

## **Lake Hood - Creating Waves in the Community**

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**SYNOPSIS.** Lake Hood is the largest artificial recreational lake in New Zealand. Located in the South Island of New Zealand, 100km south of Christchurch it services the Ashburton district, which has a population of 30,000 people. The lake area is just over 70 hectares with approximately 7000 m of shoreline and was developed principally for water sport activities. It provides for an international length-rowing course (2km), as well as water skiing, sailing, dive training, swimming and sunbathing. As part of the development of the lake a new residential subdivision on its shores has been planned. This includes a staged construction of 150 sections with lake or canal frontages.

From its initial conception the social impact of the lake's construction on both the township and its surrounding population was considered. Throughout this innovative project the close liaison with the local community, through public meetings, public open days and transparent media coverage has meant that support has grown in parallel to this community spirit. The community resource has impacted, both socially and commercially, on the lives of those living in and around the district.

### **INTRODUCTION**

In 1987 Ken Kingsbury, who had seen the creation of man-made lakes in Britain, decided that such a project was feasible and desirable for the keen water sport enthusiasts in Ashburton. He called a public meeting and a sufficient number of people attended the initial meeting to encourage those present to form a working party to investigate suitable sites.

A number of sites were considered and in 1989 a site was chosen within 6 kilometres of the main road and adjacent to the banks of the Ashburton River. The initial committee was enlarged and the committee formed an Incorporated Society with the aim of negotiation and purchase of land.

In 1990 the site became available to purchase with a price tag of NZD\$120,000. The Society decided on a funding scheme of \$100 joining

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fee and a \$20 per year annual subscription. The local paper ran free advertisements and within seven weeks the society had purchased the land.

The Society, over a period of three years, obtained limited technical assistance, using local civil contractors and volunteers to prepare and apply for water resource consents. After three hearings, 29 resource consents were obtained relating to diversion and use of water to construct a dam to form a recreational lake. The majority of these consents related to the takes and discharges of water and sediments from/to Ashburton River and a number of minor streams.

A local contractor developed the idea of a staged construction sequence involving progressive impoundment with comprehensive monitoring of seepage piezometric gradient. The aim was to take flood flows from the Ashburton River and use the flood sediment to line the lake floor.

The Society had limited funds so a separate entity was created to control the development and construction of the recreational lake giving more protection to the Society and the new Trustees of the Ashburton Aquatic Park Charitable Trust (Trust)

The Trust was now responsible for management of construction and operation of the lake. The Society was responsible for fund raising to meet requests by the Trust.

### DEVELOPMENT OF LAKE CONCEPT

Tonkin & Taylor Ltd (T&T), Environmental and Engineering Consultants became involved during the last resource consent hearing and provided detailed technical support. This led on to the development of the lake layout and development of a construction sequence for the Trust.

T&T suggested an assessment of all the risks to the project. A 'risk management' workshop was held to help give clear focus and direction to the Trust. T&T then developed a staged programme to address/manage each risk, involving and reporting to the Trust with up to date cost estimates.

Each of the project risks was broken down into separate packages for the Trust to consider. Each risk and mitigation measure had to be seen as practical and affordable.

The approach became "which is the current highest risk to the Trust". T&T spent considerable time and energy breaking down the risks and the steps needed to resolve and react if needed.

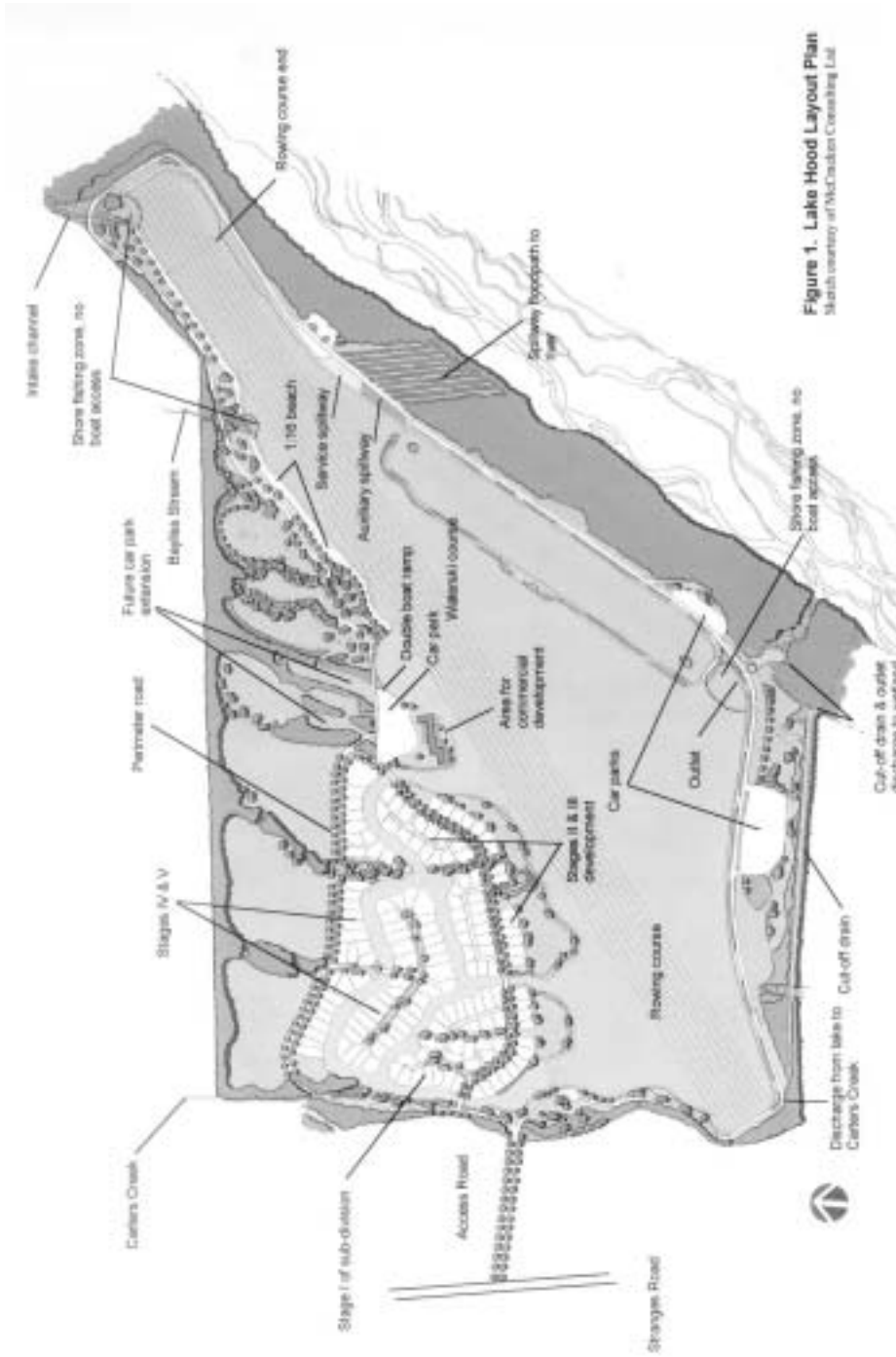


Figure 1. Lake Hood Layout Plan  
Marsh courtesy of McCracken Consulting Ltd

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The Trust kept the Society and community informed of each risk item that was being addressed. This helped when it came to the fund raising for each item. The community became increasingly committed and enthusiastic about the project as it developed to fruition.

### Field trials

One of the major risks to the project was the source and installation of an economical liner material.

The construction of the lake above the ground water table, over an existing floodplain with highly pervious cobbles, resulted in the crucial design task of preventing excessive seepage losses. Construction of an adequate lake floor liner that ensured water would be retained was critical to the success or failure of the project. The deepest section of the lake is about 6.5 metres. This was the largest risk to the project.

A modified silt liner was proposed and, with detailed computer modelling combined with field trials, was decided upon as the best way forward. A farmer from an adjoining property, who supported the project, indicated that silt on his property could be used. The silt was from 1m bgl (below ground level) to 2.5 m bgl.

A MODFLOW model was developed for the 2.5 ha trial pond with in excess of 20 peizometres installed.

The 2.5ha trial pond was constructed to determine the depth of silt to be placed over the existing soils to meet several important conditions:

- a) Reduce seepage to hold the lake above natural ground water level
- b) To ensure lake seepage was less than 500l/s as required by the resource consent
- c) To ensure that groundwater rise at the downstream boundary was less than 150mm.

Silt was spread over the ground to predetermined depths and cultivated into the existing soils to a depth of 300mm, using typical farming equipment.

The new soil mix was then compacted to form the lake floor liner. The trial showed that an average of 150 to 200 mm of silt was necessary to provide a suitable liner material. It was difficult to confirm the risk and options available should the liner not meet the Resource Consent conditions.

A local source of natural bentonite clay was found (250 km round trip). T&T investigated the material and decided that it was suitable if it could be made into slurry and dispersed. Local transport firms were informed and

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several came forward and transported, at no cost, several loads to the site for a trial.

A team of 20 local Society members came to help break up the clumps of natural bentonite before it was put into a grout pump and pumped to the trial lake floor. After half a day it was found that this was not going to be practical on a large scale. The material was too “plastic”.

Bentonite was placed at 10m centres around the lake edge, chopped up as much as possible by the Society members using shovels and spades, and then thrown into the trial pond using an excavator. To disburse the bentonite the Society members used two jet boats and one outboard powered boat for a period of five hours.

The piezometre readings over the next couple of weeks showed quite a step in reduced permeability of the liner as the bentonite moved to areas of high seepage. The trial pond was drained and on visual inspection a thin film of bentonite was found on most of the trial pond floor. The MODFLOW model was now calibrated ready for the main lake. Seepage was estimated at 200 to 250 l/s, half of the consent requirements.

### Construction

Major fund raising began in 1999 and lake construction was tendered and prices confirmed. Major grants were sought to raise the required NZD \$3.95 M including 10% contingency and comprised the following:

i)	New Zealand lotteries board	\$1,200,000
ii)	Community Trust	\$750,000
iii)	Ashburton District Council	\$650,000
iv)	Loan from Ashburton District Council	\$1,000,000
v)	Ashburton Trust	\$200,000
vi)	Public donations	\$150,000

Construction started December 2000. Public viewing platforms were built with controlled access to areas for the public to view construction progress.

Public open days were held every three months on site with buses taking the public around the site explaining where the status of construction was at and what was to happen next. This Public Relations exercise was considered necessary as the Trust depended on local support.

During construction another trial lake was developed (15ha. Sited as part of the final lake) and it was used to check that the assumptions made in the trial pond and MODFLOW model were correct.

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The other purposes of the trial lake were

- a) To determine the response of the water table to a known recharge
- b) To locate areas of floor liner with high leakage by identifying local groundwater increases
- c) To establish the need for a groundwater cut-off drain along the southern boundary (mitigation measure to stop ground water rise being greater than 150 mm)

The test was to give certainty and assurance to the Trust in several areas.

- a) That the liner was working
- b) Would the contingency allowed for bentonite be required? If not, the budget surplus would be used to redesign the lake to eight rowing lanes not six
- c) Could all the resource consents be met, in particular, the groundwater rise at the boundary?

The MODFLOW model predicted the groundwater rise at the boundary, would be in excess of the Resource Consent requirement, however the consent conditions could be met with the installation of the cut-off drain.

	Field Results	MODFLOW Model Results
Predicted Seepage	77 to 140 l/s	93 to 151 l/s

Several meetings were held with the Trust to explain the 15 ha trial lake results and make recommendations from these results. The Trust decided to install the cut-off drain and go back to the public to raise money for the additional rowing lanes.

The lake was completed on 15<sup>th</sup> December 2001 and during Christmas and New Year 2001 the mean annual flood in the Ashburton River occurred. The lake was quickly filled by the floodwater. It transpired that this was the best thing that could happen for the lake, for a week floodwaters were taken, which successfully helped seal the lake floor with natural flood sediments.



Intake during normal flow



Intake during flood flow Jan 02

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The lake was monitored for nearly a month and showed the average seepage to ground was between 101 l/s and 115 l/s with 97.5 % confidence.

The cut off drain was installed along the southern property boundary between 28/1/02 and 8/2/02. Ground water level readings dropped and became stable and the resource consent conditions were met.

The lake was officially opened on 28 April 2002. The high level of attendance reflected the support from the community.



Lake Hood – Typical weekend

### CURRENT USE OF THE LAKE

#### Service clubs

As with any rural district and community, Ashburton has a multitude of active service clubs. These clubs have become increasingly supportive in several areas that in time will see an increase in the use of the lake and any ongoing fund raising. These clubs have attended to landscape plantings on the site and developed walking paths and mountain bike tracks. Ashburton Jaycees, who have run a triathlon for the last 17 years, had a new venue for the event almost purpose built.

#### Ashburton College

Ashburton High School has a role of 1150 pupils and accommodates year 9 through to year 13 students. Currently the school is encouraging students to join the Rowing Club and gives students leave to attend training and events.

## LONG-TERM BENEFITS AND PERFORMANCE OF DAMS

In time, Ashburton College would like to have training courses in place for yachting and canoeing. Unfortunately New Zealand Government legislation under the Health and Safety Act, combined with the personal responsibility that teachers/instructors now take for school field trips, has had a negative impact on outdoor school activities. The New Zealand legislation has made it so much of a burden on schools that on many occasions schools do not contemplate activities off the school grounds.

Ashburton College's Principal has already seen the 35 students involved in rowing become more focused and willing to accept challenges. The school is looking at ways of managing the risk of programmes involving outdoor water events. Once this is remedied Lake Hood will become a great resource to Ashburton College.

### Lake community

At the end of November 2003, two families live permanently at the lake sub-division with a further four houses currently being built. A total of 31 sections out of 35 Stage 1 sections have been sold. Stage 2 of the sub-division is currently being designed for construction in 2004.



New residential houses under construction

The completion of the first houses has resulted in a dramatic increase in the sale of remaining sections. Now that families are residing at Lake Hood there is already the feel of a community. In time these local residents will enjoy a rural lifestyle with a water front aspect.

### Sports clubs

With Ashburton previously being approximately 1½ hours away from facilities suitable for water sports activity (other than jet boating), Lake Hood provides an ideal venue at their back doorstep. Consequently the level of activity in leisure water sports in the Ashburton area has risen.



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Listed below are some of the new clubs recently established in the Ashburton area:

Rowing	75 members
Sailing	32 boats
Water skiing Club	28 members

Sports clubs an hour away in Christchurch travel to Ashburton for training and 'day out' events.

The Lake's effect on sports clubs has already shown signs of being of significant benefit to those other than water sports. There has been an increase in general support for other clubs e.g. cricket, tennis etc. It was found that parents of children playing cricket or tennis on a Saturday now became more involved in the sport. Where previously parents would drop the children off, go home and pack up the boat to go away 'up country' for water-skiing etc., this was now not necessary.

The resulting effect on these clubs is viewed by locals as having a very positive influence on community spirit and on the sporting clubs themselves.



Ashburton sailing - Club day

### Ecology

The new lake has had an impact on the local ecology. Transforming what was grass farmland into a lake and wetland hinterland. Already there are signs of wildlife taking up residence. Trout have been released for recreational fishing. Careful plantings of native and appropriately introduced species have initially had positive results both aesthetically and practically on the lake environ.

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### Commercial

Local businesses have invested in the lake during feasibility investigations, construction and by way of sponsorship of clubs and events on the lake. They are already seeing results from their investments in terms of increased sales, new developments and new industries.

New businesses have emerged catering for water sports selling new and used powerboats, used sailing yachts, water ski equipment, canoes, kayaks and other boating accessories. Local motorcycle shops have expanded to cater for jet skis and mechanical servicing of boats.

The community is affected each time there is a significant event held on the lake. Events such as the New Zealand Long Distance Canoe Meet or the New Zealand Powerboat Racing National Championships impact right throughout the community. Such businesses as petrol stations, hotels, motels, company groups, restaurants, and supermarkets are all positively affected.



New Zealand Power Boat National Championships April 2003

The hotels have noticed increased use of their facilities, conference rooms for meetings and after match functions. The closest Tavern to the lake is doing major redevelopment, increasing meeting room and restaurant capacity and installing a drive through bottle store.

The local hotels are part of a District Licensing Trust. The trust is proactive at giving support at sponsoring events or with capital support for equipment for water sport clubs. They have become the 'anchor' sponsor for the annual 'Aquafest.'

### Local attraction

A passive use of Lake Hood has been use of the lake as a local point of interest. Local residents and tourists use the lake as a quiet place for picnicking, walking and as spectators of water activities. As facilities grow this type of use will only increase.

### *Lessons learnt when dealing with the community*

- A community-based project invariably starts with a few keen individuals who volunteer their time.
- Keep the community involved and informed from inception to completion
- Keep development transparent – so that everyone knows what is happening
- Ask for help
- Where possible use local suppliers and businesses.

### CONCLUSIONS

Ashburton is fortunate to have long twilights in the summer and a warm climate. With the lake so close to the township locals comment it is noticeable over just one summer the changes in family use of the lake. Whether involved in water sports or not, families appear at the lake edge to have a barbecue in the evenings. On the weekends the lake abounds with water craft of all shapes and sizes and the continuing development of the lakeside subdivision is offering a choice of lifestyle opportunities.

Over time and generations the culture of the community will adapt and embrace the lake as part of its fabric.

The lake has had a ripple effect throughout all aspects of the community. The dreams of a small but determined group of people have been realised to benefit the individuals and community as a whole, not just now but in the years to come.

### ACKNOWLEDGEMENTS

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