water and to cool the milk.

Electricity Ashburton had to continually revise and expand distribution plans. Today the amount of electricity used in the County in summer far exceeds the amount used in the wintertime. This summer peak demand is unusual in New Zealand. In most other areas the highest demand is in winter for heating and extra lighting. In the Pendarves corner of the County there is now in excess of 400 irrigation wells.

Irrigation supplements natural rainfall. The average irrigation season rainfall in this area (eight months-September to April) is about 450 mm but varies annually from about 250 mm to 600mm. The seasonal water requirement to maximise plant growth would be about 900mm. The deficit, therefore, in a dry year could be 680mm, and in a wet year 300mm. An irrigation scheme needed to be designed to apply to the dry seasons requirements, although in other years the total amount would not be needed. Irrigation design would also have to allow for specific crop demands, to allow a margin of safety, and to allow for uneven distribution due to wind distortion, high evapo-transpiration or imperfect irrigator design.

The irrigation electricity usage for all of the Ashburton County in 2006 was about 140 million kilowatt hours (kW/hs). (2006 was an average year). If the irrigation season had been wet, the usage could have been as low as 80million kW/hs. Conversely if the season had been dry the usage could have been as high as 180 million kW/hs. There is a big difference, in demand from season to season. The biggest concentration of irrigation wells in the Ashburton County is in the general Pendarves area and this is where a largest part of the energy is used.

The Pendarves area now has heavy electricity power lines along most roadsides and has most of the fields covered with a patchwork of large sophisticated irrigators of all makes and sizes. There are numerous agencies who sell and service the various models and provide strong competition.

Computerisation is now standard and operators can preset commands such as making the machines apply varying amounts of water to different areas, travel at varying speeds, stop at certain points, reverse the direction of travel, stop if a certain amount of rain has fallen, start at a predetermined time, record information, or alert the operator via his cell phone if there is a problem.

Prior to irrigation, farmers needed to farm conservatively by using low stocking rates, growing only low value drought resistance crops, and having contingency plans for droughts. They needed also to carry over large amounts of conserved fodder, be prepared to sell stock at fire-sale prices, buy off-farm grazing, or buy in extra stock fodder, often at very high prices.

With irrigation, farmers can now confidently have high stocking rates or grow high value specialist crops which can increase their productivity and profit tremendously.

COMMUNITY DEVELOPMENT 1991-2000

To reignite interest a public biennial meeting was held on 29th. July 1991 in the Chertsey hall.

Several scenarios were presented:
1 Continue to use the Lockhead Cutting intake and irrigate the 15,000 hectares of the Lower Rakaia surface supply area. This area had the Rakaia River to the north, the existing Ashburton /Lyndhurst Irrigation Scheme to the south, Mitcham Road to the west and the railway, plus about 5,000 hectares on the coastal side near Dromore on the east.

2 Take an extra six cumecs and sell it to the bottom end of the Ashburton /Lyndhurst scheme.

3 Work with the Barrhill Association and together take water from further up the river.

The possibility of Lake Coleridge being used as a storage lake was also discussed.

It was decided to investigate the level of interest by holding mini meetings in the area. About 100 farmers were involved and of these about 65 attended these meetings and voted 90% in favour of continuing investigations. The challenge to the farming leaders was recognised but subsequent events were greater and more time consuming than anyone had imagined.

The election of officers resulted in myself (Brian Cameron) elected Chairman, Shirley Bond Secretary, Michael Hill Treasurer and a Committee of Peter Watson, Brian McGuigan, Bill Hood, Paul Wilkinson, Alastair Burrows and Lance Innes

Roger Tasker of the Regional Council was in attendance.

The next Committee meeting was held on 12th. August 1993

There was a general update on various matters.

Various organisations were actively engaged in research projects on aspects of the Rakaia Catchment.

Some were looking at in-stream values and others at the effects of abstractions. Farm Economic studies were showing promising returns from irrigated farming.

There had been a number of applications granted for abstractions from small irrigation groups on the Rakaia River and with the "first in time/ first in right" philosophy, had priority in the order of granting. These were adding up rapidly and the one for one sharing rule compounded the effect on availability. This meant for every cumec taken out, one needed to be left in the river before further allocations could be made. Each successive right had a lower certainty of supply and the committee was concerned at delays. For 10% of the time, under the Conservation Order, there would be no abstractions at all from the river. This was compounded by the fact that low flows occurred erratically and the nil abstraction could last for several weeks in the worst-case scenario.

The earlier granted water rights totalled about 30 cumecs and with the one for one sharing rule (between in-stream users and abstractors), meant the river flows needed to be 60 cumecs above the particular minimum flow before the Lower Rakaia Irrigation Scheme could take any water at all. To take out the full 15 cumecs the Lower Rakaia Scheme were required to leave another 15 cumecs in the river. With this condition the reliability of supply drops off very rapidly.

The methodology used by the authority in granting these rights is interesting. Mostly the applications were for border dyke schemes, and required a large volume of water for a short period of time.

Typically this would be half a cumec for two days a week. The Catchment Board would allocate half a cumec to them. Other similar applications were treated in a similar manner with the next one getting the next but different half cumec. Yet they were each only using it for two days a week.

Seven days of allocated flow was only being used for two days.

The amount allocated could have been reduced by two thirds if they had allocated the same water between three irrigators, and expected them to share it by one using it for the first two days of the week, the second person using it for the second two days and so on. All these irrigators would still be getting their full allocation of water and be no worse off.

The 30 cumecs largely allocated in this way could have been and can be greatly reduced. This would considerable improve the reliability of later ranked applications.

The beneficial effects would be doubled when the one for one sharing rule is taken into account.

In the case of the Barrhill/Chertsey scheme it would have improved the reliability by several percent. The severity of the Conservation Order can be seen by looking at the Rakaia river flows. The mean flow of the Rakaia River is 224 cumecs and the median flow during the irrigation season is 174 cumecs. The minimum low flows of the Conservation Order for the six main irrigation months are 106cumecs for September, 129 cumecs for October, 139 cumecs for December, 124 cumecs for January, 108 cumecs for February and 105 cumecs for March.

It was realised that the possibility of a community scheme was reduced as more and more farmers developed private schemes. Computer modelling had shown there would be unsustainable pressure on the ground-water system if the whole of the area was developed from this source. Sooner or later there would need to be a river and /or a storage supply-system to service the upper Plains. With no community scheme in sight, individual farmers who wanted to irrigate had to sink expensive wells and pay high energy charges to lift the water to the surface. However, from their point of view an expensive private scheme was better than none.

The earlier proposed Lower Rakaia intake at Lockheads Cutting, (10km. above Rakaia), was technically easy and relatively cheap, it being possible to channel the water up the terrace and deliver it to the Plains area without pumping. The height of the terrace at this point is about 10 metres. It was still the preferred option for a stand-alone scheme in the 15,000 hectares of the original proposal. The plan involved an intake from the river, feeding into a settling pond with a flushing device in order to remove excess silt, and a channel slowly coming out onto the top of the terrace. The fall of the land in this area is several metres per kilometre and it took the channel several kilometres to reach the top of the terrace. It was gravity feed and did not require any energy input. Because of the slope of the land the intake would be higher in elevation than the discharge point onto the plains.

The main channel was to roughly follow Mitcham Road across the Plains and have laterals delivering water to each farm property at its highest point.

Farm Life! Daughters - Helen, Joanne and Lynette

There was considerable cost savings if the main race could follow the land contours, which swung away from Mitcham road. This would have meant, however, that some farmers would have had the race bisecting their properties at odd angles and this caused considerable opposition. With hindsight a five-metre cutting for about a kilometre along Mitcham Road would have overcome this problem.

Dr. Anthony Taylor, an irrigation engineer, advised the committee the scheme could be built for approximately half the Ministry of Works cost if done privately using low cost alternatives. It would not be a Rolls Royce scheme and could also be done at less cost if the water was delivered only to the top corner of the each farm and at a constant flow.

However with increasing costs, and farmers developing irrigation privately, and an unreliable water supply, a community scheme looked a difficult proposition.

During 1993/4 discussions were held with a number of people who were either associated with irrigation or had special skills that could be utilised.

As Chairman of the New Zealand Cooperative Association I had previously

worked with David Stock, a very experienced international corporate solicitor, and David agreed to help us with legal and corporate advice. David was of tremendous help, both to the Lower Rakaia, and later in the formation and operation of the Barrhill /Chertsey Irrigation Company. He did not charge for his time because he saw it as a community service for the benefit of the Canterbury area and because he saw exciting prospects for irrigation development. He was also impressed with the farmer attitude of self-help and inventiveness.

I also had connections with Lincoln University and knew Terry Heiler of Lincoln Ventures, the commercial arm of the University. Terry was very helpful and through him we developed a working relationship with Lincoln Ventures. We used their services over many years and also generated a lot of work for them, in particular John Bright and Neal Borrie. They both had expertise in hydrology, computer simulation and consent applications and did a great deal of work for the Lower Rakaia Association and later the Barrhill/ Chertsey Company.

Other people who where contacted and consulted with, included--

Matthew Hall of 'Save the Rivers' and other environmental groups

Dr.Anthony Taylor –Irrigation engineer

Hugh Williams –North Canterbury Federated Farmers

Ron Cocks- Ashburton Irrigation Committee and National Water Authority

District Councillors and Council Staff

Jenny Shipley M.P.

Canterbury Catchment Board Councillors and Staff

Grant McFadden of Ministry of Agriculture and Fisheries.

Clair Mulcock- Federated Farmers Policy Adviser.

Walter Lewthwaithe- Ministry of Works.

Jack McKendry –Barrhill-Highbank Irrigation Association.

Barry Knox - ECNZ Resource Adviser (Dunedin)

Bob Engelbrecht- Farm Consultant

LAKE COLERIDGE STORAGE

Because of the very restrictive nature of the Conservation Order the Committee's greatest concern was the uncertainty of water supply. This had to be overcome before the committee could recommend a scheme. Water supplementation, therefore, became the immediate interest for the Association.

It was made clear by the Judge in the Conservation Order that he had left an opening for irrigation storage by not placing restrictions on the Wilberforce and Harper Rivers and Lake Coleridge systems. The Committee decided to look more closely at storage and multi-purpose usage of this complex.

At this time the Electricity Corporation of New Zealand (ECNZ) were the owners of the Lake Coleridge Power Station and the associated structures, which diverted water from the Wilberforce and Harper Rivers into Lake Coleridge. They recharged the lake from the rivers whenever possible and generated electricity through the power station and spilled the water back into the Rakaia River.

They could only divert water when the river flows were above the low flows as stipulated by the Conservation Order.

ECNZ were required to renew their water rights for the Lake Coleridge Power Station in 1996. The Association took the opportunity of talking to them and expressing our interests in Lake Coleridge as a multipurpose storage lake. ECNZ wanted allies for the consent hearing and were pleased to work with us. ECNZ wanted to maximise the throughput and efficiency of the power station.

The approach taken by ECNZ was to settle as many areas of conflict as possible before applying for the renewal of their water permits. The technique used was to consult and negotiate rather than litigate. This involved a succession of public meetings at Lake Coleridge extending over a considerable time. ECNZ invited interested parties to express their opinions and concerns and to suggest improvements. This invitation was taken up by a number of groups.

I attended all of these meetings and various members of the Committee also attended when possible. Jack McKendry and later, Phil McKendry (his son) of the Barrhill-Highbank Irrigation Association attended also.

The meetings took the form of presented papers by various groups and general discussions. Following these meetings ECNZ would organise further reports and suggest solutions to particular problems. Many aspects of the Lake's future were discussed and eventually most of the environmental problems were resolved. ECNZ conceded a limited range of lake levels, in spite of this adversely affecting the output of the station. This involved absolute high and low levels and an intermediate range where some discretion was possible. There were also restrictions on water diversion from the Wilberforce and Harper Rivers when there was high sediment loads. The Associations interest was in multi-usage and water storage and pushed this aspect as much as possible.

However the Association still had the problem that under the Rakaia National Water Conservation Order the water from the Coleridge tailrace into the River immediately became 'natural water' and as such came under the sharing rules of the Order. This was in spite of it having been diverted and stored for a period and not adversely affecting the low flows in the River. In fact this process enhanced the low flows of the river, by lifting the minimum flow by about four cumecs on average, and more when there were low flows occurring. In practise, water was diverted from the river in times of higher flows and returned to the river in times of low flow.

We have always been surprised that the diverted water was considered as "natural water" if it was returned to the river. The value of this water would have been enormous if it could have been used for irrigation. The constraints of the Order in regard to low flows would have given full environmental protection.

At the Conservation Hearing two sets of figures, covering many years of recording, were produced by the Ministry of Works. The first was the daily flow figures as if the Lake Coleridge infrastructures was not there i.e. the Natural Flow. The other was the Modified Flow, which took into account the modified flows as created by the operation of the power station complex. On average over the year the Modified Flow was about five cumecs higher. There was considerable debate as to which should be used. We took the view that the Natural Flow should be used to determine the official low flows, because, quite simply, this was the natural low flow.

As it stands the Tribunal decided to use the Modified Flow as the base for determining the low flows and decreed that when the water was returned to the river it became natural water again.

Further, if extra water could be diverted into the Lake and then spilled back into the River it was only of use to the irrigators if above the allowable Conservation Order limits.

The irrigators and ECNZ worked closely on the Lake Coleridge Power Plant consents and we supported ECNZ on their application. In return ECNZ agreed to help us, and initiated a study with Works Consultancy, Wellington, to do a scoping study on the feasibility of augmenting Rakaia flows with Coleridge storage. If the power station could then be run at times to suit the irrigator groups it would have been extremely useful.

The ability to modify the natural hydrological regimes of the River and Lake systems had strategic value for both ECNZ and irrigators. The Irrigation Association took the view that if they were the beneficiaries of enhanced diversion into the lake they would be prepared to contribute to that cost as part of their scheme headwork's costs.

ECNZ would agree to run the station at full or greater capacity as and when the irrigators required it. The agreement would be that the Irrigation Company would compensate any variation from the optimum usage by ECNZ, which cost them loss of income. It would be value neutral to ECNZ but would be extremely valuable to the Irrigation Company.

A quantity of water, available to the irrigators on call, would have made the scheme more viable.

It would have been even more valuable if it could have been classified as 'stored water' and the whole amount available for abstracters!

In his summing up in the Conservation Hearing, Judge Skelton said "in our judgement all is not lost for the irrigators."

In referring to alternative sources of water he said--- " we express the view that this should include the storage capacity of Lake Coleridge " and---" it would also provide for the need for a reliable supply of water."

As a corporate citizen, ECNZ agreed to fund half of a computer simulation study of the waters of the entire Rakaia catchment, with particular reference to examining alternative regimes for the Lake and power station. (The Canterbury Regional Council was the other main funder).

This was referred to in the findings of the Hearing where it was mentioned as a commitment given in an individual agreement, " These measures include an undertaking to the Lower Rakaia Irrigators to continue discussions on the basis that ECNZ and Canterbury Regional Council would financially support a modelling programme to assess the benefits and effects of various Rakaia River flow augmentation options, but on the basis that any proposal would be value neutral to ECNZ.

This document was finally published in 1995 as the Lower Rakaia Irrigation Study –Flow Augmentation for Irrigation.

It was modelled on the assumption that the Lower Rakaia required a constant 15 cumecs, and that the output of the Power Station would be modified to meet this demand. This lifted considerably the availability of water for irrigation. It did not change the amount of electricity generation but shifted it from winter to summer, which was a negative for profitability for ECNZ.

This supplementation would only be needed for short periods of time. The first water used by the irrigation scheme would be run-of- the- river flows, which would be available for most of the time. Also over the season the full amount would not always be needed because of rainfall supplementation and low crop demands. This arrangement would have given the Lower Rakaia and Barrhill /Higbank Irrigation Schemes adequate water and at an acceptable cost.

To fully meet the 15cumec requirement, the Station would need to be enlarged to 54 megawatts (from a maximum flow of 36cubic metres to 51 cumecs). This could be done under all the existing consents and Orders, so technically Lake Coleridge could be used as a storage lake and provide a considerable amount of water for irrigation and still not adversely affect the in-stream values. Electricity would have been generated at a different time of the year and possibly could have cost ECNZ income, but would have remained value neutral with the irrigators paying for the difference as a " head-works charge."

Because of the background preparatory work done by ECNZ the Lake Coleridge Resource hearing was straightforward and the ECNZ consent was granted.

It was a valuable lesson in regard to the process used. Rather than have an adversitorial approach involving Courts and massive legal fees, the applicant

talked directly to objectors in order to understand their concerns and then set out to solve the problems. ECNZ paid for certain improvements around the Lake, but probably saved much more in legal costs. It was a win/win situation and all parties were satisfied.

This approach proved to be very effective and was used later by the Barrhill/Chertsey Irrigation Company in securing its 17 cumec Water Right from the Rakaia River.

It looked as though we had solved the reliability problem but had to wait for the publication of the Augmentation study. In the meantime we were able to advance other matters.

Top left: "Stainless steel screen, which would be fitted to the bottom of the riser pipe"
Top Right: "Large Auger rig operating, driving pipe and expelling rubbish"
Middle left: "Electric Motor (bottom) and submersible pump being lowered. Riser pipes on ground would be added as the pump is lowered"
Middle right: "Developing Well-Two compressors blowing air into the bottom of the well (140 metres) to agitate materials"
Bottom left: "Well sinking - welding another length of pipe before driving into the ground with monkey on right of machine"
Bottom right: "Measuring the flow and developing the well"

ASHBURTON WATER TRUST.

In 1994, the Ashburton District Council compiled a Draft Strategic Plan for the district. This was a document to chart the future direction for the district to 2010 and beyond. The only references made to water were a suggestion that some water races be piped, and there would be benefits from having a dam in the headwaters of the Ashburton River. Yet surprisingly, thirteen strategic goals were identified in the Plan, and of these eleven were inexorably linked to the way in which water-storage issues are resolved.

Phil McKendry (Barrhill-Highbank Irrigation Association) and I (Lower Rakaia Irrigation Association) prepared submissions to the Council on the general lines that there was a need for a water enhancement policy and water was one of the most important ingredients in future planning for Ashburton County. The emphasis should be on multipurpose use of available water and the benefits to all sectors of the community should be taken into account.

It was suggested there was a need for a forum for discussion on a district wide plan. Individual groups had gone as far as they could and now a community consensus on the most effective, equitable and sustainable use and development of water resources both for farming and community usage was needed. Considerable use was made of material supplied by Bob Engelbrecht on the on farm and off-farm benefits of enhanced irrigation.

The submission was very well received, and the Council asked us for our help and suggestions. The District Council wrote to the Associations acknowledging a commitment to a water enhancement issues and options study, as outlined in their submissions. In reply the Associations suggested a planning process. Stage one would be a scoping paper, which would examine the best organisational structure and take an overview of the big picture. The second stage would be an issues and options study where the community would be invited to identify issues as they saw them and then consider the options.

Phil McKendry and I offered to assist in the convening of a steering committee, to select and employ a professional consultant and to supervise the scoping report. The report would take up to two months and cost about $15,000. This was accepted and Terry Heiler (water management consultant) was employed and consulted widely and wrote his report. His main recommendations were

that the Council should make it a top priority for all sectors of the community to be involved, and the studies should look at all aspects of water management and in particular water storage. Initially the priorities would be to collate all relative available information, highlight framework issues, identify major stakeholders and flag important issues.

At this time there was a wide gap between irrigators and environmental interests, in terms of understanding each other's positions. If nothing had been done, the two groups would have continued to talk past each other. Education and discussion were going to be very important.

An interim community advisory group for the development and environmental enhancement in Mid-Canterbury was set up. It functioned for a period, and included the Ashburton District Mayor, (Murray Anderson), Council Staff, Environmentalists, Phil McKendry and me. This group recognised early on it was not desirable to have representatives who were too clearly on one side or the other and that the purpose of this group was to set up a balanced structure (preferably a Trust) that would be seen to be neutral. A name suggested at the time was "Ashburton District Sustainable Futures Trust" – Highlighting sustainability and the future development and enhancement options.

"Irrigated Tic Beans being break fed to sheep for winter fodder. 1990s"

Eventually the Ashburton Community Water Trust was formed and members included the legal professional, business people, and the Council. The irrigators dropped out at this point but felt satisfied at having advanced the notion this far. It was funded basically by the Ashburton District Council but also sought other funding.

The Trust funded a major Lincoln Environmental report and this was made public in May 2001. It identified significant opportunities for the harvesting and storage of water in an ecologically and socially acceptable way. It identified the possibility of increasing the minimum flow in the Ashburton River. The Trust also funded a study of the groundwater resources of the District.

The Trust believed there is likely to be sufficient water for all reasonable expectations, provided that it is managed, conserved where necessary, diverted, harvested, and stored in a proper and sustainable manner. The Trust endeavoured to co-ordinate a community approach to water and to encourage and support the further development of the region's water resources for the benefit of the Ashburton District Community. This is also now firmly part of the Ashburton District Council Annual Plan. The Trust has also submitted an application, in conjunction with Central Plains, to take up to 40 cumecs from the Rakaia River for irrigation, within the limits set by the Conservation Order. This would have priority after the 17 cumecs already granted to the Barrhill/Chertsey Irrigation Company.

SUSTAINABLE IRRIGATION RESEARCH.

One of the impediments to advancing an agreement with ECNZ regarding the shared use of Lake Coleridge, was the lack of information on the water requirements of the Lower Rakaia and the Barrhill /Highbank Irrigation Schemes. At this time the Lower Rakaia and Barrhill Irrigation Associations were working together. We were not very financial, and needed to rely on donations from local farmer members. All our time and travel was given voluntarily. A study of this nature would cost in excess of $100,000. This was a great deal of money for us and did not seem achievable.

We had to be able to quantify the reasonable water requirements for the scheme and make progress on scheme design. The Associations also realised that we needed to manage natural resources in a responsible sustainable manner. Another requirement was to be able to identify and specifically analyse issues to do with sustainability of irrigated agriculture, and particularly the effects of water and nutrients on the ecosystem under different irrigation management strategies. This would also be in line with Ministry of the Environment aspirations.

Following discussions with Grant McFadden of the Ministry of Agriculture and Fisheries Policy Division, it was decided to approach the Ministry of the Environment for funding.

To encourage better farm practises, the Ministry for the Environment provided funding for certain projects. The Associations put forward the idea of a case study on their area, where a variety of soil types, rainfall and farming practises would provide valuable information on Twenty First Century irrigation scheme planning. This information could then be used in irrigation planning for them and for other potential East Coast irrigation areas.

One problem was the Sustainable Agricultural fund would only provide 40% of the cost of the project. The farmers would need to fund the balance! This had us scratching our heads for a while. However it was then suggested the farmers place a value on their time and expenses and their local knowledge, information and experience and then pay in kind.

We did not have any trouble logging up a big number of hours and travel expenses but it still did not add up.

Being country people and being used to voluntary work in the community we had put a value of $10 an hour on our time. It was then pointed out to us that professional people doing essentially the same work would charge between $100 and $200. This message was taken on board and an important lesson learnt! The revised figure brought our share “in kind ”up to the necessary level of about $70,000!

The project was approved and became the “Sustainable Irrigated Agriculture Project”, between Barrhill Highbank / Lower Rakaia Irrigation Associations and the Ministry for the Environment.

Lincoln Environmental, a division of Lincoln Ventures, which was the commercial arm of Lincoln University, was given the contract, and this became Report No. 2445, completed in August 1996.

The leader of the group, John Bright, was very experienced in computer modelling and the study was based on tracing the movements of water and nutrients through the soil and out of the soil. Twenty-three years of climatic data was used and various irrigation management practises were evaluated. The project established optimum water usage and application methods and “ best practice ”farm management.

The study emphasised that good irrigation design and accurate application methods were important.

The project used the Barrhill Highbank / Lower Rakaia area as a case study. The area included a sufficient range of soil types, irrigation season rainfall figures, and farming practises to enable general conclusions to be drawn about likely impacts in East Coast alluvial soils of New Zealand. The likely impacts of irrigated agriculture on water resources were assessed by computer simulating the movement of water and nutrients in soils, under representative farm management and irrigation practises.

The effects of various irrigation practises were then compared and analysed. One of the major findings was that applying smaller amounts more frequently reduced the demands on water resources and the loss of nutrients to groundwater.

For the same seasonal water requirement, a variable-depth irrigation strategy, which responds to current moisture conditions, can produce higher and less

"Irrigated maize for Five Star Beef - Akeringa 1990s"

variable yields. To this end, low labour systems, capable of covering large areas and applying small amounts and having an on-demand supply of water are essential. For example, this may mean applying 10mm of moisture every two days at about 60% moisture holding capacity and stopping if this deficit is being supplied by rainfall.

The study area was 40,000 hectares and 22 sub groups were used involving different soil and climate types.

This project, initiated by farmers, was to have considerable effect on environmental planning.

It was able to identify environmentally sustainable irrigation development options for future development. As expected it established a valuable database for this and other potential irrigation projects. The value of this project cannot be over emphasised.

BARRHILL/CHERTSEY IRRIGATION CO-OPERATIVE COMPANY.

At this stage it was decided to formally combine the two Associations as they were essentially undertaking the same activities and it made sense to combine and at the same time set up a better structure. David Stock and I had had considerable experience with co-operatives and we thought this should be the business model. Up to this point the two Associations had a joint committee of three committee members from each group and with the two Chairmen jointly working together. This was working very well but it was desirable to have the authority of a company in future negotiations.

David Stock was our unpaid solicitor and did a tremendous amount of work, particularly in the establishment of the company. This involved compiling a constitution, getting the company registered, going through the legal steps of formally establishing the Company, issuing shares and generally directing and assisting the farmers.

The farmers were also receiving advice from Terry Heiler (ex Lincoln Ventures), Grant McFadden (MAF), Bob Engelbrecht (farm adviser), and John Bright, Neal Borrie and Ian McIndoe from Lincoln Environmental and others.

The Company was duly established and a Board elected. The Company name would be the Barrhill/ Chertsey Cooperative Irrigation Company. Four people from the Barrhill area and two from the Lower Rakaia were elected by the shareholders at the first Annual Meeting, and at the first Board Meeting Phil McKendry was elected Chairman.

The funds of the two Associations were transferred to the Company and the two Associations went through the process of formally winding themselves up.

The final Lower Rakaia Irrigation Association meeting was held on 7th.of October 1999. The Association had been in existence for twenty-eight years.

RESEARCH WORK

The main issues facing the company at this stage were a prefeasibility study, an engineering design, a measure of farmer support, and resource consents. These were to be developed simultaneously.

The prefeasibility study would look at the cost/benefits of the proposal to the farmers and to the nation.

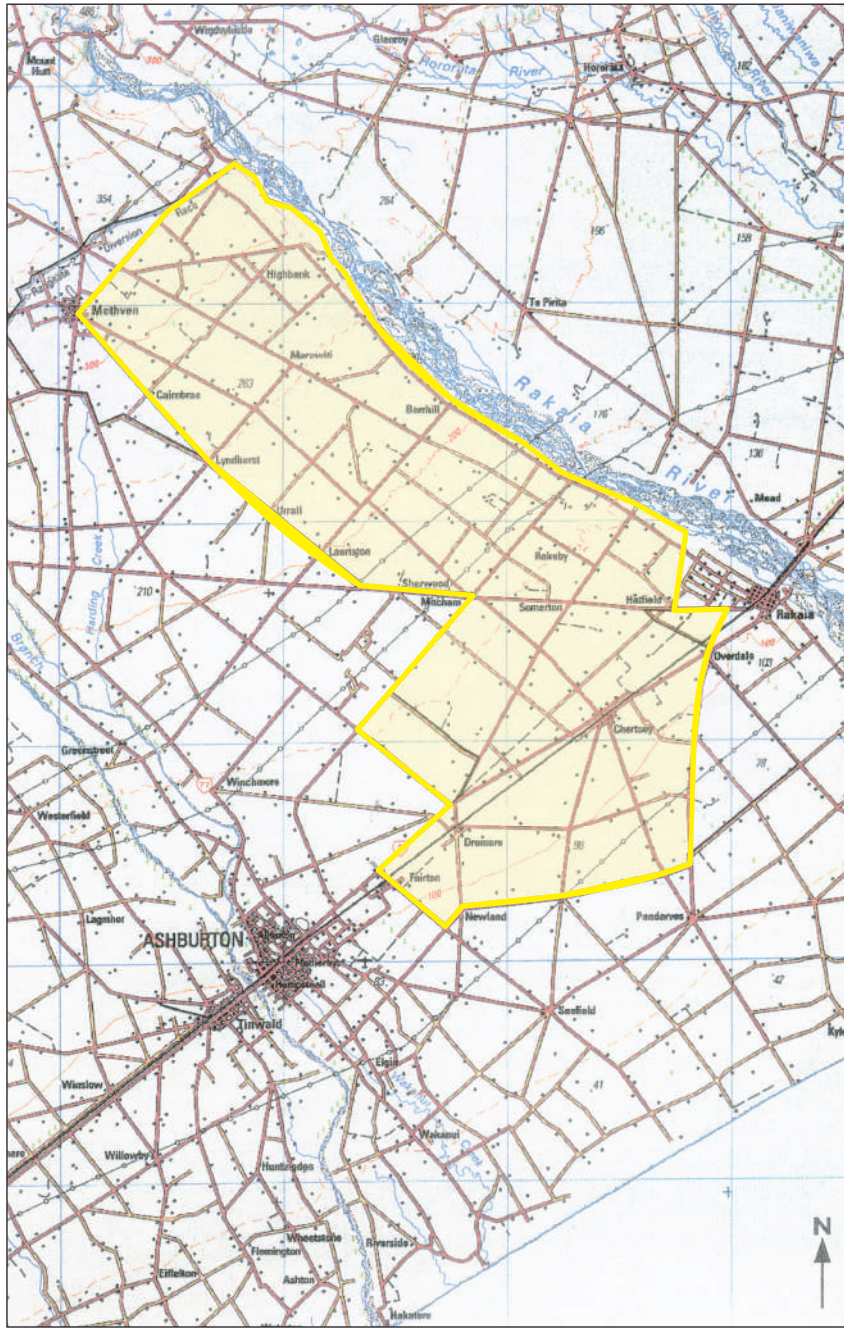
The engineering design would be best practise taking into account costs, environmental issues and farm management practises. The farmers would be the final arbitrators of the scheme and needed to be satisfied. If possible it was to be multipurpose and include recreational functions and hydro-generation.

Commercially developing a project of this complexity was a major undertaking but the farming leaders were convinced of the future value of irrigation in the district and were prepared to give it a go.

The general consensus in the community, however, was that it would not be possible to obtain the necessary consents and the company was wasting its time and effort. This suited the Board because publicity was avoided and the press did not take a great deal of notice of us. We quietly get on with the business in hand. It is much easier to do things under the radar rather than in the glare of publicity.

The Directors had learnt a valuable lesson from the ECNZ Lake Coleridge consent application and adopted a similar policy. We would negotiate in good faith and attempt to consult and mitigate. Publicity was avoided and lawyers were kept in the background. It was agreed to work within the Rakaia National Water Conservation Order (1988) and existing Environmental Canterbury's "first in time, first in right ", prioritised water allocation plan.

The directors took the view that this was probably the only opportunity for the local farmers to obtain irrigation water from the Rakaia River and they must be successful in doing so.



Proposed Barhill/Chertsey Irrigation Area

PRE-FEASIBILITY STUDY

The pre-feasibility study was to be a comparison between all options, but it was becoming increasingly clear that the best long-term practise would be a piped system. It was assumed that because of the very large quantity of pipes involved and improving technology the costs of the pipes could be significantly reduced. It was also understood there was low-head electricity generating equipment available, which made it possible to incorporate generating capacity into the scheme.

The experiences of the Lower Rakaia Scheme was that open races were unpopular with farmers, particularly where reasonably large races would run through their properties. There was also the issues of evaporation, and other losses from open races, high maintenance costs, compensation costs for land lost to races, the possible legal costs of obtaining easements, and the loss of opportunity of generating electricity.

So while the capital costs of piping the water was high, the benefits were very large. The main benefits of a piped scheme was that farmers would receive water under pressure and would not have to have on-farm pumps, maintenance costs would be low and they would not have large electricity costs.

As far as it was possible the intention was for the pipelines to follow, and be on roadsides. Some of the main feeder pipes would need to cross farmland but with some compensation and the restoration of the topsoil it was assumed that these farmers could be satisfied. The pipe system was seen as being the best long-term engineering design. Subsequent work on feasibility and engineering design confirmed this philosophy.

Lincoln Environmental, (a division of Lincoln Ventures), were commissioned to do a pre-feasibility study of development options. This was done in several parts and became Report No 2680/1 (February 2002).

Irrigation Demand

The area was divided into soil, rainfall and cropping system areas and the individual irrigation requirements aggregated. The average demand was a duty of 0.45 litres per hectare of the farm irrigable area at the farm gate. The total farm water demand for the scheme on this basis was a maximum of 17cumecs. With an on-demand supply, the mean flow requirements were considerably

less that the maximum. The seasonal demand was very modest and full flow is not required at all times.

Water supply

The exercise assumed that the only water available was from the Rakaia and this would be under the Conservation Order conditions. The intake would require a settling pond to remove most of the sediments from river water, and a sluicing system to remove sediment from the pond. Fish screens and by-wash structures would need to be installed to prevent fish entering the intake. Any adverse effects on the in-stream users would require mitagation, and the pre-feasibility study would provide sufficient information to begin negotiations on these points. NIWA and Fish and Game were consulted on all of these points. A logger would continuously monitor the quantity of water taken in real time and the information be made available to Ecan and to a web site.

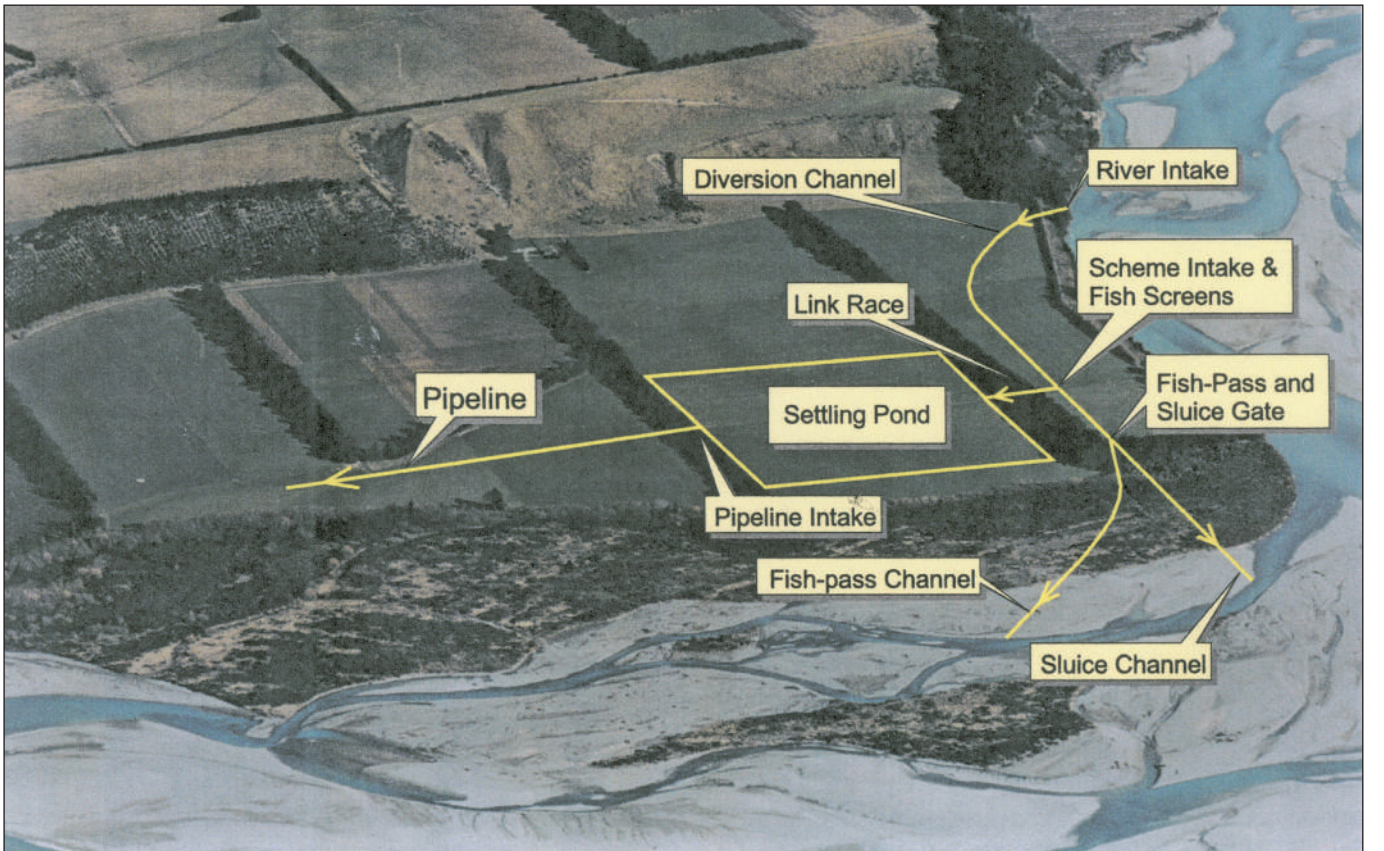
Conveyance strategies

The first method considered was to pump water up onto the plains by converting the Highbank Power Station generator into a pump-turbine which could be used to either generate electricity from water flowing down from the Rangitata Diversion Race in winter or be used as a pump, with introduced electricity, to deliver Rakaia water to the terrace above when required for irrigation in summer and distributing the water via the Rangitata Diversion Race to individual farmers.

The second method was to construct an open channel along the side of the 100metre high terrace and gravity feed the water onto the top of the terrace at a point about 13 kilometres downstream. Because of the slope of the land in this area the discharge point would be lower than the intake point and no pumping would be required.

The third option was to pipe water down the river bed for about 13 kilometre by which time there would be sufficient "head" to push the water up a pipe onto the top of the terrace. When the water was not needed for irrigation it could be diverted through a generating power station in the riverbed. With a 17 cumec flow and a "head "of about 90 metres, there could be a moderately sized generating station.

The Highbank pumping option had the lowest capital cost but had the



Barhill-Chertsey Irrigation Scheme River Intake

highest operating cost. The gravity system had a highest capital cost but had very low operating costs. The piped option would require two 2200mm steel pipes to convey 10.5 cumecs or two 2800 mm pipes to convey 17 cumecs and would have the highest capital cost. This, however, could be offset by income from generating electricity. The pipeline would probably be buried in the riverbed close to the terrace and would be very safe and cause little permanent disturbance in the riverbed.

Distribution System

The distribution system was to deliver water at a rate and pressure sufficient to operate commonly used travelling irrigators. Water would be available continuously at a controlled rate, and subject to availability from the Rakaia River under the Conservation Order conditions. The total fall from the top of the scheme to the bottom boundary is about 210 metres, enabling supplying a pressure of 60 metre head immediately upstream of the delivery point control valves and water metres for most of the area.

Water would only flow when water was abstracted and used for irrigation, i.e. on demand "or when the tap was turned on". The distribution system must pass or lead to every property in the scheme area, and preferably to the highest point on the farm boundary. The saving on on-farm pumps and electricity would be huge. The pipe network was a new concept in New Zealand but was an outstanding feature of the proposal. It would be a highly regulated and monitored system with nil distribution network losses. The Company would supply information that the farmers could use to maximise yields and efficiency. The proposal was a quantum leap ahead of any other work previously done in New Zealand. It was of world class and would set a new standard for irrigation schemes.

Water Trading

Efficiencies could be further enhanced if farmers with surplus water at a given time could transfer it to other farmers with a greater need for water. This could occur because of different crop rotations or farming systems. A simple auction system could be used and market forces could set the price. A price would be set that would reflect supply and demand. A quantity of water would be traded between farmers for a specified period but the water right itself would not be traded. The Company would own the Water Right and would contract to supply farmers with water.

"Akeringa irrigating oilsedd rape 1990s"

Intake

The river intake, diversion channel, fish pass, and fish pass channel were designed to provide continuous fish passage between active river braids. The details had been agreed with Fish and Game and Gordon Glover of NIWA. There were sluice gates and fish pass structures and settling ponds to take out sediments. The object was to allow water abstraction for irrigation but to minimise the effects on fish passage and other adverse effects on the river system.

Capital Cost

The total capital cost of the scheme was estimated at $168million, which was $4200 per hectare. It was assumed that the farmers would initially pay one third of the capital ($1270 per hectare) and repay the balance ($2930 per hectare) at 7% interest over 30 years. The total annual water charge (servicing capital, electricity, and operation and maintenance) would be about $530 per hectare. These estimates assume that full development and full uptake occurs from day one. (Unfortunately this is not the way these schemes do develop and a slow uptake of water is often the difference between success and failure.)

These costs appeared very high to the farmers, many of who farmed next to the Ashburton/ Lyndhurst scheme built by the Government in the 1940s and which was eventually gifted to these farmers.

The effect of this was the capital cost of the Ashburton/ Lyndhurst scheme was written off entirely and only meant the operational cost of about $25 per hectare needed to be paid. For the Barrhill/Chertsey farmers paying over 20 times as much was a bitter pill for the Barrhill/ Chertsey farmers to swallow. This discrepancy did and always will make it difficult to combine schemes, even though it may be very beneficial to do so.

The attitude of the Ashburton /Lyndhurst farmers was surprising considering the value of the scheme asset and the massive benefits that they were receiving from irrigation. I was aware of this attitude.

In 1972 we (Brian and Norma Cameron) had bought a dryland farm within the Ashburton/Lyndhurst Irrigation scheme area and fully developed it for border-dyke irrigation. At the annual meetings of the Association at this time, the main topic discussed was the unfairness of their farmers having to pay water charges. Some members argued that because they did not ask for the scheme to be put in they should not have to pay. (the scheme was constructed by the Ministry of Works in the 1940s and where necessary, races were placed on properties without compensation). The farmers were less sure when it was suggested that if that was the case the Lower Rakaia Irrigation Association would be only too happy to buy the water off them!

BENEFITS

The direct benefits of the proposed Barrhill/ Chertsey Scheme to the Ashburton economy would be huge. Initially there would be about $300 million of goods needed to be invested in on-farm and off-farm project development. Increased farmer spending on goods and services in the district would be more than $50 million annually. The scheme would lift total annual farm income in the region by about $20 million. Farm employment would increase by at least 130 full time jobs on-farm, with another 130 off-farm jobs being created. This would enlarge the population of the District by at least 700. This in turn requires more people and businesses to do all the other things that a community require.

Economists have suggested that if $10 Billion Dollars was spent on improving the infrastructure of Auckland's roads, there would be a net increase in wealth of $I Billion Dollars per year. (i.e. 10% return on capital) On our figures if $1 Billion Dollars was spent on East Coast irrigation, there would be a net gain of $1 Billion Dollars per year. (i.e. 100% return on capital)!

"Akeringa - Lincoln Boom irrigator 1990s"

BARRHILL/CHERTSEY PHILOSOPHY

There had been 50 years of serious attempts to develop irrigation and the present farmers had a lot of experience to fall back on. They knew now that the Government would not assist them and it was a case of self-help. The green lobby was getting very strong and environmental factors were becoming increasingly important. On farm costs were increasing rapidly and any modern scheme needed to be highly efficient, economical on water usage, suit the crops grown, and be environmentally friendly. It would be there for the long haul and would have to be adaptable to any form of farming. Above everything else it had to be profitable and acceptable to the farmers.

The development of irrigated agriculture leads to many advantages to both the farmers and also to the surrounding community.

The correction of soil moisture deficits clearly has a beneficial effect on farm economics. Higher yields and quality of crops, greater dry matter production from pastures and opportunities to grow new crops are the more obvious advantages. Because of the build up of organic matter in the soils there are more earthworms and microorganisms, the moisture holding capacity of the soil is increased greatly and the use of chemicals and fertilizers can be substantially reduced.

While the cost of irrigation may be high it can be shown that the positive benefits, with good management, outweigh the irrigation costs.

Bob Engelbrecht and other economists showed that the scheme could generate conservatively $20 million to the farmers in 1990-dollar terms and technologies. Of even greater importance economists also showed that the scheme would generate another $140 million off farm. There would be more produce to sell, more produce to process and more produce to transport, more farm services and farm inputs required, plus a multitude of other activities further down the line. This called the multiplier effect. The social benefits of irrigation in a Mid-Canterbury climate cannot be quantified but the benefits are obvious to anyone who has experienced dry-land farming in the area. High production can be budgeted and planned for and be achieved. There is not the financial stress of losing crops, selling capital stock, needing to buy in extra supplementary feed, or farming at a loss for the year. Mental stress on farmer and family is alleviated.

Irrigated farms enhance the environment. Soil health is improved by more organic matter, which increases microbiological activity and water holding capacity, Soil erosion is reduced because the soil is not dry enough to blow away. Soil structure is improved by less cultivation when dry and because of the build-up of organic matter.

It is possible to establish and maintain good shelter for stock and crops.

Amenity plantings around the farm and homesteads is possible, the landscape can be enhanced and there can be diversified land use.

With constant plant growth there is a continuous uptake of nutrients from the soil and leaching to the subsoil is greatly reduced.

There are greater opportunities for on and off farm employment. A conversion from a sheep farm to a dairy farm, made possible by irrigation, may increase on-farm employment opportunities from one to six.

Off farm opportunities also abound, with transport, processing of products, marketing of products, suppling of farm inputs, advising, providing services of all types. Secondary activities associated with a growing town also increase.

Programme
The Board mapped out a proactive plan of action, based on past experiences. It was realised they needed to have answers to questions before the questions were asked.

Environmental
The first step was to address environmental concerns. This was the Sustainable Irrigated Agriculture Project which was described earlier. It looked at the nature and magnitude of the impacts on water resources and possible losses of nutrients. It was a complex computer simulation of the inter-reaction of the relative factors involved.

The first major conclusion was that water had to be on demand and be available when required i.e. a flexible supply. This was also the most efficient method and reduced total consumption very significantly. It was also important to monitor soil moisture and irrigate according to crop or pasture requirements. Enough had to be applied to maximise growth but not enough to result in excess drainage of water and nutrients.

Irrigating with relatively small amounts and irrigating more frequently achieved the best outcome. These factors were subsequently incorporated into the scheme design. With this approach, it was relatively easy to convince outsiders of the scheme's efficiency and the benign effects on the environment.

The Board wished to avoid litigation as much as possible and attempted to consult and negotiate, and be inclusive. Although background legal advice was used, it was decided to keep solicitors out of the equation and use our own negotiators and technical advisors to make contact with other stakeholders.

Water Supply

The second step was to seek a water supply. The work already done showed that there was not sufficient "run-of-the-river water and that an extra supply was important. Earlier work had shown that the Rakaia River could supply 79% of the scheme's requirements under the Rakaia National Conservation Order. More water and a more reliable supply was needed hence the work done with ECNZ. This was the Study of Enhancements Options from Lake Coleridge. This has been discussed earlier.

Efficiency

To proceed further a study involving engineering options and costs was needed to meet the requirements of the earlier studies. This was the pre-feasibility study done by Lincoln Ventures, which was mentioned earlier. The preferred option was a largely piped system, which supplied pressurised water on demand. Water losses would be very low, maintenance almost negligible, and the system easily monitored and controlled.

Consultation

At all stages the Irrigation Associations and later the Board endeavoured to inform and consult with the other irrigation stakeholders. These were the Ashburton District Council, the Ashburton Community Water Trust, the Regional Council, other local irrigation companies, and of course the local farmer stake-holders. In stream users were also informed and consulted.

The Irrigation Associations realised it was important to have the support of the wider Ashburton community.

Towards this end submissions were made on the Ashburton District Council draft Strategic Plan in 1995, saying the plan should include mechanisms and

policies which would lead to the sustainable use and development of the district's water resources. The Irrigation Associations efforts led to the formation of the Ashburton Community Water Trust. The Trust's main objective is the fostering of a community consensus and vision for the wise and sustainable use of the district's water resources.

Intake
The amount of water applied for was 17 cumecs, which was to service 40,000 hectares. This amounted to a duty of about 0.45 litres per second per hectare. This was a modest amount but if used correctly and efficiently was adequate. The fact that it was to be a piped scheme reduced water losses and added further to efficiency. The intake from the Rakaia River was to be at Happy Valley, which is a low lying area, at river level at that point, and highly suitable as an intake site. The owner, John Holmes, indicated that, in the interests of the community, he would be willing to co-operate to make an intake possible.

Mitagation
The Company was now ready to apply for a Resource Consent to take water from the Rakaia River.

The application was formally lodged with the Canterbury Regional Council towards the end of 1999.

It was notified publicly and submissions invited. A substantial number of submissions were received, either expressed support for the development or concerns regarding adverse environmental effects. A considerable number wished to be heard at a hearing. The Ecan Investigating Officer also requested additional information. Further investigational work was done.

The Company was employing Lincoln Environmental and in particular John Bright and Neal Borrie, to give technical advise. John was an engineer who specialised in computer analysis of water effects and Neal specialised in consent procedures. Their specialised input was of great value, as was advice received from David Stock, Terry Heiler and others.

Prehearing
It was agreed between Ecan and the Company that the best approach was to have a "pre-hearing."

This was held in March 2000 and was chaired by Richard Budd, an Ecan Councillor with mitigating experience and took place in March 2000. The purpose of the meeting was:

To invite all submitters to enter into a consultative process.

To report to all submitters opposed on work done since the consents were notified.

To clarify concerns raised by various submitters.

The Board and advisors were encouraged by the pre-hearing meeting which clarified some concerns and highlighted others. The strongest opposition came from North Canterbury Fish and Game Council representatives. Other groups were prepared to follow their lead and allow them to be the chief negotiators with the Company. The view was taken that if the company could satisfy Fish and Game that would satisfy these other group's concerns. Not to say that the company did not talk to all concerned. Phil McKendry in particular met with and telephoned all groups and discussed their concerns. The Company decided that it would be better if a small team negotiated with Fish and Game.

This team of Phil McKendry, myself, John Bright and Neal Borrie attended meetings held in Christchurch with Richard Budd of Ecan acting as chairman and facilitator. Five meetings were held between May and September 2000. The earlier meetings were largely listening to the concerns of Fish and Game. A large number of points were brought forward, most of which were handled with little trouble at subsequent meetings, but a handful were of considerable importance.

The river users had every reason to be satisfied with the Conservation Order and as the company proposal was entirely within its rules, the amount of water abstracted and times of abstractions was not debated.

A major issue was the problem of preventing fish entering the irrigation intake. Technically this has always been difficult and various structures from around the world were considered. The engineers at Lincoln Environmental eventually came up with a structure and invited Gordon Glover, a fisheries person and expert on local conditions, to make suggestions for improvements. Fish and Game accepted his recommendations.

A great deal of discussion took place to find the best system to safely assist fish passage past the intake structure. By-washes and water depths were considered and eventually a satisfactory design was arrived at. Older schemes often did not have preventive structures at all and the loss of smolt into the systems was considerable. The Company wanted to avoid this problem and have the best possible system.

With a braided river and high rainfall catchments such as the Rakaia the conditions, which contribute to "fishability", vary greatly over time. At the time of floods or freshes the river carries a lot of sediment, fish cannot see the lures and are not caught. On the other hand if river levels are very low the water in the river is very clear. Under these conditions the fish easily see fisherman movement on the bank and move away. Fishing is unsatisfactory.

Good fishing only occurs in the Rakaia when flows are between about 170 and 180 cumecs. Fish and Game were concerned that the irrigation scheme would seriously reduce the time these flows actually occurred. In an effort to clarify this, the Company did a computer simulation study to measure the reduction in good fishing time which would occur if the scheme was operating. To everyone's surprise this only amounted to on average about one day a year.

It was decided to do a commercial deal between Fish and Game and the Company, with the company stopping abstractions when fishing was adversely affected. This would have been a formal collateral legal document, binding on the Company. The condition was that in the months of February and March when the Rakaia is flowing between 173.25 and 180 cubic metres per second, the company would reduce their take of water so that it would not reduce the flow in the Rakaia River below 160 cubic metres per second. This would have entirely eliminated any adverse effect of the proposed scheme on the fishability of the river.

Unfortunately, one of the Fish and Game officials decided this should be a condition on the consent and opposed the application on these grounds. This changed the status of the application from a non-notifiable consent to a notifiable consent and therefore required a formal hearing before a Tribunal.

After the notification of the Hearing, this official's opposition to the consent was withdrawn! But as the wheels were in motion a formal hearing had to

proceed. The hearing was set down for the 28th. February 2001. To take part in the proceedings a party or person is required to have lodged an objection and asked to be heard at that hearing. In our case, because of the mitigating efforts done, everyone had withdrawn their objections and as a result indicated they did not wish to oppose the application. This meant the Company simply made a presentation .The proceedings took about three hours and in the opinion of the Directors was very worthwhile in that it enabled all the facts to be recorded.

The commercial deal to stop irrigating when there was optimum fishing lapsed, because it was conditional upon the hearing not be a notifiable consent. Ecan were against this being a consent condition on the grounds that it effectively changing the National Conservation Order and if the Fish And Game were concerned, then the appropriate process would be to apply to change the National Conservation Order.

It was a red- letter day for the Company, concluding a long and difficult process. There was great satisfaction on the outcome and endorsed the careful and detailed preparation done.

The total cost was in the order of a few tens of thousands of dollars plus a very large number of voluntary hours of work done by some of the farmers. The principles decided upon a few years earlier were carefully followed and with hindsight proved to be highly successful. Many people had earlier indicated the Company had no chance of achieving this outcome and many were still sceptical. The economic value of the consent to the Ashburton County and the wider community is huge.

The consent was formally granted on 13th. March 2001.

Reporting back

The Board's attention could now be turned to other matters. The first thing was to report back to the farmer shareholders and invite their support for the next phase.

The pre-feasibility study had broadly outlined the optimum direction that the Company should be aiming for but did not have the detail necessary for the next step. The balance of 2001 was spent looking at ways in which the scheme could be further refined and financed.

Investigations indicated that about $600,000 would be needed to fund a suitable full feasibility study. This money was raised by a share issue to farmers in the area, (who were given priority) but also to other potential investors. This was a highly technical matter and assistance was sought from David Stock and also Brian Keft, an expert in this field. Further technical investigations were being carried out as required to advance planning further. While not much seemed to be happening there was a great deal of work being done behind the scenes.

Every effort was made to inform farmers on matters that may effect their investment. Bob Engelbrecht was employed to do on-farm case studies to indicate management programmes and financial consequences. Several field days were held, involving a number of speakers covering various aspects of irrigation farming. Eric Weir, retired General Manager of Electricity Ashburton, was employed to visit individual farmers to ensure they had adequate information on the proposal.

Late in 2001 the Company issued a prospectus, inviting interested people to invest in what the Company were calling "Founder Shares". The offer was slightly oversubscribed and the shares were only allocated to farmers within the scheme area. The directors took a cut in their allocation to round out the amount to the neat $600,000. These shares had various rights attached to them, which made it attractive for farmers to invest in the Company. Other subscribers were unsuccessful and monies were refunded.

This sum was raised, in various amounts, from a percentage of the farmers in the proposed area. The total number of farmers in the proposed area was approximately 200, but a considerable number had not waited for the scheme and had put down private irrigation bores. Most of these were sunk to deep aquifers, which involved high capital costs and permanently high pumping expenses.

Another potential problem for private irrigators was that if too many attempted to use groundwater there would be excessive competition for the limited amount of water available. Being aware of this, some of the irrigators elected to support the feasibility study financially and therefore secure access to water from the community scheme and were prepared to write off their existing bores, if and when the community scheme arrived.

Some of the outside investors saw it as a means of assisting a worthy cause and others as a good investment. At this time the Company had a very valuable asset in the granted Water Right of 17 cumecs from the Rakaia River. Present day (2009) costs of obtaining this could be several million dollars, and even then efforts could be unsuccessful. On top of this there is the added value given to the Ashburton County. The add-on value of this water to agriculture and the community would be in the hundreds of millions of dollars. As a property right it has a high commercial value. It was and is the envy of other potential irrigation groups.

In the past individuals had donated money to the Company without any real security, so the Company issued shares to these people as "Existing Shares", (a total of 51,146). Obviously this early injection of capital was of great value to the initial efforts and made the whole exercise possible. These shareholders would eventually be issued irrigation shares at a ratio of two to one. In most companies early injection of capital would be rewarded by the issue of "options" which enabled them to buy shares in the future at a greatly discounted price. As we were a co-operative and we were interested in doing something for the district and community we did not take this course.

One organization wished to invest $15.000, but because of its constitution was issued preference shares.

This money had been used to pay for the early costs of preliminary studies, and expenses associated with obtaining the resource consent.

While there were no obvious problems in sight, the Company applied for and received a "Requiring Authority Status". This gave the company the right, as a last resort, to ask the Minister of Lands to compulsorily purchase land or gain easements through land, that may otherwise block the scheme's progress. However, the Company had a clear policy of using every other approach, e.g. negotiating and paying a premium for land because of its special value, before resorting to using the Authority.

The most critical structure was the intake and there was virtually only one possible and unique site upon which to build it. Fortunately the owner of the land required for the scheme intake was co-operative and at the right price would have sold land and or given easements to achieve our desired outcome.

As most of the conveyancing in the main part of the scheme was via buried pipes, it would have been possible to easily compensate farmers who were adversely affected, and therefore compulsory acquisition was not likely to be used.

Full Feasibilty Study

This began in mid 2002 and was completed in mid 2003. The Company employed Les McCracken as a professional project manager. He had had extensive experience in the planning and construction phases of various mining and civil engineering projects in Australia and New Zealand. His brief was to oversee all the various aspects of the contracts, monitor progress and report to the Board.

A feasibility study involves investigations of engineering, economic, legal, financial, costings, and timelines. Contracts were given to various organizations whom had particular expertise in certain areas.

The beginning point was the pre-feasibility studies done previously by Lincoln Environmental.

A considerable number of options were considered but the recommended option was:

An Intake at Happy Valley (on the Rakaia river).

Piped to Highbank Power Station via twin pipes.

100% pumped at Highbank into the RDR via a dedicated riser.

Delivered from the RDR to the pipeline network laterals via a thick-walled mainline.

Pressures controlled in the laterals by pressure reducing valves.

All PVC being Class C rated at 90m head.

No internal pipe lining.

External pipe protected by cathodic protection and epoxy coating.

This option, in 2003 had a total capital cost of approximately $170million and an annual operating cost of approximately $10 million.

This would mean an up-front payment of about $2500 per hectare and an annual operating charge of about $ 550 /hectare / year.

"Hatfield - Lateral irrigator being reversed to do the return run"

The on-farm economic study, done by Bob Engelbrecht, indicated quite low returns on capital, supporting the argument that the greatest benefit comes from the resulting off-farm multiplier effect.

The farmers not only had to provide the equity to fund the irrigation project, but also fund the on-farm development costs, which could be as high as $1 million per farm. This would include mainline distribution systems, irrigators and ancillary items such as plant upgrade, more grain storage, re-fencing, more housing, land clearing and stock water.

The next step was to do a survey of farmer interest. This was not an absolute commitment to the scheme but was necessary to gauge the level of interest. It was the make or break time for the company. Strong support was needed to make the scheme viable.

The results were disappointing to the Board.

The area in the lower third of the scheme (ie the old Lower Rakaia area) gave only about 10% support, mainly because of the reasonable alternative of shallow ground-water and also because the farmers tended to own larger properties.

The upper two thirds supported the scheme to the extent of 25-30 %. The groundwater levels in this area are very deep, and pumping costs are very high. About 70-80% uptake was required. The lack of support was due to perceived high capital and operating costs, uncertainty of water supply and the existence of alternative private schemes.

The Company owned a very valuable asset in the 17cumec resource consent and needed to look towards other alternatives, but effectively it ended the involvement of Lower Rakaia farmers. It would not have been economic to transport water to this area with such a small level of support. However there were still two directors on the Board from this area and a number of farmers still had shares in the Company.

Meanwhile there was still groundwater development going on in the Chertsey/ Rakaia/Dorie/ Pendarves/Seafield area where this story began. Every year there are more wells being drilled and irrigation development occurring. The systems are getting more efficient and automated and are very different from the hand shift pipes and 150mm wells in use in the 1960s/1970s.

CURRENT SITUATION (2009)

Approximately 500 irrigation bores have been sunk in the Pendarves corner of the County since 1968.

The average flow rate is about 45 litres per second for these wells. If they were to all operate simultaneously, which is very unlikely, this would be a flow rate of 18,000litres per second (ie 18cumecs).

Because of rain events and periods when irrigation is not required eg when crops are ripe or early or late in the season when evapo/transpiration rates are low this amount is seldom reached. In a dry year it is likely the total amount used would be about 66% and in a wet year about 33% of the pumping capacity in an irrigation season of eight months. This would be equal to an average continuous flow of about three cumecs in a wet irrigation season and about six cumecs in a dry irrigation season. People are often surprised at the small amount of water actually used. The tendency is to look at the total allocated amount.

There is an economic cost in pumping excess amounts of water and farmers are not wasteful with their water. The power requirement would be about 70 GWhs.

"Motorised end assembly for lateral - Wards - South Canterbury"

Most of this 60,000 hectare area has had water take consents allocated and most of the area is being irrigated successfully.

It is interesting to note that while the water race system was massively important in the period from 1882 until about the late 1900s, it has now become partly redundant. Dairy farmers prefer clean stock water from wells. They can also be an obstruction when operating modern irrigators. The farmer's chore of keeping them clean is eliminated as well. Where a group of farmers on a particular race indicate to the Council they no longer need it, the Council will close the race down.

The nature of the changes that have occurred have been dramatic. The sheep farms carrying ten ewes to the hectare are giving way to dairy farms carrying four high-producing cows to the hectare or cropping farmers growing high value specialist seed crops, root crops such as potatoes or onions cereals or vegetable seeds. The area has become recognised as world class for both dairy and arable production. Many non-dairy farmers are generating a second income by growing out of season fodder crops for wintering dairy cows or fattening store lambs. The skill level of the local farmers is very high.

The Ashburton County specialises in the production of carrot seed, bulbs, and other high value crops. Onion and potatoes are other major crops. A large industry has grown up around the growing of flower bulbs and flowers. Seed multiplication for the northern hemisphere is important. By using both the northern and southern hemisphere summers it is possible to grow two crops in a single year. Other conventional crops are also grown and there are numerous dairy farms.

The returns from dairying are equally impressive. In August 2008, Enterprise Ashburton commissioned Business Economic Research Ltd. to research the productivity of the Ashburton faming industry. It showed that Ashburton dairy farmers topped the key categories of production per head in milk volume, milksolids and milk protein and are top in production per hectare in milksolids and protein for New Zealand.

The returns from the arable industry are also impressive. The Ashburton District provides about 33% of the world's carrot seed, 80 % of the New Zealand's vegetable seed exports (worth an estimated $32 million), produces

about 60% of the country's ryegrass seed exports, and produces about 60% of New Zealand's clover seed exports. The Ashburton District supplies 50% of the world's requirements of radish seed and is a key supplier of the world's bok choy seeds. The farmers are well supported by the local seed companies.

A very large part of Ashburton District's production occurs in Pendarves and surrounding Districts.

The efficiency of the modern irrigation systems is very high. Centre pivots are highly favoured on dairy farms where regular applications of small amounts of water onto pasture is required and where low labour inputs are desirable. Cropping farms require a system which allows specific quantities of water to be applied at specific times and here the lateral irrigators are preferred.

Any temperate climate crop can be grown. Because of the current world situation of food shortages, and the severe water shortages in most countries, the future appears very bright for the local farmers.

All this has only been made possible by irrigation.

"Everything is computerised" Wards- South Canterbury

The Barrhill /Chertsey Irrigation Company is continuing to explore development opportunities. It is working with Electricity Ashburton Cooperative, Ashburton District Council, Rangitata Diversion Race Company and Environmental Canterbury. The District Leaders are aware of the value of the allocate water resource and are confident that they will be able to utilise it for the benefit of the people of the Ashburton County.

Local irrigation development was very slow in the earlier years but has accelerated rapidly in recent years. It will only be a matter of time before there will be full irrigation development in the Ashburton County. All sections of the community, as well as the farmers, will be the beneficiaries.

What are the thoughts, 70 years later, of the eight-year-old boy referred to on page one? What progress has he seen since his childhood venture down the well in a bucket?

In 1938 sheep carrying capacity was one sheep per hectare, there were no legumes being used in the pastures, and paddock sizes ranged up to 80 hectares. Small amounts of wheat were being grown as a cash crop and oats grown for chaff. Horses were still being used but Bulldog tractors were becoming popular. Labour was plentiful and cheap. Water for stock was provided by water races and if they were lucky the family had well or rain water to drink. Farm expenses were very low.

In 1973, thirty-five years later, the sheep carrying capacity was up to twelve per hectare, lucerne and other legumes were grown and paddock sizes were 10-15 hectares. Sheep farming was still the dominant industry and farm machinery was significantly better. Irrigation was being introduced and fertilizers and chemicals were being used. Family succession was still very strong.

In 2008, another thirty-five years later, sheep farming has just about disappeared being replaced by intensive dairying and cropping. Nearly the whole area is irrigated with highly efficient computerised irrigators. Growing cash crops in summer and fodder crops in winter for grazing dairy cattle or for fattening stock is common, effectively creating two incomes. Farm expenses are very high and farmers have to be very skilled. The district is world class in dairying and intensive cropping.

Many of the old family names have disappeared and the previously strong rural

community spirit is disappearing. Transport to main centres for social and sports activities is now fast and easy.

Further intensification is to be expected with such things as more research, plant and animal breeding, use of computers, GPS systems, better equipment, automation, better educated farmers and higher skilled labour. In each era the availability of water has been the limiting factor and has dictated the style of farming. Modern farming would not be possible without the certainty of water supply.

"Liquid Gold" is the lifeblood of the district.

ACKNOWLEDGEMENTS

My thanks to my two proofreaders, Judy Boyd and Dianne Engelbrecht. for the excellent job that they did and their encouragement.

Also to Michael Hanrahan for his advice and help.

This story would not be possible with out the activities of dozens of local farmers who willingly gave of their time and experience.

Also the willingness of a group of technical people who advised, and helped in many ways, often at no or little renumeration to themselves. These include David Stock (solicitor), Terry Heiler (irrigation expert), John Bright (water planner), Neil Borrie (consent expert) and Bob Engelbrecht (farm advisor), Grant McFadden (MAF) and many others.

PHOTO CREDITS

Front page	Rainer Irrigation Ltd.
Page 7	Ashburton Museum
Page 12	Christchurch Press
Page 21	Ashburton Museum
Page 23	Ashburton Museum