CANTERBURY REGIONAL COUNCIL

ASSET MANAGEMENT PLANS – Part I

SOUTHERN COMPREHENSIVE SCHEMES

Rangitata
Orari-Waihi-Temuka
Opihi
Pareora
Lower Waihao
Lower Waitaki

Oct 2014
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RANGITATA RIVER

Summary

Objective
To maintain the Rangitata River system to minimise erosion and flooding on the south side of the river, and to prevent flood flows entering the South Branch at flows less than 1500 cumecs

Term
In perpetuity.

Maintenance
5 year average 2009-14: $204,400

Reporting
Annually
- Prepare annual maintenance plan and budget.
- Discuss and agree with rating district (report in Annual or Long Term Plan)
- Report on works undertaken and costs to liaison committee and Council.

Three Yearly - Revalue infrastructural assets

Six Yearly
- Assess from aerial photos fairway, berm and fairway edge condition - report to Council.
- Review asset management plan, to be agreed with liaison committee and adopted by Council.

Flood Performance
- Report to Liaison Committee and Council on performance of scheme in all floods exceeding 2500 cubic metres/second.

Funding
Maintenance funded by: Targeted rate, Works & Services rate, General rate, in the ratios set in the Council's Annual or Long Term Plan and Part A, Appendix C

Damage repairs funded by: Rates (as above) Financial Reserves Reprioritising works Loan

Financial Reserves
Aim to:
- Maintain at approximately 100% of average annual maintenance level
- Build up reserves to meet above average planned expenditure
- Draw down reserves to meet unexpected expenditure
- Use to smooth rating variations

Review of Plan
Review when there is a change in maintenance standards, a change in funding policy, or at 6 yearly intervals.
Section 1: Description

1.1 Purpose Of Asset Management Plan

Asset Management Plans define the objectives and performance standards of the river control and drainage schemes for which the Council has the maintenance responsibility and provide the basis upon which the effectiveness of their maintenance can be measured.

This plan:

- Defines the service level for the Rangitata River Special Rating District.
- Defines the level of maintenance needed to retain the operating and service capacity of the river control and drainage assets managed by the Council.
- Provides a base against which the Council’s performance in maintaining the service capacity of the infrastructural assets can be measured.

1.2 Background

The Rangitata River rises on the main divide in the Southern Alps. Its catchment area at Klondyke is 1495 km². The mean annual flood is 1350 cumecs. The characteristics of the Rangitata are similar to the other Canterbury rivers with alpine catchments, in that its floods are generated by nor’west storms and flow through gorges onto a plain formed almost entirely of alluvium deposited by the river. The largest difference is the bed gradient of the Rangitata below Arundel of 6.2m/km compared with the Rakaia 4.4m/km and Waimakariri 4.2m/km downstream of their gorges. This gradient represents a much greater energy level or erosive power.

Between Arundel and State Highway 1, the river bifurcates into two main channels known as the North Branch and the South Branch. Just below the State Highway, the South Branch further splits into the Middle Channel. The land lying between the North and South branches is known as Rangitata Island. In the current regime, all but major flood flows are confined to the North Branch but reports from the 1920's note that the distribution of flows between the North and South branches varied from year to year but that the size of the South Branch appeared to have increased over the period 1870 to 1920. The divergence of the North and South branches is about 5km upstream of State Highway 1, but water can overflow from the main channel right bank upstream of this point almost as far upstream as the Arundel bridge and find its way to the South Branch.

Prior to the 1920’s, property owners undertook river works on an ad hoc basis. The risk of a major break to the south must have been apparent to the Railways Dept very early, because in 1877 they are reported as “spending the then huge sum of 10,000 pounds on very heavy protection works to prevent the river from returning to old flood channels that lead well to the south of the Rangitata railway station and finish up in the Orari Lagoon and requiring another bridge.” Following the River Commission hearings in 1919, the Geraldine Rivers Board was established with works being undertaken on both the north and south branches of the Rangitata River. With the passing of the Soil Conservation and Rivers Control Act 1941, the South Canterbury Catchment Board was established in 1944, replacing the Geraldine Rivers Board.
A large flood in December 1957 (3460 cumecs) caused extensive flooding and damage and resulted in the Board implementing measures to limit the frequency of flood flows in the South Branch. Total diversion of flows to the North Branch was not undertaken because of the concern that such action might increase the incidence of bank erosion in that branch. This approach of routing all but major flood flows to the North Branch has removed the need to erect bank protection works in the Middle and South branches of the river and released land in these areas for production.

From 1982-1988, heavy bank protection using rock and extensive channel manipulation by dozing was substantially affecting expenditure levels both in terms of establishment costs and in subsequent maintenance.

In 1988, a review of the standards of maintenance highlighted the difficulty in justifying the level of expenditure relative to the rating base and value of land being protected. The review noted “The introduction of rock training works following the 1982 review have substantially affected expenditure levels both in terms of establishment costs and in subsequent maintenance and in most instances do not yield an adequate return on invested capital. The emphasis placed on in stream channel modification, while expensive, has had no lasting effect and should be discontinued as a general rule; exceptions being :
(a) minor diversions to establish or effect repairs on scheme assets
(b) manipulation of river patterns adjacent to and upstream the south channel entry point. “

The cost of maintaining the Rangitata scheme at that time was estimated as $118,500 (approx $225,000 in 2014 terms) while it was concluded that the assets being protected could only justify an annual expenditure of $70,000 (approx $132,000 in 2014 terms) to give a 10% internal rate of return.

Prior to 1987, works had been funded from separate rates collected from the benefiting ratepayers and from Central Government funds allocated from the Water & Soil vote. The Government contribution ranged from 65% to 75%. In its 1987 budget, the Government advised an end to all funding towards catchment works and this withdrawal of funding was completed by 1990.

The South Canterbury Catchment Board was abolished in 1989 as a part of the national reform of local government and its functions and powers assumed by the Canterbury Regional Council.

With the withdrawal of all Central Government funding, the ratepayers in the Rangitata scheme are faced an almost impossible task in affording the cost of maintaining the river protection system. The years 1986 to 1993 brought no significant floods. Then in January 1994 was a flood of 2950 cumecs, in November 1994, 1200 cumecs and in Dec 1995, 2200 cumecs. The expenditure needed to repair the damage from these floods forced the account into deficit even after a doubling of the rates.

It is recognised that the property owners occupying the land adjacent to the Rangitata River cannot afford the level of expenditure needed to provide a high level of protection to their properties. In the report of the Rivers Commission in 1920, it was stated ‘The flooding of the adjacent lands is caused by the fact that along some stretches the natural banks were lower than the grade of a high flood and furthermore that the river is running on a fan and once the floodwaters get over the immediate bank, they tend to follow old channels, which lead away from the main channel’ and “Wherever active erosion is taking place, it is usually impossible to stop this, except at
a cost out of all proportion to the area of land likely to be lost; but a great deal can be done by a local organisation fully alive to the problem .....” These comments are as valid today as they were in 1920.

In 2012, the rating classification was adjusted in order to collect approximately $1000 per year in additional rates from the South Rangitata Huts (Class AA) in order to allow for occasional river mouth openings (normally in advance of floods).

1.3 River Control System

The Rangitata River control works are all located on the true right or south bank of the North Branch of the river and consist of:-

**Stopbanks**

3.63 km value $ 1.04m (May 2014)

The stopbanks are intermittent low banks cutting off flood overflows onto areas of low ground with the main section of bank at the entrance of the south branch where it is designed to prevent flows down the south branch in floods less than 1500 cumecs (5 year return period).

**Erosion control works**

- Impermeable Groynes 1 value $ 0.26m
- Tree planting 34.3 km value $ 6.45m
- Lateral rock work 4100 tonne value $ 0.26m

Total $ 8.01m (May 2014)

Figure 1 Extent of Works
1.4 Rating District Classification

The targeted differential catchment works rate for the Rangitata River Rating District comprises five classes and is levied per $100,000 land value.

<table>
<thead>
<tr>
<th>Category of rateable land</th>
<th>Differential relationship between categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A</td>
<td>100</td>
</tr>
<tr>
<td>Class B</td>
<td>60</td>
</tr>
<tr>
<td>Class C</td>
<td>40</td>
</tr>
<tr>
<td>Class D</td>
<td>20</td>
</tr>
<tr>
<td>Class AA</td>
<td>1190</td>
</tr>
</tbody>
</table>

Figure 2: Rating district classification map.

1.5 Assets Being Protected

The Rangitata floodplain extends from the end of Ferry Rd above Arundel, downstream through the settlements of Arundel and Rangitata following the south bank of Kapunatiki Stream to the coast.

Community infrastructure such as roads, railways, pipelines, water supply intakes, power and telephone lines all derive benefit from the river control system. Opportunities for recreational access and wildlife habitat are created as a consequence of works (ie. tracks and picnic areas, clear riverbeds for ground nesting birds).
The value of land on the floodplain is approximately $203m (June 2014).
1.6 **Maintenance Expenditure**

Part A, Appendix B shows expenditure for the years 2009-14. The average expenditure in this period on maintenance has been $204,400 per year.

An annual programme of maintenance will be prepared each year. This programme will be discussed with a liaison committee of ratepayer representatives, prior to adoption by the Council for inclusion in the Annual or Long Term Plan.

In preparing the annual maintenance programme consideration will be given to:

- Works identified as necessary.
- Works that can be anticipated given a 'normal' season.
- Flexibility to meet unbudgeted damages.
- Affordability.
- Environmental effects.

1.7 **Existing Standards**

The standard of Rangitata River works have been reduced since 1988, when a review of the costs of maintaining the heavy rock structures and the level of river channel dozing work was determined to be uneconomic. Recovery from the damage sustained in December 1995 was spread over a number of years.

Works are undertaken to: control vegetation; control shingle movement that would otherwise reduce the capacity of the river channel, and; divert active channels of the river away from new planting works or eroding sections of river bank. These works involve spraying, dozing and cutting exotic vegetation in the fairway. Tree and brush growth in the river bed is not a significant problem in the Rangitata because the steep gradient and large gravel size largely prevents trees establishing in the bed.

Channel dozing to manage the alignment of river braids at, and upstream of, the bifurcation point between the North and South Branch is undertaken to:

- limit the pressure on the banks at this site and
- prevent flows below 1500 cumecs entering the South Branch.

The berm planting component of this scheme is still being constructed.

Best practice for managing infrastructure assets (as required by the 2002 Local Government Act) is being applied and this is starting to identify issues that the district will need to address.

In the times that schemes such as this were set up, landowners willingly agreed to give up the use of a portion of their land for the collective and individual benefit that they would receive from the proposed works. This land is often not viewed in the same way by current owners as it was when the scheme was set up and the effectiveness of the scheme is being threatened. The most significant need is to develop a plan that defines the berm planting zone that is needed to meet the performance requirements of this scheme and put measures in place to ensure that the rating district receives the level of protection it requires.

The Flood Protection and Drainage Bylaw 2013 (under the Local Government Act 2002) was introduced to manage, regulate and protect flood protection and flood
control works belonging to or under the control of the Canterbury Regional Council from damage or misuse. The Bylaw controls activities that may affect the integrity or effective operation and maintenance of the flood protection and flood control works. A permit is required for certain activities that can affect the works, including:

- Altering or obstructing drains and floodways, and access to them
- Activities that interfere with or damage drains, erosion protection plantings, stopbanks, hydrological recording equipment or survey benchmarks etc

(Resource consent or further authorisation may also be required from the Canterbury Regional Council, relevant territorial authority or the Department of Conservation to carry out these activities).

Environment Canterbury also has powers relating to the maintenance of the scheme (land entry, disposal of drain cleanings etc) under the Soil Conservation and Rivers Control Act.

Environment Canterbury has the policy of recovering damage repair costs on behalf of the rating district from landowners where that damage is caused by the landowner's action or inaction. Prosecutions can be made under the Soil Conservation and Rivers Control Act or the Local Government Act.
Section 2: Service Levels

2.1 Objectives

To prevent erosion and limit surface flooding of productive farmland within the rating district.

To control bank erosion by reducing the area of direct attack and working towards a continuous band of live protection.

To prevent low to moderate flows entering the South and Middle branches by the installation and maintenance of low shingle banks, which major floods would overtop.

2.2 Historic Flood Sizes

The following floods have been recorded or estimated in recent years:-
Rangitata at Klondyke
27/12/57  2380 cumecs
2/12/79  2300 cumecs
9/1/94  2950 cumecs
13/12/95  2200 cumecs
28/12/10  2150 cumecs
2/1/13  2020 cumecs

2.3 Damage Exposure

River control works are constructed in a very high-energy environment with the purpose of resisting and absorbing some of that energy. No matter what the standard of maintenance damage to such systems is inevitable.

An assessment of maximum damage potential in a single flood event is $2.73m or about 35% of the value of the scheme assets (May 2014, refer to Part A, Section 5.2 and Appendix D).

2.4 Reporting On Performance Levels

The monitoring and reporting procedure outlined in Section 3 (and Part A, Section 7.4) will be used to assess the standard of maintenance carried out and the performance of the scheme.
## Section 3: Reporting

### 3.1 Annual Asset Management Plan Compliance Report For Rangitata River Rating District

The asset management plan adopted by the community and Environment Canterbury:

- Defines the service level for the Rangitata River Rating District
- Defines the level of maintenance needed to retain the service capacity of the rating district's river control assets managed by Environment Canterbury
- Provides a base against which the Council's performance in maintaining the service capacity of the rating district's river control assets can be measured
- Requires Environment Canterbury to report to the rating district's liaison committee annually.

The matters to be reported to the rating district's liaison committee annually are:

<table>
<thead>
<tr>
<th>Action required</th>
<th>Report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepare maintenance programme and budget.</td>
<td>As presented to liaison committee meeting on……………………………..</td>
</tr>
<tr>
<td></td>
<td>Copy attached to minutes of the meeting.</td>
</tr>
<tr>
<td>Prepare ten-year forward projection of maintenance and funding requirements.</td>
<td>As presented to liaison committee meeting on……………………………..</td>
</tr>
<tr>
<td></td>
<td>Copy attached to minutes of the meeting.</td>
</tr>
<tr>
<td>Report on works undertaken and costs.</td>
<td>As presented to liaison committee meeting on……………………………..</td>
</tr>
<tr>
<td></td>
<td>Copy attached to minutes of the meeting.</td>
</tr>
<tr>
<td>Inspect all stopbanks for erosion, damage, or active berm erosion. Report on inspection noting all cases of erosion of stopbank or berm erosion within 10m of stopbank and on the programme for dealing with these problems.</td>
<td>No erosion of stopbank or berm erosion within 10m of stopbank observed, or</td>
</tr>
<tr>
<td></td>
<td>……………………………………………………………………………………</td>
</tr>
<tr>
<td>Report on condition of system to liaison committee. Report to specifically identify any deferred maintenance that will impact on the performance of the scheme.</td>
<td>The protection system is in ………………. condition, (however future issues will be …………..) No maintenance which will impact on the performance of the scheme has been deferred, or</td>
</tr>
<tr>
<td></td>
<td>Deferred maintenance comprises ………….. And the effect on the performance of the scheme is likely to be ………………..</td>
</tr>
<tr>
<td>Report to liaison committee on the performance of the river control system for floods exceeding 2500 cumecs.</td>
<td>No floods exceeding 2500 cumecs have occurred over the last 12 months, or:</td>
</tr>
<tr>
<td></td>
<td>As presented to liaison committee meeting on……………………………..</td>
</tr>
<tr>
<td></td>
<td>Copy attached to minutes of the meeting.</td>
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</tbody>
</table>

Prepared by …………………………….(Area Engineer) ………………….. Date
3.2 Six Yearly Asset Management Plan Compliance Report For Rangitata River Rating District

The asset management plan adopted by the community and Environment Canterbury:
- Defines the service level for the Rangitata River Rating District
- Defines the level of maintenance needed to retain the service capacity of the rating district's river control assets managed by Environment Canterbury
- Provides a base against which the Council's performance in maintaining the service capacity of the rating district's river control assets can be measured
- Requires Environment Canterbury to report to the rating district's liaison committee six yearly.

The matters to be reported to the rating district's liaison committee at six yearly intervals are:

<table>
<thead>
<tr>
<th>Action required</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Review asset management plan.</td>
<td>As presented to liaison committee meeting on……………………………… Copy attached to minutes of the meeting.</td>
</tr>
<tr>
<td>No cross sections where the width of protection planting has reduced by greater than 20% of previous survey unless programmed.</td>
<td>The width of protection planting has not reduced by greater than 20% of previous survey, or …………………………………………………………………………………</td>
</tr>
<tr>
<td>No cross sections where more than 30% of the fairway is obstructed by vegetation greater than 1m in height.</td>
<td>No more than 30% of the fairway is obstructed by vegetation greater than 1m in height, or …………………………………………………………………………………</td>
</tr>
<tr>
<td>No reduction in quantities of infrastructural assets unless a reduction was identified as intended in the asset management plan.</td>
<td>There has been no reduction in the quantities of infrastructural assets, or Reasons for and the reductions in quantities of infrastructural assets are as presented to liaison committee meeting on………………… Copy attached to minutes of the meeting.</td>
</tr>
</tbody>
</table>

Prepared by ...........................................(Area Engineer)  ....................... Date
ORARI - WAIHI – TEMUKA RIVERS

Summary

Orari Waihi Temuka Rivers Rating District Asset Management Plan

Objectives

The objectives of the Orari Waihi Temuka Rivers Rating District are:-
- to provide a flood channel, stabilised with poplar and willow planting, capable of carrying (with berm flows):-
  Waihi 150 cumecs
  Orari 1200 cumecs (design capacity varies down the river)
  Temuka 700 cumecs
- to stabilise shingle areas and to provide a source of supply for future planting in the catchment and river by the planting of berms with poplars and willows.

Term

In perpetuity

Maintenance

5 year average 2009-14: $584,200

Reporting

- Prepare annual maintenance plan and budget.
- Discuss and agree with rating district (report in Annual or Long Term Plan)
- Report on works undertaken and costs to liaison committee and Council.

Three Yearly - Revalue infrastructural assets

Six Yearly
- Assess from aerial photos fairway, berm and fairway edge condition - report to Council.

Flood Performance
- Report to Liaison Committee on performance of scheme for all floods exceeding:
  Waihi River 120 cumecs
  Orari River 900 cumecs
  Temuka River 550 cumecs

Funding

Maintenance funded by:
- Targeted rate,
- Works & Services rate,
- General rate, in the ratios set in the Council's Annual or Long Term Plan and Part A, Appendix C.

Damage repairs funded by:
- Rates (as above)
- Financial Reserves
- Reprioritising works
- Loan

Financial Reserves

Aim to:
- Maintain at approximately 50% of average annual maintenance level
- Build up reserves to meet above average planned expenditure
- Draw down reserves to meet unexpected expenditure
- Use to smooth rating variations

Review of Plan

Review when there is a change in maintenance standards, a change
Section 1: Description

1.1 Purpose Of Asset Management Plan

Asset Management Plans define the objectives and performance standards of the river control and drainage schemes for which this Council has the maintenance responsibility and provide the basis upon which the effectiveness of their maintenance can be measured.

This plan:
- Defines the service levels for the Orari Waihi Temuka Rating District.
- Defines the level of maintenance needed to retain the operating and service capacity of the catchment control assets managed by the Council.
- Provides a base against which the Council’s performance in maintaining the service capacity of the infrastructural assets can be measured.

1.2 Background

The Orari Waihi and Temuka Rivers' floodplain extends from the Rangitata River catchment in the north to the Opihi River system in the south. The catchment downstream of the Gorge is approximately 700 sq.km. and above the gorge approximately 520 sq.km, consisting of the tributary catchments the Mowbray, Phantom and Hewson.

Maps made when the Canterbury Development Company first explored the country (Torlesse 1849) show that the Orari flowed through a depression which can still be traced near the Geraldine Racecourse (Dobbies Creek) to the Waihi Temuka Opihi system and had no defined channel where it flows now. Seven years later, when the area was again mapped for settlement, the Orari River was following its present course. Sometime in that seven year period, the river had taken up its present course directly to the sea, leaving the Waihi-Te Moana-Temuka system as tributaries of the Opihi. However, at times of high flood, the Orari frequently overflowed to the south and a sizeable portion of the total flow followed the historic course into the Opihi-Waihi-Temuka Rivers, leaving a trail of damage in its wake.

In 1871, the river overflowed and flooded all the land lying to the south of its present course between the railway and the sea. During the following years, the South Orari River District was constituted and remedial works were carried out.

In 1902, the Orari overflowed near the bridge approaching Geraldine and from there into the Waihi, flooding the intervening country and Temuka. This area was constituted into the Upper Orari River District in 1903 and protective works were constructed.

In 1919, the Governor General established the Rivers Commission to report on a number of river districts and river problems and to recommend future management and legislation requirements. The Commission reported that the works that had been constructed by the River Districts had not been maintained and that the river beds were heavily congested with vegetation, particularly willows, gorse and other exotic
species. The report described the condition of the river bed as “shocking.” It described willow layering work done in such a way that that branches were allowed to float down the river and take root wherever they might and a grazed riverbed with fence posts cut from willow branches that had been allowed to grow. The Commissioners could not find records from either the River Boards or the Geraldine County that would enable them to assess the size of the largest floods that had been experienced.

The Commissioners recommended the clearing out of a uniform channel from the upper bridge near Geraldine, the construction of stopbanks and the formation of a drainage district to ensure drain maintenance in the Clandeboye area. No new legislation was recommended, but the entire river below the Geraldine Bridge and the Clandeboye drainage area should be under the control of the Geraldine County Council, which, for the purpose of this control, should have the powers of a River Board and Drainage Board. Unfortunately, the remedial measures recommended were delayed for some years and then, due to increased costs and very restricted finances, the River Board carried out only a small portion of the recommended capital work.

The functions and powers of this Rivers Board were transferred to the newly formed South Canterbury Catchment Board following the passing of the Soil Conservation and Rivers Control Act 1941 which for the first time gave one authority comprehensive control over the whole river and its catchment. In 1950, the new Board adopted a programme of works to upgrade the Orari, Waihi and Temuka Rivers and to construct soil conservation works in the upper catchment to reduce the inflow of shingle to the river system. The proposal included a new diversion and mouth direct to the sea, from a point near where the Ohape Creek was diverted into the Orari (Browns Ford) and an overflow weir in the left (north) stopbank upstream of the Geraldine Bridge, discharging towards Cooper’s Creek. The proposals were intended to protect the lower river channel and defences and to direct floodwaters to areas where the least damage would occur.

In 1955, a classification setting the rating proportions for the rating district was adopted and government funding of 75% was approved. The works were very similar in concept to those proposed by the Rivers Commission in 1921.

Works started in 1956, with the mammoth task of clearing unwanted vegetation from the fairway of the lower reaches of the river and, over successive years, constructing stopbanks and live training works. In latter years, the emphasis moved to the construction of shingle traps in the upper catchment. These construction works continued as a series of programmes, each gaining significant Government funding, (up to 75% for river works and 86% for upper catchment works) until the 1987 budget announced the removal of all Government funding towards water and soil works other than those already contractually committed. This meant that the final central government funds towards works in the Orari catchment were received in 1991.

The South Canterbury Catchment Board was abolished in 1989 as a part of the national reform of local government and its functions and powers assumed by the newly formed Canterbury Regional Council. After central Government funding ceased, further upper catchment works were not carried out and the priority was maintenance of the scheme assets in the lower catchment and keeping the river fairway clear of vegetation that would otherwise impede river flows.

A separate rating district was set up for some localised stopbanking and rock protection works at Blandswood. The scheme members resolved not to continue.
funding the maintenance of this separate scheme, although the rating scheme remains, in effect, mothballed. The assets of this scheme and their maintenance are not included in the sections below.

The most successful elements of the Orari-Waihi-Temuka scheme, in terms of effective protection at an affordable cost, are the river works in the lower catchment, the stopbanks, live planting on the berms, live tree erosion control at sites of active erosion and channel improvement.

1.3 Catchment control scheme

The Orari-Waihi-Temuka Rivers Control Scheme consists of :-

**Stopbanks**

<table>
<thead>
<tr>
<th>Section</th>
<th>Flow (m³.s⁻¹)</th>
<th>Freeboard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouth to Ohapi Creek Diversion (0-1.4 km)</td>
<td>1275</td>
<td>600 mm</td>
</tr>
<tr>
<td>Ohapi Creek to Coopers Creek (1.4-6.0 km)</td>
<td>1220</td>
<td>600 mm</td>
</tr>
<tr>
<td>Coopers Creek to SH1 Bridge (6.0-16 km)</td>
<td>1050 (true right), 1050 (true left)</td>
<td>600 mm, 300 mm</td>
</tr>
<tr>
<td>SH1 Bridge to Station Stream (16-26.5 km)</td>
<td>1050 (true right), 1050 (true left)</td>
<td>750 mm, 300 mm</td>
</tr>
<tr>
<td>Station Stream to Spillway (26.5-28.6 km)</td>
<td>1020 (true right), 1020 (true left)</td>
<td>750 mm, 300 mm</td>
</tr>
<tr>
<td>Spillway (28.6-29.9 km)</td>
<td>1020 (true right), 850 (true left)</td>
<td>750 mm, 300 mm</td>
</tr>
<tr>
<td>Upstream of spillway to the gorge (29.9 km-end)</td>
<td>1275 (true right)</td>
<td>750 mm</td>
</tr>
</tbody>
</table>

The stopbanks are continuous on both sides of the Orari River from the mouth to 5 km upstream of SH1 and then largely continuous on the right bank to the gorge at the Tripp Settlement. There are short reaches where natural terraces are high enough to provide the design river capacity without constructed stopbanks with freeboard of 300 – 750mm. The stopbanks are generally 300mm higher on the south side of the river. On the left bank, stopbanks above the continuous section are intermittent between natural terraces, apart from a continuous length of approximately 9 km downstream of the gorge. A spillway on the north side is designed to divert part of the flow above 850 cumecs into Coopers Creek, which has a stopbank upstream of Clandeboye to return the flow to the river.

There are some small stopbanks on parts of Station Stream (Sweetwater Creek).

The River Control Scheme Design Discharges are:

- **Mouth to Ohapi Creek Diversion (0-1.4 km)**
  - Both banks 1275 m³.s⁻¹ with 600 mm freeboard.
- **Ohapi Creek to Coopers Creek (1.4-6.0 km)**
  - Both banks 1220 m³.s⁻¹ with 600 mm freeboard.
- **Coopers Creek to SH1 Bridge (6.0-16 km)**
  - South Bank (true right) 1050 m³.s⁻¹ with 600 mm freeboard.
  - North Bank (true left) 1050 m³.s⁻¹ with 300 mm freeboard.
- **SH1 Bridge to Station Stream (16-26.5 km)**
  - South Bank (true right) 1050 m³.s⁻¹ with 750 mm freeboard.
  - North Bank (true left) with 300 mm freeboard
- **Station Stream to Spillway (26.5-28.6 km)**
  - South Bank (true right) 1020 m³.s⁻¹ with 750 mm freeboard.
  - North Bank (true left) 1020 m³.s⁻¹ with 300 mm freeboard.
- **Spillway (28.6-29.9 km)**
  - South Bank (true right) 1020 m³.s⁻¹
  - North Bank (true left) 850 m³.s⁻¹ with no freeboard.
- **Upstream of spillway to the gorge (29.9 km-end)**
  - South Bank (true right) 1275 m³.s⁻¹ with 750 mm freeboard.
North Bank (true left) 1275 m³.s⁻¹ with 600 mm freeboard.

The Waihi River has continuous stopbanks on both sides from the confluence with the Temuka River to just below Geraldine and intermittent banks through the urban area of Geraldine. Upstream of Geraldine, the banks are intermittent between natural terraces. Design freeboard is 600mm.

The Temuka River is stopbanked on the true left bank with a continuation of the Opihi river stopbank upstream from the Temuka-Opihi confluence to high ground at the western boundary of the Temuka sewage treatment works. Design freeboard is 600mm. Upstream of SH1, there are intermittent banks between high ground up to the confluence with the Waihi and Te Moana rivers. The scheme does not provide a design flood capacity for the Te Moana River.

**Erosion control works**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Length</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree planting</td>
<td>155.6 km</td>
<td>$29.26m</td>
</tr>
<tr>
<td>Lateral rock work</td>
<td>5520 tonne</td>
<td>$0.35m</td>
</tr>
</tbody>
</table>

Tree vegetation of the bermlands strengthens their resistance to bank erosion. Also included in the tree planting value are six areas in the upper catchment retired from grazing and planted to reduce erosion, trap sediment and thereby reduce the volume of sediment deposited in the lower reaches of the rivers.

**Ancillary Works**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Length</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drains/grassed waterways</td>
<td>38.7 km</td>
<td>$0.84m</td>
</tr>
<tr>
<td>Culverts and Floodgates</td>
<td>30</td>
<td>$0.47m</td>
</tr>
</tbody>
</table>

**Total** $58.60m (May 2014)

**Drains**

The Clandeboye drainage system consists of a number of main drains between the Orari and Opihi rivers, generally running parallel to these rivers and discharging to either drains or a coastal lagoon running parallel to the coast and discharging to the Opihi or the Orari rivers.

**Tracks**

In addition to general river access tracks, the scheme maintains 1.4km of formed track from Park Road to the Orari River mouth for construction and maintenance access (last upgraded 1996). This is not a legal road.

**Channel Clearing**

Works are undertaken to control shingle movement, (which would otherwise reduce the capacity of the river channel), control vegetation and to divert active channels of the river away from new planting works or eroding sections of river bank. These works include spraying, dozing, cutting exotic vegetation in the fairway and direction and control of the commercial extraction of shingle.
1.4 Rating District Classification

The targeted differential catchment works rate for the Orari-Waihi-Temuka Rating District comprises six classes and is levied per $100,000 capital value.

<table>
<thead>
<tr>
<th>Category of rateable land</th>
<th>Differential relationship between categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A</td>
<td>30</td>
</tr>
<tr>
<td>Class B</td>
<td>21</td>
</tr>
<tr>
<td>Class C</td>
<td>14</td>
</tr>
<tr>
<td>Class D</td>
<td>7</td>
</tr>
<tr>
<td>Class E</td>
<td>3</td>
</tr>
<tr>
<td>Class F</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure 1: Rating District classification map.
1.5 **Assets Being Protected**

Community infrastructure such as roads, railways, pipelines, water supply intakes, power and telephone lines all derive benefit from the river control system. Opportunities for recreational access and wildlife habitat are created as a consequence of works (i.e. tracks and picnic areas, clear riverbeds for ground nesting birds).

The capital value of land and buildings on the floodplain is approximately $2,308m (June 2014).

1.6 **Maintenance Expenditure**

Part A, Appendix B shows expenditure for the years 2009-14. The average expenditure in this period on maintenance has been $584,200 per year.

An annual programme of maintenance will be prepared each year. This programme will be discussed with a liaison committee of ratepayer representatives, prior to adoption by the Council for inclusion in the Annual or Long Term Plan.

In preparing the annual maintenance programme consideration will be given to:

- Works identified as necessary.
- Works that can be anticipated given a 'normal' season.
- Flexibility to meet unbudgeted damages.
- Affordability.
- Environmental effects.

1.7 **Existing Standards**

Many of the upper catchment works constructed to prevent, or minimise erosion and loss of land and to reduce the supply of detritus from the upper catchment to the lower river system are reaching the end of their service life and are maintained only by controlling vegetation. They would not be reinstated following severe damage in a flood event.

The lower catchment capital works are well maintained and fairway maintenance meets scheme requirements. Over recent years, progress has been made on removing fencing and overhanging trees from the stopbanks and removing trees that have been encroaching into the river bed. Strengthening of berm plantings is continuing.

Bed level surveys are carried out to monitor the effects of gravel extraction. Continued monitoring will enable this to be controlled so that scheme performance is enhanced without weakening the protection system.

Landowners have an individual responsibility for care of the protection system. It is important that landowners help to ensure the performance of the stopbanks by:

- Providing access to the works,
- Controlling stock so that they do not damage the grass cover or the banks themselves. This is achieved by fencing stopbanks out from adjacent paddocks and controlling grazing and stock movement,
- Controlling stock to ensure that berm plantings are not damaged,
• Controlling vehicle and machinery movements so they don't damage stopbanks.

The Flood Protection and Drainage Bylaw 2013 (under the Local Government Act 2002) was introduced to manage, regulate and protect flood protection and flood control works belonging to or under the control of the Canterbury Regional Council from damage or misuse. The Bylaw controls activities that may affect the integrity or effective operation and maintenance of the flood protection and flood control works. A permit is required for certain activities that can affect the works, including:
  • Altering or obstructing drains and floodways, and access to them
  • Activities that interfere with or damage drains, erosion protection plantings, stopbanks, hydrological recording equipment or survey benchmarks etc
(Resource consent or further authorisation may also be required from the Canterbury Regional Council, relevant territorial authority or the Department of Conservation to carry out these activities).

Environment Canterbury also has powers relating to the maintenance of the scheme (land entry, disposal of drain cleanings etc) under the Soil Conservation and Rivers Control Act.

Environment Canterbury has the policy of recovering damage repair costs on behalf of the rating district from landowners where that damage is caused by the landowner's action or inaction. Prosecutions can be made under the Soil Conservation and Rivers Control Act or the Local Government Act.

Future changes in land use may create the desire to investigate options for improving the standard of protection offered by this scheme.
Section 2: Service Levels

2.1 Objectives

The objectives of the Orari-Waihi-Temuka Rivers Rating District are:-

- To provide a flood channel, stabilised with poplar and willow planting, capable of carrying (with berm flows):-
  Waihi  150 cumecs
  Orari  1200 cumecs
  Temuka  700 cumecs

- To stabilise shingle areas and to provide a source of supply for future planting in the catchment and river by the planting of berms with poplars and willows.

2.2 Historic Flood Sizes

The following floods have been recorded or estimated in recent years:-

Orari River at Silverton
Floods in 1852, 1868, 1871, 1902, 1945, have been estimated to be in the range 900 - 1250 cumecs. The accuracy of these values cannot be judged.

<table>
<thead>
<tr>
<th>Date</th>
<th>Cumecs</th>
</tr>
</thead>
<tbody>
<tr>
<td>21/2/45</td>
<td>1000</td>
</tr>
<tr>
<td>17/4/51</td>
<td>800</td>
</tr>
<tr>
<td>13/3/86</td>
<td>800</td>
</tr>
<tr>
<td>26/5/10</td>
<td>510</td>
</tr>
</tbody>
</table>

Waihi

<table>
<thead>
<tr>
<th>Date</th>
<th>Cumecs</th>
</tr>
</thead>
<tbody>
<tr>
<td>17/4/51</td>
<td>162</td>
</tr>
<tr>
<td>April 1980</td>
<td>187</td>
</tr>
<tr>
<td>13/3/86</td>
<td>300</td>
</tr>
<tr>
<td>31/7/12</td>
<td>103</td>
</tr>
</tbody>
</table>

Temuka River

<table>
<thead>
<tr>
<th>Date</th>
<th>Cumecs</th>
</tr>
</thead>
<tbody>
<tr>
<td>21/2/45</td>
<td>850</td>
</tr>
<tr>
<td>17/4/51</td>
<td>800</td>
</tr>
<tr>
<td>13/3/86</td>
<td>1500</td>
</tr>
<tr>
<td>26/5/10</td>
<td>560</td>
</tr>
<tr>
<td>31/7/12</td>
<td>580</td>
</tr>
</tbody>
</table>

2.3 Damage Exposure

River control works are constructed in a very high-energy environment with the purpose of resisting and absorbing some of that energy. No matter what the standard of maintenance, damage to such systems is inevitable.

An assessment of maximum damage potential in a single flood event is $20.2m or about 35% of the value of the scheme assets (May 2014, refer to Part A, Section 5.2 and Appendix D).
2.4 Reporting On Performance Levels

The monitoring and reporting procedure outlined in Section 3 (and Part A, Section 7.4) will be used to assess the standard of maintenance carried out and the performance of the scheme.
Section 3: Reporting

3.1 Annual Asset Management Plan Compliance Report For OWT Rating District

The asset management plan adopted by the community and Environment Canterbury:
- Defines the service level for the OWT Rating District
- Defines the level of maintenance needed to retain the service capacity of the rating district's river control assets managed by Environment Canterbury
- Provides a base against which the Council's performance in maintaining the service capacity of the rating district's river control assets can be measured
- Requires Environment Canterbury to report to the rating district's liaison committee annually.

The matters to be reported to the rating district's liaison committee annually are:

<table>
<thead>
<tr>
<th>Action required</th>
<th>Report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepare maintenance programme and budget.</td>
<td>As presented to liaison committee meeting on…………………………….. Copy attached to minutes of the meeting.</td>
</tr>
<tr>
<td>Prepare ten-year forward projection of maintenance and funding requirements.</td>
<td>As presented to liaison committee meeting on…………………………….. Copy attached to minutes of the meeting.</td>
</tr>
<tr>
<td>Report on works undertaken and costs.</td>
<td>As presented to liaison committee meeting on…………………………….. Copy attached to minutes of the meeting.</td>
</tr>
<tr>
<td>Inspect all stopbanks for erosion, damage, or active berm erosion. Report on inspection noting all cases of erosion of stopbank or berm erosion within 10m of stopbank and on the programme for dealing with these problems.</td>
<td>No erosion of stopbank or berm erosion within 10m of stopbank observed, or ……………………………………………………………...</td>
</tr>
<tr>
<td>Report on condition of system to liaison committee. Report to specifically identify any deferred maintenance that will impact on the performance of the scheme.</td>
<td>The protection system is in ……………………. condition, (however future issues will be ………. No maintenance which will impact on the performance of the scheme has been deferred, or Deferred maintenance comprises …………. And the effect on the performance of the scheme is likely to be …………………...</td>
</tr>
<tr>
<td>Report to liaison committee on the performance of the river control system for floods exceeding: Waihi river 120 cumecs Orari river 900 cumecs Temuka river 550 cumecs</td>
<td>No floods exceeding: Waihi river 120 cumecs Orari river 900 cumecs Temuka river 550 cumecs have occurred over the last 12 months, or: As presented to liaison committee meeting on…………………………..... Copy attached to minutes of the meeting.</td>
</tr>
</tbody>
</table>

Prepared by ……………………………………………(Area Engineer) ………………….. Date
### 3.2 Six Yearly Asset Management Plan Compliance Report For OWT Rating District

The asset management plan adopted by the community and Environment Canterbury:
- Defines the service level for the OWT Rating District
- Defines the level of maintenance needed to retain the service capacity of the rating district's river control assets managed by Environment Canterbury
- Provides a base against which the Council's performance in maintaining the service capacity of the rating district's river control assets can be measured
- Requires Environment Canterbury to report to the rating district's liaison committee six yearly.

The matters to be reported to the rating district's liaison committee at six yearly intervals are:

<table>
<thead>
<tr>
<th>Action required</th>
<th>Report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Review asset management plan.</td>
<td>As presented to liaison committee meeting on………………………………………………………</td>
</tr>
<tr>
<td></td>
<td>Copy attached to minutes of the meeting.</td>
</tr>
<tr>
<td>No cross sections where the width of protection planting has reduced by greater</td>
<td>The width of protection planting has not reduced by greater than 20% of previous survey, or</td>
</tr>
<tr>
<td>than 20% of previous survey unless programmed.</td>
<td>.....................................................................................................................................</td>
</tr>
<tr>
<td></td>
<td>No cross sections where more than 30% of the fairway is obstructed by vegetation greater</td>
</tr>
<tr>
<td></td>
<td>than 1m in height.</td>
</tr>
<tr>
<td></td>
<td>No more than 30% of the fairway is obstructed by vegetation greater than 1m in height, or</td>
</tr>
<tr>
<td></td>
<td>.....................................................................................................................................</td>
</tr>
<tr>
<td>No reduction in quantities of infrastructural assets unless a reduction was</td>
<td>There has been no reduction in the quantities of infrastructural assets, or</td>
</tr>
<tr>
<td>identified as intended in the asset management plan.</td>
<td>Reasons for and the reductions in quantities of infrastructural assets are as presented to</td>
</tr>
<tr>
<td></td>
<td>liaison committee meeting on……………………………………………………………………</td>
</tr>
<tr>
<td></td>
<td>Copy attached to minutes of the meeting.</td>
</tr>
</tbody>
</table>

Prepared by ……………………………………………(Area Engineer) ………………….. Date
OPIHI CATCHMENT CONTROL SCHEME

Summary

Objective  To maintain the Opihi Catchment Control Scheme to minimise flooding, erosion and degradation/aggradation in the lower river and the contribution of upper catchment detritus to the lower river.

Term  In perpetuity.

Maintenance  5 year average 2009-14: $604,500

Reporting  Annually - Prepare annual maintenance plan and budget.
- Discuss and agree with rating district (report in Annual or Long Term Plan)
- Report on works undertaken and costs to liaison committee and Council.

Three Yearly - Revalue infrastructural assets

Six Yearly - Assess from aerial photos fairway, berm and fairway edge condition - report to Council.

Flood Performance
- Report to Liaison Committee on performance of scheme in all floods exceeding the 50-year event for any section of the river system.

Funding  Maintenance funded by:
- Separate rate
- Works & Services rate
- General rate
  in the ratios set in the Council's Annual or Long Term Plan and Part A, Appendix C

Damage repairs funded by:
- Rates (as above)
- Financial Reserves
- Reprioritising works
- Loan

Financial Reserves  Aim to:
- Maintain at approximately 50% of average annual maintenance level
- Build up reserves to meet above average planned expenditure.
- Draw down reserves to meet unexpected expenditure

Review of Plan  Review when there is a change in maintenance standards, a change in funding policy, or at 6 yearly intervals.
Section 1: Description

1.1 Purpose Of Asset Management Plan

Asset Management Plans define the objectives and performance standards of the river control and drainage schemes for which this Council has the maintenance responsibility and provide the basis upon which the effectiveness of their maintenance can be measured.

This plan:
- Defines the service levels for the Opihi Special Rating District.
- Defines the level of maintenance needed to retain the operating and service capacity of the catchment control assets managed by the Council.
- Provides a base against which the Council’s performance in maintaining the service capacity of the infrastructural assets can be measured.

1.2 Background

The Opihi River has a catchment area of 2350 km² and consists of four main sub catchments as follows

<table>
<thead>
<tr>
<th>Sub-catchment</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opihi</td>
<td>mouth to Burkes Pass</td>
</tr>
<tr>
<td>Temuka</td>
<td>including Temuka, Te Moana, Waihi, (not part of Opihi scheme)</td>
</tr>
<tr>
<td>Tengawai</td>
<td>from Pleasant Point to Mackenzie Pass</td>
</tr>
<tr>
<td>Opua</td>
<td>from Raincliff to the Two Thumb Range</td>
</tr>
</tbody>
</table>

Since European settlement in 1850, widespread flooding over the 75 km² Levels Plain (a triangular coastal plain and the wider strips of low lying valley floors adjoining the main river systems) was a detriment to efficient land use. Large floods were recorded in 1868, 1887, 1902, 1911, 1924, 1936, 1945, 1951, 1957 and 1961.

Landowners affected by the flooding formed a committee and made representations to the Minister of Works and the newly formed South Canterbury Catchment Board to:
- declare the area an emergency area,
- declare that works were necessary to give immediate protection and
- form a rating district to carry out works.

The Catchment Board prepared a stop-gap scheme to: clear and form a fairway in the Opihi River from the mouth to the SH8 Bridge (10 km above Fairlie); similar work on the Tengawai from its confluence with the Opihi to Clellands Bridge (3km below Cave); and construction of stopbanks sufficient to retain the 1951 flood (2000 cumecs) with a freeboard of 150 mm. Construction was started in 1951. By Nov 1952, when a flood occurred of similar size to April 1951, damage was limited to the river scheme works and was small by comparison with the damage that would have occurred without the works.

Because of their urgent need, the river works received priority but the Board was aware of the need for improvements in the minor rivers and streams and in the upper catchment. By 1952, the Board had prepared a 15-year programme of soil conservation works in the upper catchment in addition to maintenance and follow up work in the main river system.
Floods in 1952, 1957, 1961, 1963 and 1965 overtopped the stopbanks and caused damage totalling 83,000 pounds, compared with 200,000 pounds in the 1951 flood. It was accepted that a scheme that was overtopped six times in 15 years was not of a satisfactory standard, but without the scheme the damages over those years would have been at least 10 times as large. A scheme was approved in 1968 to:–

(a) provide a flood channel stabilised with trees capable of carrying a 50 year flood,
(b) raise and strengthen the stopbanks and construct new banks on both the Opihi and Tengawai rivers to contain a 50 year flood with a 300 mm freeboard,
(c) effect channel clearing, berm planting and destocking river margins in the upper catchment,
(d) maintain and extend gravel traps and grade control structures in the upper catchments to control gravel movement.

These works were to be spread over a 20-year period and were funded by special rates collected over a classified rating district (25%) and subsidy from central Government (75%). Construction work started in 1970 and the scheme was reviewed and extended to include more gravel control work in the upper catchments in 1968. At this time, the Government contribution to works in the upper catchment was increased to 81.25%.

A further review in 1986 proposed an extension to complete the above works and to realign sections of the fairway edge and effectively widen the fairway in the lower reaches of the Opihi River over a five-year period. The 1987 budget announced the removal of all Government funding towards water and soil works other than those already contractually committed, which meant that the final central government funds towards works in the Opihi catchment were received in 1991.

The South Canterbury Catchment Board was abolished in 1989 as part of the national reform of local government and its functions and powers assumed by the Canterbury Regional Council. The construction and maintenance of upper catchment works was discontinued.

The most successful elements of the Opihi scheme in terms of effective protection at an affordable cost are: the river works in the lower catchment, the stopbanks, live planting on the berms, live tree erosion control at sites of active erosion and channel improvement.

**The failure of the partially constructed Opuha dam in 1997 caused a flood estimated at 1500-2000 cumecs…………..**

Construction of the Opuha Dam lowered the 50-year flow on the Opihi from 1530m$^3$/s to about 1200m$^3$/s. This allowed construction of stopbanks around Pleasant Point to be increased to cater for floods up to 1200m$^3$/s on the Tengawai River without a net increase of the 50-year flow downstream of there.

The stopbanks on the Tengawai above cross-section 5 were constructed to be 0.15m above the 1951 flood grade or level. The 1951 flood flow was estimated at 700m$^3$/s. So the Tengawai effectively has 3 standards:

**Confluence to cross-section 4a:** 1200m$^3$/s (300mm freeboard)
This includes the flow in a floodway adjacent to cross-sections 2 and 3. The inner stopbanks at these sections have a design capacity of 880m$^3$/s.

**Cross-section 4a to 5:** 880m$^3$/s (300mm freeboard)

**Cross-section 5 to 19:** 700m$^3$/s (150mm freeboard)
1.3 Catchment Control Scheme

The Opihi Catchment Control Scheme consists of:

**Stopbanks**

80.05 km value $33.43m (May 2014)

The stopbanks are continuous on both sides of the Opihi River from the mouth to 8km upstream of the Tengawai River confluence (Hanging Rock) and on the right bank of the Tengawai River for 5km upstream of the Opihi confluence. There are intermittent stopbanks on the Tengawai River and on the Upper Opihi and some tributaries near Fairlie.

**Erosion control works**

- Tree planting 274.7 km value $43.39m
- Lateral rock work 8200 tonne value $0.52m

Revegetation of the berms strengthens their resistance to bank erosion.

**Ancillary Works**

- Drains/grassed waterways 13.8 km value $0.65m
- Culverts and Floodgates 11 value $0.18m

Total $78.17m (May 2014)

**Channel Clearing**

Works are undertaken to control vegetation, control shingle movement that would otherwise reduce the capacity of the river channel, and divert active channels of the river away from new planting works or eroding sections of river bank. These works include spraying, dozing, cutting exotic vegetation in the fairway and direction and control of the commercial extraction of shingle.

**Upper Catchment Works**

The maintenance and extension of gravel traps and grade control structures in the upper catchments to control gravel movement has been abandoned. Channel clearing, berm planting and destocking river margins in the upper catchment is carried out.
1.4 Rating District Classification

The targeted differential catchment works rate for the Opihi River Rating District comprises eleven classes and is levied per $100,000 capital value.

<table>
<thead>
<tr>
<th>Category of rateable land</th>
<th>Differential relationship between categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A</td>
<td>100</td>
</tr>
<tr>
<td>Class B</td>
<td>95</td>
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<td>Class C</td>
<td>75</td>
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<td>Class D</td>
<td>55</td>
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<tr>
<td>Class E</td>
<td>20</td>
</tr>
<tr>
<td>Class F</td>
<td>7</td>
</tr>
<tr>
<td>Class U1</td>
<td>100</td>
</tr>
<tr>
<td>Class U2</td>
<td>40</td>
</tr>
<tr>
<td>Class U3</td>
<td>20</td>
</tr>
<tr>
<td>Class U4A</td>
<td>14</td>
</tr>
<tr>
<td>Class EU4</td>
<td>7</td>
</tr>
</tbody>
</table>

Figure 1: Rating district classification map.

1.5 Assets Being Protected

The capital value of land and buildings on the floodplain is approximately $2,101m (June 2014).

Community infrastructure such as roads, railways, pipelines, water supply intakes, power and telephone lines all derive benefit from the river control system.
Opportunities for recreational access and wildlife habitat are created as a consequence of works (ie. tracks and picnic areas, clear riverbeds for ground nesting birds).

1.6 Maintenance Expenditure

Part A, Appendix B shows expenditure for the years 2009-14. The average expenditure in this period on maintenance has been $604,500 per year.

1.7 Existing Standards

All completed capital works (except upper catchment gravel traps) are well maintained and fairway maintenance meets scheme requirements. Strengthening of berm plantings is continuing.

Bed level surveys are carried out to monitor the effects of gravel extraction. Continued monitoring will enable this to be controlled so that scheme performance is enhanced without weakening the protection system.

Landowners have an individual responsibility for maintenance of the protection system. It is important that landowners help to ensure the performance of the stopbanks by:

- providing access to the works,
- controlling stock so that they do not damage the grass cover or the banks themselves. This is achieved by fencing stopbanks out from adjacent paddocks and controlling grazing and stock movement,
- controlling stock to ensure that berm plantings are not damaged,
- controlling vehicle and machinery movements so they don't damage stopbanks.

The Flood Protection and Drainage Bylaw 2013 (under the Local Government Act 2002) was introduced to manage, regulate and protect flood protection and flood control works belonging to or under the control of the Canterbury Regional Council from damage or misuse. The Bylaw controls activities that may affect the integrity or effective operation and maintenance of the flood protection and flood control works. A permit is required for certain activities that can affect the works, including:

- Altering or obstructing drains and floodways, and access to them
- Activities that interfere with or damage drains, erosion protection plantings, stopbanks, hydrological recording equipment or survey benchmarks etc

(Resource consent or further authorisation may also be required from the Canterbury Regional Council, relevant territorial authority or the Department of Conservation to carry out these activities).

Environment Canterbury also has powers relating to the maintenance of the scheme (land entry, disposal of drain cleanings etc) under the Soil Conservation and Rivers Control Act.

Environment Canterbury has the policy of recovering damage repair costs on behalf of the rating district from landowners where that damage is caused by the landowner's action or inaction. Prosecutions can be made under the Soil Conservation and Rivers Control Act or the Local Government Act.
Section 2: Service Levels

2.1 Objectives

Lower Opihi River
- to provide a flood channel, stabilised with poplar and willow planting, capable of carrying (with berm flows) the following flood flows (mean annual flood in brackets):
  - Tengawai (above Pleasant Point) 700 cumecs (290)
  - Tengawai (Pleasant Point lead-in) 880 cumecs (290)
  - Tengawai (Pleasant Point) 1200 cumecs (290)
  - Opihi (above Pleasant Point) 1,530 cumecs (515)
  - Opihi (Pleasant Point to Temuka confluence) 2,410 cumecs (780)
  - Opihi (Temuka confluence to Mouth) 3,130 cumecs (1020)

- to stabilise shingle areas by planting of berms with poplars and willows

- to provide a source of supply of poplars and willows for future planting in the catchment and river.

Opihi Catchment
- to prevent, or minimise, erosion and loss of land
- to reduce the supply of detritus from the upper catchment to the lower river system.

2.2 Historic flood sizes

The following floods have been recorded or estimated in recent years:-

Opihi River at Rockwood:
- 21/2/45 660 cumecs
- 19/7/61 466 cumecs
- 13/3/86 1020 cumecs
- 19/3/94 827 cumecs
- 1/8/12 370 cumecs

Opuha River at Skipton
- 21/2/45 390 cumecs
- 18/7/61 228 cumecs
- 13/3/86 591 cumecs
- 19/3/94 767 cumecs


Flood hydrology altered post construction of Opuha Dam
- 17/5/2014 368 cumecs

Tengawai River at Cave
- 18/7/61 837 cumecs
- 13/3/86 1500 cumecs
- 19/3/94 1000 cumecs
- 1/8/12 1025 cumecs

(The 1986 floods caused extensive damage to the rating district assets and to the surrounding areas protected by the scheme…refer to flood report, 1994 Marsh McLennan risk assessment).
2.3 Damage Exposure

River control works are constructed in a very high-energy environment with the purpose of resisting and absorbing some of that energy. No matter what the standard of maintenance, damage to such systems is inevitable.

An assessment of maximum damage potential in a single flood event is $27.1m or about 35% of the value of the scheme assets (May 2014, refer to Part A, Section 5.2 and Appendix D).

2.4 Reporting On Performance Levels

The monitoring and reporting procedure outlined in Section 3 (and Part A, Section 7.4) will be used to assess the standard of maintenance carried out and the performance of the scheme.
### Section 3: Reporting

#### 3.1 Annual Asset Management Plan Compliance Report For Opihi Catchment Control Scheme

The asset management plan adopted by the community and Environment Canterbury:
- Defines the service level for the Opihi Catchment Control Scheme
- Defines the level of maintenance needed to retain the service capacity of the rating district's river control assets managed by Environment Canterbury
- Provides a base against which the Council's performance in maintaining the service capacity of the rating district's river control assets can be measured
- Requires Environment Canterbury to report to the rating district's liaison committee annually.

The matters to be reported to the rating district's liaison committee annually are:

<table>
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<tr>
<th>Action required</th>
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<tbody>
<tr>
<td>Prepare maintenance programme and budget.</td>
<td>As presented to liaison committee meeting on…………………………..&lt;br&gt;Copy attached to minutes of the meeting.</td>
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<tr>
<td>Prepare ten-year forward projection of maintenance and funding requirements.</td>
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<tr>
<td>Report on works undertaken and costs.</td>
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<tr>
<td>Inspect all stopbanks for erosion, damage, or active berm erosion. Report on inspection noting all cases of erosion of stopbank or berm erosion within 10m of stopbank and on the programme for dealing with these problems.</td>
<td>No erosion of stopbank or berm erosion within 10m of stopbank observed, or …………………………………………………………</td>
</tr>
<tr>
<td>Report on condition of system to liaison committee. Report to specifically identify any deferred maintenance that will impact on the performance of the scheme.</td>
<td>The protection system is in ......................... condition, (however future issues will be ..........) No maintenance which will impact on the performance of the scheme has been deferred, or Deferred maintenance comprises ............ And the effect on the performance of the scheme is likely to be ..................</td>
</tr>
<tr>
<td>Report to liaison committee on the performance of the river control system for floods exceeding the following peak flows: Tengawai 880 cumecs Opihi (above Pleasant Point) 1,530 cumecs Opihi (P/Point to Temuka) 2,410 cumecs Opihi (conf Temuka to Mouth) 3,130 cumecs</td>
<td>No floods exceeding these flows have occurred over the last 12 months, or: As presented to liaison committee meeting on…………………………..&lt;br&gt;Copy attached to minutes of the meeting.</td>
</tr>
</tbody>
</table>

Prepared by ...........................................(Area Engineer) ..................... Date
3.2 Six Yearly Asset Management Plan Compliance Report For Opihi Catchment Control Scheme

The asset management plan adopted by the community and Environment Canterbury:

- Defines the service level for the Opihi Catchment Control Scheme
- Defines the level of maintenance needed to retain the service capacity of the rating district's river control assets managed by Environment Canterbury
- Provides a base against which the Council's performance in maintaining the service capacity of the rating district's river control assets can be measured
- Requires Environment Canterbury to report to the rating district's liaison committee six yearly.

The matters to be reported to the rating district's liaison committee at six yearly intervals are:

<table>
<thead>
<tr>
<th>Action required</th>
<th>Report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Review asset management plan.</td>
<td>As presented to liaison committee meeting on…………………………….. Copy attached to minutes of the meeting.</td>
</tr>
<tr>
<td>No cross sections where the width of protection planting has reduced by greater than 20% of previous survey unless programmed.</td>
<td>The width of protection planting has not reduced by greater than 20% of previous survey, or ……………………………………….</td>
</tr>
<tr>
<td>No cross sections where more than 30% of the fairway is obstructed by vegetation greater than 1m in height.</td>
<td>No more than 30% of the fairway is obstructed by vegetation greater than 1m in height, or ……………………………………….</td>
</tr>
<tr>
<td>No reduction in quantities of infrastructural assets unless a reduction was identified as intended in the asset management plan.</td>
<td>There has been no reduction in the quantities of infrastructural assets, or Reasons for and the reductions in quantities of infrastructural assets are as presented to liaison committee meeting on…………………………….. Copy attached to minutes of the meeting.</td>
</tr>
</tbody>
</table>

Prepared by ……………………………………………(Area Engineer) ………………….. Date
LOWER PAREORA RIVER

Summary

Objective  To maintain the Lower Pareora River Control Scheme to minimise erosion, flooding and aggradation. To contain a flood flow of 500 cumecs downstream of the Pareora Huts.

Term  In perpetuity.

Maintenance  5 year average 2009-14: $99,100

Reporting  Annually
- Prepare annual maintenance plan and budget.
- Discuss and agree with rating district (report in Annual or Long Term Plan)
- Report on works undertaken and costs to liaison committee and Council.

Three Yearly - Revalue infrastructural assets

Six Yearly -  Assess from aerial photos fairway, berm and fairway edge condition - report to Council.

Flood Performance
- Report to Liaison Committee and Council on performance of scheme in all floods exceeding 490 cumecs.

Funding

Maintenance funded by:
- Targeted rate
- Works & Services rate
- General rate in the ratios set in the Council's Annual or Long Term Plan and Part A, Appendix C.

Damage repairs funded by:
- Rates (as above)
- Financial Reserves
- Reprioritising works
- Loan

Financial Reserves  Aim to:
- Maintain at approximately 100% of average annual maintenance level
- Build up reserves to meet planned above average expenditure
- Use to smooth variations in rating.

Review of Plan  Review when there is a change in maintenance standards, a change in funding policy, or at 6 yearly intervals.
Section 1: Description

1.1 Purpose Of Asset Management Plan

Asset Management Plans define the objectives and performance standards of the river control and drainage schemes for which this Council has the maintenance responsibility and provide the basis upon which the effectiveness of their maintenance can be measured.

This plan:
• Defines the service level for the Lower Pareora Rating District.
• Defines the level of maintenance needed to retain the operating and service capacity of the catchment control assets managed by the Council.
• Provides a base against which the Council’s performance in maintaining the service capacity of the infrastructural assets can be measured.

1.2 Background

The Pareora River has a catchment area of 540 km² above the SH1 bridge. Approximately 50% of the catchment lies in steep hill country on the northeast flank of the Hunter Hills. The south branch of the Pareora River drains pastoral country rising to 1371 m on the Hunter Hills. Most of the upper catchment tributaries are gravel-bearing with the gravel coming from the bed and banks.

Dense lupin growth in the lower 16km of the Pareora riverbed was trapping silt and shingle to the extent that the entire main flood channels from Holme Station to the sea were choked and floodwaters sought unimpeded channels through farmlands bordering the river. River defences had been erected in a piecemeal fashion but aggradation and the changing course of river channels had weakened the works or, in some cases, overwhelmed them during larger floods.

The lack of both adequate maintenance and an organised plan to develop the existing works contributed to the deterioration of flood security in the valley.

A flood control scheme was proposed by the South Canterbury Catchment Board in 1955. Its objectives were:
• Initial positive protection of Pareora township from all floods from any source.
• Initial provision of flood channels in the main river capable of containing floods with an expected frequency of 25 years with 300mm freeboard.
• Initial provision of flood channels and diversion channels in the main streams feeding the Lower Pareora River capable of containing with 300mm freeboard floods with an expected frequency of 25 years. The aim was to provide flood free access by the main arterial traffic routes in the valley from floods up to 25 years frequency.
• The acceptance of some risk of flood spillage in the early years of the control works, but the spillage from such floods to be directed in a route where the minimum of damage would result.
• Initial provision of cheap and weak live tree controls in the floodways calculated to ultimately bring about the entrenchment of the main flood channel, heightening of the berms and confinement of all except extreme floods below berm levels.
• The ultimate development by the main river by natural processes and from comparatively weak initial controls of confining the main river channel to a
stabilised width of 160m capable of safely coping with all floods of frequency up to say 100 years.

- Clearance whenever economically justifiable of all creeks in the Lower Pareora River valley floor to cope with floods up to 25 year frequency.

The 25 year flood flow was determined for each reach of the river, and design fairway and bank levels were based on these figures

In 1981, the South Canterbury Catchment Board reported that all stopbanking had been completed, and that improvements to Lyalldale Creeks and Pareora River Tributary Creek were also completed. In addition, the cleared fairway, pilot channels, and a portion of the planting works including floodway marginal belts were installed.

However, considerable lengths of the installed live works were either undermined or washed away or never grew due to the effects of freshes and floods in the first case, and absence of ground moisture at a vital stage in the second case. In addition, the whole lower river bed channel had been subject to considerable variations in level with the movement of shingle through it: natural aggradation at some sites was forcing flood outflows from the fairway across the berms, exerting pressure on adjoining berm growth and stopbank/terrace containing system. Elsewhere, degradation and bed scour, combined with meandering flood/fresh patterns, had carved out berms, leaving high banks and toppling over/struggling pole growth. The fluctuating bed levels were due to waves of shingle being transported downstream during flood events.

Comments on each objective were:

- Pareora township had received its initial positive protection;
- the initial provision of flood channels in the main river had been achieved;
- the initial provision of flood channels and diversion channels in tributary creeks had also been achieved;
- almost all flood flows to that date had been contained by the stopbanks;
- entrenchment of the main flood channel, heightening of the berms and confinement of all except extreme floods below berm levels had not been achieved and formed the reason for proposed ongoing works;
- there was no possibility of channel development safely coping with floods up to 100 years until the previous objective had been achieved;
- Clearance whenever economically justifiable of all creeks in the Lower Pareora River valley floor had been largely achieved but some further clearance and maintenance was necessary to reach the full 25 year frequency containment proposed.

The 1981 proposal aimed to complete the installation of a band of live training works in its entirety on both sides of the fairway over a 10 year period.

In its 1987 budget, the Government advised an end to all funding towards catchment works and this withdrawal of funding was completed for this scheme in 1989.

The South Canterbury Catchment Board was abolished in 1989 as a part of the national reform of local government and its functions and powers assumed by the Canterbury Regional Council.

The most successful elements of the Lower Pareora River Control Scheme in terms of effective protection at an affordable cost are; maintenance of the stopbank system,
live planting on the berms, live tree erosion control at sites of active erosion and channel clearing and improvement.

A Floodplain Management Strategy was developed in 2004. The key outcomes are contained in the following schedule:

### Strategy Measures and Implementation Schedule

<table>
<thead>
<tr>
<th>Measure</th>
<th>Lead Agency</th>
<th>Mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide flood protection works</td>
<td>Environment Canterbury</td>
<td>Community Plan</td>
</tr>
<tr>
<td>Maintain existing stopbanks and erosion control works</td>
<td>Environment Canterbury</td>
<td>Community Plan</td>
</tr>
<tr>
<td>Pursue opportunities to fence off critical stopbank reaches</td>
<td>Environment Canterbury</td>
<td>Community Plan</td>
</tr>
<tr>
<td>Investigate increased funding for enhanced flood protection particularly between Pareora Huts &amp; Holme Station Rd (right bank)</td>
<td>Environment Canterbury</td>
<td>Community Plan</td>
</tr>
<tr>
<td>Investigate the viability of constructing a secondary stopbank at Pareora Huts near the potential breakout location</td>
<td>Environment Canterbury</td>
<td>Community Plan</td>
</tr>
<tr>
<td>Ensure the maintenance of the design (500 m$^3$/s) channel capacity</td>
<td>Environment Canterbury</td>
<td>Community Plan</td>
</tr>
<tr>
<td>Gravel extraction</td>
<td>Environment Canterbury</td>
<td>Regional Plan</td>
</tr>
<tr>
<td>Manage the planting and/or clearance of vegetation to ensure protection of stopbanks and the maintenance of channel capacity</td>
<td>Environment Canterbury</td>
<td>Community Plan</td>
</tr>
<tr>
<td>Monitor the effectiveness of flood protection and channel maintenance works</td>
<td>Environment Canterbury</td>
<td>Community Plan</td>
</tr>
<tr>
<td>Continue the 10 yearly bed level monitoring programme and undertake additional surveys as warranted</td>
<td>Environment Canterbury</td>
<td>Community Plan</td>
</tr>
<tr>
<td>Monitor flood events to assess the scheme performance and river channel capacity and report back to the community</td>
<td>Environment Canterbury</td>
<td>Community Plan</td>
</tr>
<tr>
<td>Provide for subdivision and land use management</td>
<td>Timaru &amp; Waimate District Councils</td>
<td>District Plan (RMA) Building Act controls</td>
</tr>
<tr>
<td>Control of subdivision and development</td>
<td>Timaru &amp; Waimate District Councils</td>
<td>District Plan</td>
</tr>
<tr>
<td>Floor level controls for new buildings</td>
<td>Timaru &amp; Waimate District Councils</td>
<td>District Plan</td>
</tr>
<tr>
<td>Building line restrictions for new buildings</td>
<td>Timaru &amp; Waimate District Councils</td>
<td>District Plan</td>
</tr>
<tr>
<td>Improve the standard of information about flood hazard on the Pareora Floodplain</td>
<td>Environment Canterbury</td>
<td>Community Plan</td>
</tr>
<tr>
<td>Education, information and advice</td>
<td>Environment Canterbury</td>
<td>Community Plan</td>
</tr>
<tr>
<td>Ensure effective emergency management</td>
<td>Environment Canterbury</td>
<td>Community Plan</td>
</tr>
<tr>
<td>Continued development of flood forecasting system and improved flood warning</td>
<td>Environment Canterbury</td>
<td>Community Plan</td>
</tr>
<tr>
<td>Provision of adequate warning to infrastructure managers</td>
<td>Environment Canterbury</td>
<td>Community Plan</td>
</tr>
<tr>
<td>Provision of adequate Civil Defence evacuation procedures and exercises</td>
<td>Environment Canterbury</td>
<td>Community Plan</td>
</tr>
<tr>
<td></td>
<td>Timaru &amp; Waimate District Councils</td>
<td>Community Plan</td>
</tr>
</tbody>
</table>

### 1.3 River Control Scheme

The Lower Pareora River Control Scheme consists of:

**Stopbanks**

27.83 km  value  $2.52m

The stopbanks are intermittent, spanning between natural terraces on both sides of the river from SH1 to the Pareora Huts.

**Erosion control works**
Tree planting 31.5 km value $ 5.93m  
Rock 1500 t value $ 0.10m  
Vegetation of the bermlands strengthens their resistance to bank erosion.

**Ancillary works**
Drains / Grassed waterways 6.7 km value $ 0.46m  

Total (Asset Valuation May 2014) $ 9.01m  

**Channel Clearing**
Works are undertaken to control vegetation and control shingle movement, which would otherwise reduce the capacity of the river channel, and to divert active channels of the river away from new planting works or eroding sections of river bank. These works include spraying, dozing, cutting exotic vegetation in the fairway and direction and control of the commercial extraction of shingle.
Figure 1. Extent of Works
1.4 Rating District Classification

The targeted differential catchment works rate for the Lower Pareora River Rating District comprises eight classes and is levied per $100,000 capital value.

<table>
<thead>
<tr>
<th>Category of rateable land</th>
<th>Differential relationship between categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A</td>
<td>20</td>
</tr>
<tr>
<td>Class B</td>
<td>15</td>
</tr>
<tr>
<td>Class C</td>
<td>10</td>
</tr>
<tr>
<td>Class D</td>
<td>6</td>
</tr>
<tr>
<td>Class E</td>
<td>3</td>
</tr>
<tr>
<td>Class F</td>
<td>1</td>
</tr>
<tr>
<td>Class U1</td>
<td>12</td>
</tr>
<tr>
<td>Class U2</td>
<td>2</td>
</tr>
</tbody>
</table>

Figure 1: Rating classification map.

1.5 Assets Being Protected

Community infrastructure such as roads, railways, pipelines, water supply intakes, power and telephone lines all derive benefit from the river control system. Opportunities for recreational access and wildlife habitat are created as a consequence of works (ie. tracks and clear riverbeds for ground nesting birds).

The capital value of land and buildings on the floodplain is $160m (June 2014).
1.6 Maintenance Expenditure

Part A, Appendix B shows expenditure for the years 2009-14. The average expenditure in this period on maintenance has been $99,100 per year.

An annual programme of maintenance will be prepared each year. This programme will be discussed with a liaison committee of ratepayer representatives, prior to adoption by the Council for inclusion in the Annual or Long Term Plan. The programme will typically be based on a normal maintenance requirement with the asset manager having the authority to rearrange as necessary. Approval will be sought from the liaison committee and the Council for proposed expenditure exceeding the annual budget by more than 10%.

In preparing the annual maintenance programme consideration will be given to:
- Works identified as necessary.
- Works that can be anticipated given a 'normal' season.
- Flexibility to meet unbudgeted damages.
- Affordability.
- Environmental effects.

1.7 Existing Standards

Capital works have been completed on the Lower Pareora River. Works are being maintained to a minimal standard that will meet the scheme objectives, but scheme damage costs could be relatively high.

Landowners have an individual responsibility for care of the protection system. It is important that landowners help to ensure the performance of the stopbanks by:
- Providing access to the works,
- Controlling stock so that they do not damage the grass cover or the banks themselves. This is achieved by fencing stopbanks out from adjacent paddocks and controlling grazing and stock movement,
- Controlling stock to ensure that berm plantings are not damaged,
- Controlling vehicle and machinery movements so they don't damage stopbanks.

The Flood Protection and Drainage Bylaw 2013 (under the Local Government Act 2002) was introduced to manage, regulate and protect flood protection and flood control works belonging to or under the control of the Canterbury Regional Council from damage or misuse. The Bylaw controls activities that may affect the integrity or effective operation and maintenance of the flood protection and flood control works. A permit is required for certain activities that can affect the works, including:
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Environment Canterbury also has powers relating to the maintenance of the scheme (land entry, disposal of drain cleanings etc) under the Soil Conservation and Rivers Control Act.
Environment Canterbury has the policy of recovering damage repair costs on behalf of the rating district from landowners where that damage is caused by the landowner's action or inaction. Prosecutions can be made under the Soil Conservation and Rivers Control Act or the Local Government Act.

Future land use changes may create the desire to investigate options for improving the standard of protection offered by this scheme.
Section 2: Service Levels

2.1 Objective

To contain a flood flow of 500 cumecs downstream of the Pareora Huts with 300mm freeboard.
To maintain the Lower Pareora River Control Scheme to minimise erosion, flooding and aggradation.

2.2 Historic Flood Sizes

The following floods have been recorded or estimated over recent years.
Pareora River at the Huts
17/4/51  580 cumecs
18/7/61  645 cumecs
13/3/86  1450 cumecs
1/8/12  620 cumecs
17/6/13  680 cumecs

2.3 Damage Exposure

River control works are constructed in a very high-energy environment with the purpose of resisting and absorbing some of that energy. No matter what the standard of maintenance, damage to such systems is inevitable.

An assessment of maximum damage potential in a single flood event is $3.1m or about 35% of the value of the scheme assets (May 2014, refer to Part A, Section 5.2 and Appendix D).

2.4 Reporting On Performance Levels

The monitoring and reporting procedure outlined in Section 3 (and Part A, Section 7.4) will be used to assess the standard of maintenance carried out and the performance of the scheme.
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<tr>
<td>Inspect all stopbanks for erosion, damage, or active berm erosion. Report on</td>
<td>No erosion of stopbank or berm erosion within 10m of stopbank observed, or</td>
</tr>
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<td>inspection noting all cases of erosion of stopbank or berm erosion within 10m</td>
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<tr>
<td>identify any deferred maintenance that will impact on the performance of the</td>
<td>No maintenance which will impact on the performance of the scheme has</td>
</tr>
<tr>
<td>scheme.</td>
<td>been deferred, or</td>
</tr>
<tr>
<td></td>
<td>Deferred maintenance comprises ..........</td>
</tr>
<tr>
<td></td>
<td>And the effect on the performance of the scheme is likely to be ..........</td>
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<tr>
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</tr>
<tr>
<td>floods exceeding 490 cumecs.</td>
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<td>Copy attached to minutes of the meeting.</td>
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</tbody>
</table>

Prepared by ...................................................(Area Engineer)  ......................... Date
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The asset management plan adopted by the community and Environment Canterbury:
- Defines the service level for the Lower Pareora River Rating District
- Defines the level of maintenance needed to retain the service capacity of the Rating District’s river control assets managed by Environment Canterbury
- Provides a base against which the Council's performance in maintaining the service capacity of the Rating District's river control assets can be measured
- Requires Environment Canterbury to report to the Rating District’s liaison committee six yearly.

The matters to be reported to the rating district’s liaison committee at six yearly intervals are:

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<td>than 20% of previous survey unless programmed.</td>
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<tr>
<td>No cross sections where more than 30% of the fairway is obstructed by vegetation</td>
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</tr>
<tr>
<td>intended in the asset management plan.</td>
<td></td>
</tr>
</tbody>
</table>

Prepared by ……………………………………………(Area Engineer) ………………….. Date
LOWER WAIHAO RIVER

Summary

Objective

To prevent flooding by containing floods up to 975 cumecs within the riverbed downstream of State Highway 1.

To prevent loss of farmland through lateral bank erosion.

Term

In perpetuity.

Maintenance

5 year average 2009-14: $33,800

Reporting

Annually - Prepare annual maintenance plan and budget.
- Discuss and agree with rating district (report in Annual or Long Term Plan)
- Report on works undertaken and costs to liaison committee and Council.

Three Yearly - Revalue infrastructural assets

Six Yearly - Assess from aerial photos fairway, berm and fairway edge condition - report to Council.
- Review asset management plan, to be agreed with liaison committee and adopted by Council.

Flood Performance

- Report to Liaison Committee and Council on performance of scheme in all floods exceeding 530 cumecs at McCulloch’s Bridge.

Funding

Maintenance funded by:
Targeted rate
Works & Services rate
General rate
in the ratios set in the Council's Annual or Long Term Plan and Part A, Appendix C.

Damage repairs funded by:
Rates (as above)
Financial Reserves
Reprioritising works
Loan

Financial Reserves

Aim to:
- Maintain at approximately 100% of average annual maintenance level
- Build up reserves to meet above average planned expenditure
- Use to smooth variations in rating

Review of Plan

Review when there is a change in maintenance standards, a change in funding policy, or at 6 yearly intervals.
Section 1: Description

1.1 Purpose of Asset Management Plan

Asset Management Plans define the objectives and performance standards of the river control and drainage schemes for which this Council has the maintenance responsibility and provide the basis upon which the effectiveness of their maintenance can be measured.

This plan:

- Defines the service level for the Lower Waihao Special Rating District.
- Defines the level of maintenance needed to retain the operating and service capacity of the catchment control assets managed by the Council.
- Provides a base against which the Council’s performance in maintaining the service capacity of the infrastructural assets can be measured.

1.2 Background

The Waihao River has catchment area of 528 km² above the SH1 Bridge. Of this, 326 km² are tussock country and the remaining 202 km² are downlands.

The river is well confined in its upper reaches above the gorge, where the catchment is in good condition (i.e. limited erosion). From the gorge to the SH1 Bridge, the river adopts the typical Canterbury braided river characteristics. From SH1 to the sea, the river is generally bounded by terraces that can be overtopped in a number of places. Flood overflow channels lead floodwaters across country, on both sides of the river to the coast, away from the true mouth of the Waihao. Approximately 240 hectares of fertile river flats between the terraces are subject to severe flooding.

As the river nears the coast, the river gradient flattens sharply and it changes regime characteristics from the typical Canterbury shingle bed to a deep, sharply meandering silt-phase channel.

Overflows in 1945, 1946, 1951, and 1961 caused considerable damage to very fertile farmland. The river channel had deteriorated to an almost impenetrable mass of willow and broom, with accumulations of shingle and silt causing a steady build-up of the bed level. Fears were held that if nothing was done, the river would inevitably seek a new course to the sea across open country to the north or south, and in so doing, devastate high producing land and endanger human life.

A number of river protection works had been built prior to the 1960’s, in a piecemeal fashion, with lack of continuity, and often sited without regard for the regime of the river, with the consequence that the river had been expected to follow practically impossible alignments.

In 1966, the South Canterbury Catchment Board proposed a river control scheme based on a 50 year return period flow calculated as 708 cumecs. The scheme was to consist of:

- a cleared flood channel in the lower reaches of the river capable of carrying, with berm flows, floods of an average return period of 50 years,
• training works, strengthened at key points, to confine main flood flows to a central fairway,
• stopbanks on both sides of the Waihao river to prevent overflows and to give a freeboard of 300mm on 50 year flows,
• development of the fairway by natural processes, from the initial cleared 85 metres width to a final stabilised width of 120 metres, which would be capable of carrying floods in excess of the design size with ample freeboard on stopbanks.

The scheme was finally accepted by farmers in 1968 and approved for subsidy (3 for 1) in 1969 on a total cost of $124,000. After the rating district was finalised, work commenced in 1971. Stopbanking and channel clearance were the main tasks undertaken.

In 1977, the estimate to complete all works was revised to $187,000 and this was approved for 3 to 1 subsidy in 1979. Works were to continue at $7000 total expenditure per year with the expected completion date being 1987. By 1985, progress was well behind that planned and experience from floods 1978-1980 indicated that the original methods needed modification.

Rock was introduced at strategic points to protect the stopbanks from erosion. Above Bradshaw’s Bridge, when rock wasn’t to be used, 60m planted berm widths were proposed. The SCCB sought funding from NWASCA to complete the scheme 1985 to 1990 at a cost of $74,813.

The March 1986 flood of about 1250m³/s was the largest since 1868. About 20km² was inundated, with damages estimated at $1m (2004), about 70% of which was on the south side. 800m of stopbanks were breached, with scour along 2100m of stopbank.

In its 1987 budget, the Government advised an end to all funding towards catchment works and this withdrawal of funding was completed for this scheme in 1990.

The South Canterbury Catchment Board was abolished in 1989 as a part of the national reform of local government and its functions and powers assumed by the Canterbury Regional Council.

In March 1994, a flood of 900m³/s overtopped the stopbanks and inundated about 14km².

Overtopping of the coastal dunes lead to flooding in the lower reaches in 2001 (and 2002?)

The most successful elements of the Lower Waihao River Control Scheme (in terms of effective protection at an affordable cost) are maintenance of the stopbank system, live planting on the berms, live tree erosion control at sites of active erosion and channel improvement.

A Floodplain Management Strategy was completed in 2004. The key outcomes are contained in the following schedule:
## Strategy Measures and Implementation Schedule

<table>
<thead>
<tr>
<th>Measure</th>
<th>Lead Agency</th>
<th>Mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide flood protection works</td>
<td>Environment Canterbury</td>
<td>Community Plan</td>
</tr>
<tr>
<td>Maintain existing stopbanks and erosion control works</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ensure the maintenance of the design (50 year return period – 975 m³/s) channel capacity</td>
<td>Environment Canterbury</td>
<td>Regional Plans</td>
</tr>
<tr>
<td>Gravel extraction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manage the planting (including consideration of native plant species where appropriate) and/or clearance of vegetation to ensure protection of stopbanks and the maintenance of channel capacity</td>
<td>Environment Canterbury</td>
<td>Community Plan</td>
</tr>
<tr>
<td>Monitor the effectiveness of flood protection and channel maintenance works</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continue the 10 yearly bed level monitoring programme and undertake additional surveys as warranted by local concerns and/or related to flood events</td>
<td>Environment Canterbury</td>
<td>Community Plan</td>
</tr>
<tr>
<td>Monitor flood events to assess the performance of the river channel during high flows and map flood extent</td>
<td>Environment Canterbury</td>
<td>Community Plan</td>
</tr>
<tr>
<td>Provide for subdivision and land use management</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control of subdivision and development</td>
<td>Waimate District Council</td>
<td>District Plan (RMA) Building Act controls</td>
</tr>
<tr>
<td>Floor level controls for new buildings</td>
<td>Waimate District Council</td>
<td>District Plan</td>
</tr>
<tr>
<td>Building line restrictions for new buildings</td>
<td>Waimate District Council</td>
<td>District Plan</td>
</tr>
<tr>
<td>Improve the standard of information about flood hazard on the Waihao and peripheral floodplains</td>
<td>Environment Canterbury</td>
<td>Waimate District Council</td>
</tr>
<tr>
<td>Education, information and advice</td>
<td></td>
<td>Community Plan</td>
</tr>
<tr>
<td>Consider extension of the strategy to include the peripheral floodplains to the north.</td>
<td>Environment Canterbury</td>
<td></td>
</tr>
<tr>
<td>Ensure effective emergency management</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continued development of flood forecasting system for improved flood warning</td>
<td>Environment Canterbury</td>
<td>Community Plan</td>
</tr>
<tr>
<td>Provision of adequate warning to infrastructure managers</td>
<td>Environment Canterbury</td>
<td>Community Plan</td>
</tr>
<tr>
<td>Provision of adequate Civil Defence procedures and exercises</td>
<td>Waimate District Council</td>
<td>Community Plan</td>
</tr>
<tr>
<td></td>
<td>Environment Canterbury</td>
<td></td>
</tr>
</tbody>
</table>

A flood of about 900m³/s in June 2013 overtopped the stopbanks (over about 1.4km between 3-5km from the coast), breached the stopbanks (50m) and flooded 2km² (see plan 13675). Bradshaws Bridge, damaged in previous floods, was washed away (and will not be replaced).

### 1.3 River Control Scheme

The Lower Waihao River Control Scheme consists of:

**Stopbanks** 15.4 km value $3.62m (May 2014)

Except for a short length downstream of the railway line on the left bank (where there is a natural terrace), the stopbanks are continuous from State Highway 1 to the sea on both sides of the river.

**Erosion control works**
Tree planting 15.8 km value $ 2.98m
Rock 2000 t $ 0.13m

Revegetation of the bermlands strengthens their resistance to bank erosion but also reduces flood capacity, so a balance must be struck.

Ancillary works
Floodgates (9) $ 0.07m

Total $ 6.80m (May 2014)

Channel Clearing
Works are undertaken to control vegetation and control shingle movement, (which would otherwise reduce the capacity of the river channel) and to divert active channels of the river away from new planting works or eroding sections of river bank. These works include spraying, dozing, cutting exotic vegetation in the fairway and to direct and control the commercial extraction of shingle.

The 120m fairway width has largely been achieved from the Railway to Bradshaws Bridge.
1.4 **Rating District Classification**

The targeted differential catchment works rate for the Lower Waihao Rating District comprises five classes and is levied per hectare of land.

<table>
<thead>
<tr>
<th>Category of rateable land</th>
<th>Differential relationship between categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A</td>
<td>100</td>
</tr>
<tr>
<td>Class B</td>
<td>65</td>
</tr>
<tr>
<td>Class C</td>
<td>45</td>
</tr>
<tr>
<td>Class D</td>
<td>15</td>
</tr>
<tr>
<td>Class E</td>
<td>5</td>
</tr>
</tbody>
</table>
1.5 Assets Being Protected

The area of land protected by the scheme is approximately 1337 ha.

Community infrastructure such as roads, railways, pipelines, water supply intakes, power and telephone lines all derive benefit from the river control system. Opportunities for recreational access and wildlife habitat are created as a consequence of works.

1.6 Maintenance Expenditure

Part A, Appendix B shows expenditure for the years 2009-14. The average expenditure in this period on maintenance has been $33,800 per year.

An annual programme of maintenance will be prepared each year. This programme will be discussed with a liaison committee of ratepayer representatives, prior to adoption by the Council for inclusion in the Annual or Long Term Plan. The programme will typically be based on a normal maintenance requirement with the asset manager having the authority to rearrange as necessary. Approval will be sought from the liaison committee and the Council for proposed expenditure exceeding the annual budget by more than 10%.

In preparing the annual maintenance programme consideration will be given to:
- Works identified as necessary.
- Works that can be anticipated given a 'normal' season.
- Flexibility to meet unbudgeted damages.
- Affordability.
- Environmental effects.

1.7 Existing Standards

Capital works have been completed on the Lower Waihao River. Works are being maintained to a minimal standard to meet the scheme objectives, but scheme damage costs can be relatively high.

Bruce: Description of existing stds needed here.

Landowners have an individual responsibility for care of the protection system. It is important that landowners help to ensure the performance of the stopbanks by:
- Providing access to the works,
- Controlling stock so that they do not damage the grass cover or the banks themselves. This is achieved by fencing stopbanks out from adjacent paddocks and controlling grazing and stock movement,
- Controlling stock to ensure that berm plantings are not damaged,
- Controlling vehicle and machinery movements so they don’t damage stopbanks.

The Flood Protection and Drainage Bylaw 2013 (under the Local Government Act 2002) was introduced to manage, regulate and protect flood protection and flood control works belonging to or under the control of the Canterbury Regional Council from damage or misuse. The Bylaw controls activities that may affect the integrity or effective operation and maintenance of the flood protection and flood control works. A permit is required for certain activities that can affect the works, including:
- Altering or obstructing drains and floodways, and access to them
- Activities that interfere with or damage drains, erosion protection plantings, stopbanks, hydrological recording equipment or survey benchmarks etc

(Resource consent or further authorisation may also be required from the Canterbury Regional Council, relevant territorial authority or the Department of Conservation to carry out these activities).

Environment Canterbury also has powers relating to the maintenance of the scheme (land entry, disposal of drain cleanings etc) under the Soil Conservation and Rivers Control Act.

Environment Canterbury has the policy of recovering damage repair costs on behalf of the rating district from landowners where that damage is caused by the landowner’s action or inaction. Prosecutions can be made under the Soil Conservation and Rivers Control Act or the Local Government Act.

Future changes in land use may create the desire to investigate options for improving the standard of protection offered by this scheme.
Section 2: Service Levels

2.1 Objectives

To prevent flooding by containing floods up to 975 cumecs within the riverbed downstream of State Highway 1.

To prevent loss of farmland through lateral bank erosion.

2.2 Historic Flood Sizes

The following significant floods have been observed or measured:

<table>
<thead>
<tr>
<th>Date</th>
<th>Cumecs</th>
</tr>
</thead>
<tbody>
<tr>
<td>20/7/61</td>
<td>700</td>
</tr>
<tr>
<td>13/3/86</td>
<td>1250</td>
</tr>
<tr>
<td>18/3/94</td>
<td>1150</td>
</tr>
<tr>
<td>17/6/13</td>
<td>984</td>
</tr>
<tr>
<td>18/4/14</td>
<td>902</td>
</tr>
</tbody>
</table>

2.3 Damage Exposure

River control works are constructed in a very high-energy environment with the purpose of resisting and absorbing some of that energy. No matter what the standard of maintenance, damage to such systems is inevitable.

An assessment of maximum damage potential in a single flood event is $2.35m or about 35% of the value of the scheme assets (May 2014, refer to Part A, Section 5.2 and Appendix D).

2.4 Reporting On Performance Levels

The monitoring and reporting procedure outlined in Section 3 (and Part A, Section 7.4) will be used to assess the standard of maintenance carried out and the performance of the scheme.
Section 3: Reporting

3.1 Annual Asset Management Plan Compliance Report For Lower Waihao River Rating District

The asset management plan adopted by the community and Environment Canterbury:

- Defines the service level for the Lower Waihao River Rating District
- Defines the level of maintenance needed to retain the service capacity of the rating district's river control assets managed by Environment Canterbury
- Provides a base against which the Council's performance in maintaining the service capacity of the rating district's river control assets can be measured
- Requires Environment Canterbury to report to the rating district's liaison committee annually.

The matters to be reported to the rating district's liaison committee annually are:

<table>
<thead>
<tr>
<th>Action required</th>
<th>Report</th>
</tr>
</thead>
</table>
| Prepare maintenance programme and budget.                                      | As presented to liaison committee meeting on.........................................................  
|                                                                                  | Copy attached to minutes of the meeting.                                                   |
| Prepare ten-year forward projection of maintenance and funding requirements.    | As presented to liaison committee meeting on.........................................................  
|                                                                                  | Copy attached to minutes of the meeting.                                                   |
| Report on works undertaken and costs.                                          | As presented to liaison committee meeting on.........................................................  
|                                                                                  | Copy attached to minutes of the meeting.                                                   |
| Inspect all stopbanks for erosion, damage, or active berm erosion. Report on    | No erosion of stopbank or berm erosion within 10m of stopbank observed, or                 |
| inspection noting all cases of erosion of stopbank or berm erosion within 10m  | ..................................................................................................................        |
| of stopbank and on the programme for dealing with these problems.               |                                                                                           |
| Report on condition of system to liaison committee. Report to specifically      | The protection system is in ......................... condition, (however future issues will be    |
| identify any deferred maintenance that will impact on the performance of the    | .................)                                                                            |
| scheme.                                                                         | No maintenance which will impact on the performance of the scheme has been deferred, or   |
|                                                                                  | Deferred maintenance comprises ..........                                                                                                                                 |
|                                                                                  | And the effect on the performance of the scheme is likely to be .............................. |
| Report to liaison committee on the performance of the river control system for  | No floods exceeding 530 cumecs at McCulloch’s Bridge have occurred over the last 12 months,  |
| floods exceeding 530 cumecs at McCulloch’s Bridge.                              | or: As presented to liaison committee meeting on...............................................  
|                                                                                  | Copy attached to minutes of the meeting.                                                   |

Prepared by .................................................(Area Engineer)  ......................... Date
3.2 Six Yearly Asset Management Plan Compliance Report For Lower Waihao River Rating District

The asset management plan adopted by the community and Environment Canterbury:
- Defines the service level for the Lower Waihao River Rating District
- Defines the level of maintenance needed to retain the service capacity of the rating district's river control assets managed by Environment Canterbury
- Provides a base against which the Council's performance in maintaining the service capacity of the rating district's river control assets can be measured
- Requires Environment Canterbury to report to the rating district's liaison committee six yearly.

The matters to be reported to the rating district's liaison committee at six yearly intervals are:

<table>
<thead>
<tr>
<th>Action required</th>
<th>Report</th>
</tr>
</thead>
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<tr>
<td>Review asset management plan.</td>
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<td>No reduction in quantities of infrastructural assets unless a reduction was identified as intended in the asset management plan.</td>
<td>There has been no reduction in the quantities of infrastructural assets, or Reasons for and the reductions in quantities of infrastructural assets are as presented to liaison committee meeting on…………………………….. Copy attached to minutes of the meeting.</td>
</tr>
</tbody>
</table>

Prepared by ……………………………………………(Area Engineer) ………………….. Date
LOWER WAITAKI RIVER

Summary

Objectives
To maintain a cleared fairway below the Waitaki Dam of 400 metres at Kurow, increasing to 700 metres at the coast.
To maintain an active riverbed generally 1000m wide at Kurow, increasing to 1300m wide at the coast.
To limit erosion of the active bed vegetated margins.

Term
In perpetuity.

Maintenance
5 year average 2009-14: $669,900

Reporting
Annually
- Prepare annual maintenance plan and budget.
- Discuss and agree with rating district (report in Annual or Long Term Plan)
- Report on works undertaken and costs to liaison committee and Council.

Three Yearly
- Revalue infrastructural assets

Six Yearly
- Assess from aerial photos fairway, berm and fairway edge condition - report to Council.

Flood Performance
- Report to Standing Committee on performance of scheme in all floods exceeding 1700 cumecs at Kurow.

Funding
Maintenance funded by:
- Separate rate 20%
- Works & Services rate 20%
- General rate 20%
- Meridian direct contribution 40%

or in the ratios set in the Council's Annual or Long Term Plan and Part A, Appendix C.

Damage repairs funded by:
- Rates (as above)
- Financial Reserves
- Reprioritising works
- Loan

Financial Reserves
Aim to:
- Maintain at approximately 100% of average annual maintenance level
- Build up reserves to meet above average planned expenditure.
- Draw down reserves to meet unexpected expenditure.
Section 1: Description

1.1 Purpose Of Asset Management Plan

Asset Management Plans define the objectives and performance standards of the river control and drainage schemes for which the Council has the maintenance responsibility and provide the basis upon which the effectiveness of their maintenance can be measured.

This plan:
- Defines the service level for the Lower Waitaki River Special Rating District.
- Defines the level of maintenance needed to retain the operating and service capacity of the river control assets managed by the Council.
- Provides a base against which the Council’s performance in maintaining the service capacity of the infrastructural assets can be measured.

1.2 Background

The Lower Waitaki River scheme extends 65 km downstream from the Waitaki Dam to the Pacific Ocean at Glenavy and comprises an active bed varying in width between approximately 1000m at Kurow to 1300m at the sea.

Within the active bed is positioned a cleared fairway which varies in width between 400m at Kurow to 700m at the coast. Extending beyond the active bed area are terrace and bermland areas, which vary in width and flood propensity. It is on these latter areas where farming activities have generally been undertaken although in some locations such practices have extended into the landward margins of the active riverbed. Development of this kind is usually preceded by a willow and gorse/broom clearing operation followed by cultivation to establish crops or grasses. In some instances these activities have progressed as far as the development of the land for irrigation. The appropriateness of these activities within the active riverbed is questionable because the removal of the berm vegetation removes a low cost erosion and flooding buffer zone putting the more secure berm and terrace areas beyond the active bed increasingly at risk. Whilst this might be an acceptable risk as far as the developer is concerned the effects of erosion and flooding that may arise when such clearance takes place often extend well beyond the developers boundary and affect adjacent and downstream properties.

Flooding into the bermlands beyond the active bed is likely once flows exceed a threshold level of about 1700 cumecs. In the first instance, outflows are likely to seek out and follow old river channels that weave their way down the berm areas (swales). The greatest risk is not flooding when this situation develops but the possibility that the outflows into the swales will develop to the extent that the channel becomes a permanent feature, isolating sections of bermland and eventually incorporating them into the active bed through the processes of erosion and deposition. Elsewhere, abandonment of sections of bed occurs, which in time revegetate to provide new berm land. There appears to be a rough balance between the development of new active bed and bermland, although a lag between the development of “eroded berm” and “new berm” occurs.
Whilst the Lower Waitaki River is a wide braided gravel river similar to others of its kind in the South Island, it has particular characteristics inherited from its morphological past that influence its behaviour. These behavioural trends have been further modified by the development of hydro storage within the mid and upper reaches of the river’s catchment. Indications are that the river is in an underfit state, primarily through the post Otiran Glaciation development of lakes Pukaki, Ohau and Tekapo but also as a result of the enhancement of these lakes by hydro development. The effect of these storage areas is to modify upcatchment inflows by routing through the available storage. Secondly, these impoundments act as effective sediment traps, limiting sediment supply to the lower river (downstream of Waitaki Dam) to the reworking of bed deposits, erosion of bermland and terrace areas and the influx from the lower catchment tributaries.

Most of the lower catchment tributaries are pseudo-ephemeral, in that their flows enter the Waitaki River by seepage through alluvial fans at their confluence within the Waitaki River. This means that sediment supply is an episodic process, only occurring in volume during periods of tributary flood, usually with flow levels well above the tributary mean annual discharge. The pulsing effect of tributary sediment (particularly where tributary outflows discharge into the active bed areas away from the Waitaki River current main stream and do not directly connect with the higher flows), can cause fan progradation and other localised effects. At a later stage, when the main river migrates laterally into these fan areas, reworking of the tributary deposits occurs, with subsequent transport and deposition downstream and the formation of island bars. These deposits can subsequently modify flow patterns in the active fairway margin and subsequently induce erosion of the vegetated buffer area and the adjacent berm and low terrace area. The combination of the intersection of the river with a prograded fan can also induce localised elevation in water levels on the upstream side of the fan, resulting in overbank flow into the berm or low terrace areas. This is particularly the case where the buffer zone is either absent or thin and old swales exist in the berm area, accessable to the main river at their upstream end.

In the 1950’s, the active bed and, in particular, the braided gravel section became increasingly congested with willow resulting in a loss of hydraulic capacity and a tendency for accelerated erosion and flooding of the river margins. A “pilot scheme” promoted by the Waitaki Catchment Commission and undertaken by the Ministry of Works, bulldozed a path down the central part of the active bed in order to try and restore channel capacity. This was followed in 1977 by the Lower Waitaki Catchment Control Scheme, designed to capture the benefits provided by the Pilot Scheme and lock the river into a 400m wide fairway. This was to be achieved by the strategic placement of gravel cored, rock armoured groyne, berm plantings, fairway spraying and willow removal. The purpose of this work was to increase the area of land available for farming from approximately 2800 ha to 5800 ha. Government subsidy was made available for these works and a classification prepared to recover the local share of the annual costs of capital and maintenance work within the scheme.

Thirty-one groyne structures were built under the 1977 scheme, with a further three being built in the early eighties at Glenavy. Twenty-five of these groynes were located on the south bank, the balance on the north bank.

It was apparent at the time of a scheme review in 1984 that the cost of maintaining the 400m fairway was prohibitively expensive and an alternative strategy was needed. This was to focus on regular spraying of willow-infested islands within a re-defined central fairway, accompanied by judicious removal of willow where that was necessary. The remaining portion of the bed flanking the central fairway was to be encouraged to develop as a vegetation buffer, assisted with new plantings and
lopping, layering and tying of willows to strengthen berm protection. Although not encouraged, some diversion works would be permitted to relieve pressure on threatened berm areas.

In July 1989, the Waitaki Catchment Board adopted as its policy a “Sectional Plan” for the ongoing management of the Lower Waitaki River. This policy developed further the cleared fairway (400m at Kurow and 700m at the coast) and berm management philosophies promoted under the 1984 Scheme Review.

River management practices currently being pursued generally follow these directions, but the scope has been broadened to allow the retention of a limited number of ponding banks, (11 of the 25 groynes constructed under the Pilot Scheme and the 1977 Scheme).

The principal focus of the annual works programme is to maintain a central cleared fairway through spraying and removal of critical obstructions within the braid network.

The Waitaki Catchment Commission was formed in 1960, replacing the Waitaki Soil Conservation Committee, which had administered the area since its establishment in 1947. In 1988 the Commission became the Waitaki Catchment Board which was then disestablished in Nov 1989 in the national review of local government. Its powers and functions were transferred to the Canterbury Regional Council.

In 1995, it was recognised that the Canterbury Regional Council did not have the authority to rate the properties within the classified area downstream of Blacks Point on the south bank of the river because this area was within the Otago Region. This, and concerns over the equity and rationale behind the rating classification, led to a review of the classification and adoption of two differential rating districts in 1999, one covering the land within the Canterbury Region, the other the land within the Otago Region.

The river was extensively studied by Meridian Energy for the Project Aqua proposals in the early 2000’s and for the North Bank Tunnel project since around 2008. Water take consents were granted for the North Bank Hydro project in 2009 and land access negotiations were started in 2010 but were put on hold in 2013. One finding from the reports was that the river braiding processes are very sensitive to vegetation (particularly since the raising of Lake Pukaki in 1979), so fairway clearance is critical to maintaining the braided nature of the river.

Fairway lines 600m apart were drafted in 2009. These are informing works, but have not been formally endorsed for application throughout the scheme.

The scheme objectives and scope were revisited jointly with the Otago Regional Council in 2013-15, culminating in the Lower Waitaki River Control Scheme Review – Options Report R15/44.

1.3 River Control Scheme

<table>
<thead>
<tr>
<th>Description</th>
<th>Length</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berm Vegetation</td>
<td>57.4 km</td>
<td>$10.80m</td>
</tr>
<tr>
<td>Groynes &amp; Ponding Banks</td>
<td>19</td>
<td>$ 5.00m</td>
</tr>
</tbody>
</table>

Total (May 2014) $15.80m
Figure 1. Extent of Works
1.4 Rating District Classification

The targeted differential catchment works rate for the Lower Waitaki River Rating District comprises three classes and is levied per $100,000 capital value. The same classification is used in both the Canterbury and Otago Regions.

<table>
<thead>
<tr>
<th>Category of rateable land</th>
<th>Differential relationship between categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A</td>
<td>60</td>
</tr>
<tr>
<td>Class B</td>
<td>30</td>
</tr>
<tr>
<td>Class U1</td>
<td>30</td>
</tr>
</tbody>
</table>

Figure 2: Rating district classification map.

1.5 Funding

Funding for works in the Lower Waitaki River comes from three sources, with subsets shown as follows:

- Environment Canterbury
  Equal contributions from the Canterbury Regional Councils
    - Differential targeted rate (classified Lower Waitaki River Rating District (Canterbury)),
    - Works and Services Rate (uniform targeted rate over Waimate district),
    - General Rate (uniform rate over Canterbury region),
• Otago Regional Council
  o Differential targeted rate (classified Lower Waitaki River Rating District (Otago)).

The ratio of total rate collected from the Canterbury and Otago region’s parts of the two classified rating districts is in proportion to the total capital values of the properties within each classified district.

• Meridian Energy

Direct contribution equal to two times the sum of the differential targeted rates levied by Canterbury and Otago Regional Councils. This applied until 1999, after which the two new (Otago/Canterbury) classifications applied. Between 1999 and 2015, this was been applied as if Otago had adopted the Canterbury rates model, i.e. as if the targeted Otago rate was 33% of the rate Otago share of the rate. From 2015/16, when the Canterbury targeted rate/general rate/works and services rate proportions were changed, Meridian has been asked for 40% of the total income as had been the case when the agreement was drawn up.

Meridian Energy’s contribution was negotiated in 1992 with ECNZ (the then manager/operator of the Lower Waitaki hydro electric power stations) and is their contribution towards the costs of maintaining the river control scheme. It is based on the level of damage done by the normal operation of the power generation (elevated low flows, suppression of flood flows and rapid and frequent fluctuations in flow rate.) and the added difficulties involved in working in a river with artificially elevated ‘low flows’.

Meridian Energy’s contribution is for scheme works only and is not intended for remedial works perceived to be caused by their management or mismanagement of river and flood flows outside the framework of the scheme objectives.

Meridian Energy’s grant portion is in fixed proportion to ratepayer contributions and increases or decreases in a fixed manner depending on the size of the rates levied.

<table>
<thead>
<tr>
<th>Funding Ratios</th>
<th>Canterbury</th>
<th>Otago</th>
</tr>
</thead>
<tbody>
<tr>
<td>Differential targeted rate</td>
<td>42%</td>
<td>60%</td>
</tr>
<tr>
<td>Works and Services rate</td>
<td>9%</td>
<td></td>
</tr>
<tr>
<td>General rate</td>
<td>9%</td>
<td></td>
</tr>
<tr>
<td>Meridian Energy</td>
<td>40%</td>
<td>40%</td>
</tr>
</tbody>
</table>

1.6 Assets Being Protected

The capital value of the area receiving scheme protection in the Canterbury area is $191m (June 2012), with a further $160m (June 2012) in a separate Otago Regional Council rating district. The two rating districts pool their resources and are managed as one.

1.7 Maintenance Expenditure

Part A, Appendix B shows expenditure for the years 2009-14. The average expenditure in this period on maintenance has been $669,900 per year.
Expenditure in the 2009/10 year and 2011/12 was elevated as a result of repair works following the floods of 2009 and 2011. The budgeted expenditure for 2014-19 averages about $505,000 per year.

An annual programme of maintenance will be prepared each year. This programme will be discussed with a liaison committee of ratepayer representatives, prior to adoption by the Council for inclusion in the Annual or Long Term Plan. The programme will typically be based on a normal maintenance requirement with the asset manager having the authority to rearrange as necessary. Approval will be sought from the liaison committee and the Council for proposed expenditure exceeding the annual budget by more than 10%.

In preparing the annual maintenance programme consideration will be given to:
- Works identified as necessary.
- Works that can be anticipated given a 'normal' season.
- Flexibility to meet unbudgeted damages.
- Affordability.
- Environmental effects.

1.8 Resource Consents

The following Resource Consents are held by the Canterbury Regional Council issued under the Resource Management Act 1991 to enable scheme works to be undertaken on the Lower Waitaki River.

Resource Consent No. CRC054296
- Granted: 26 August 2005
- Expires: 26 August 2015 (continuing under s124)
- Purpose: To disturb the bed of a river.

Resource Consent No. CRC981580
- Granted: 21 February 2002
- Expires: 21 February 2022
- Purpose: To discharge herbicides.

1.9 Maintenance Standards

The objectives of the scheme are:
- To maintain a cleared fairway below the Waitaki Dam of 400 metres at Kurow, increasing to 700 metres at the coast.
- To maintain an active riverbed generally 1000m wide at Kurow, increasing to 1300m wide at the coast.
- To limit erosion of the active bed vegetated margins.

Maintenance aims to provide for:
- The containment of flows up to 800 cumecs within the cleared fairway, and 1700 cumecs within the river system (fairway plus vegetated berms) between Kurow and the sea
- To minimise, within financial constraints, lateral erosion directly affecting developed farmland.

The maintenance works comprise the systematic spraying of the cleared fairway on a three-year rotation on a rolling programme to eliminate crack willow infestation of the
island bars. Aerial spray application is done by helicopter, with follow-up hand application where necessary.

Where stranded willows pose a threat in terms of flow diversion, island bar formation or bank erosion, snagging is undertaken to remove the trees to safer locations, either for destruction or incorporation into bank protection works.

A limited number of pilot cuts are undertaken where it is evident that such activity will provide immediate and necessary relief to active erosion sites and there is a reasonable likelihood that such action will provide longer-term benefits (weeks, months). Similar diversion works are undertaken to dewater sites to enable protection works to be constructed and established.

The establishment of primary vegetated protection in the area between the cleared fairway and the boundary of the active riverbed is sought to be achieved through the retention of existing vegetation (willow, gorse, broom, flax, toi toi, sedge) and the strengthening of it through lopping, layering and tying of willows and the planting of more appropriate willow species. Fairway edge stabilizing involves lopping, layering and tying of willows and the planting of selected willow species on a 10-year rolling programme for the whole river.

Maintenance of groynes and replacement or repair of dislodged rock rip-rap facing is restricted to selected structures that are deemed to play an integral part in the achievement of the primary scheme objectives. Other structures that do not fulfil this role are considered redundant and scheme funds are not used for their maintenance.

Shingle extraction management is carried out to help meet the schemes objectives, however demand for gravel is relatively small compared to the size of the river.

Systematic removal of vegetation along the fairway margin by land development activities is of major concern and reduces the performance of the scheme, not only on the property concerned, but also on those downstream. Removal of vegetation from this buffer zone exposes the margin, berm and terrace lands beyond and the developments (such as fencing, tracks and irrigation races) to erosion and flooding. In addition, permanent fencing associated with this land development is cutting off access to the river and making maintenance more difficult and expensive.

In Canterbury, the Flood Protection and Drainage Bylaw 2013 (under the Local Government Act 2002) was introduced to manage, regulate and protect flood protection and flood control works belonging to or under the control of the Canterbury Regional Council from damage or misuse. The Bylaw controls activities that may affect the integrity or effective operation and maintenance of the flood protection and flood control works. A permit is required for certain activities that can affect the works, including:

- Altering or obstructing drains and floodways, and access to them
- Activities that interfere with or damage drains, erosion protection plantings, stopbanks, groynes, hydrological recording equipment or survey benchmarks etc

(Resource consent or further authorisation may also be required from the Canterbury Regional Council, relevant territorial authority or the Department of Conservation to carry out these activities).

A similar Flood Protection Management Bylaw was introduced in Otago in 2012.
Environment Canterbury and the Otago Regional Council also have powers relating to the maintenance of the scheme (land entry, disposal of drain cleanings etc) under the Soil Conservation and Rivers Control Act.

Environment Canterbury (and Otago Regional Council?) has the policy of recovering damage repair costs on behalf of the rating district from landowners where that damage is caused by the landowner's action or inaction. Prosecutions can be made under the Soil Conservation and Rivers Control Act or the Local Government Act.

From time to time, landowners wish to carry out works to a standard higher than those provided under the scheme, to work on groynes and ponding banks deemed superfluous to the scheme or to provide structures which are not considered a primary benefit to the scheme. In these situations, arrangements may be made to have the works undertaken by the Canterbury Regional Council works section at the cost of the promoter. The responsibility for acquiring the necessary resource consents prior to construction rests with the landowner as does the on-going repair and maintenance.

Best practice for managing infrastructure assets (as required by the 2002 Local Government Act) is being applied and this is starting to identify issues that the district will need to address.

In the times that schemes such as this were set up, landowners willingly agreed to give up the use of a portion of their land for the collective and individual benefit that they would receive from the proposed works.

This land is often not viewed in the same way by current owners as it was when the scheme was set up and the effectiveness of the scheme is being threatened. The most significant need is to develop a plan that defines the berm planting zone that is needed to meet the performance requirements of this scheme and put measures in place to ensure that the rating district receives the level of protection it requires. This is being addressed through the establishment of the Flood Protection and Drainage Bylaw 2012. An equivalent bylaw is also proposed in the Otago region.

1.10 Development proposals

Project Aqua was a proposed hydro power scheme investigated by Meridian Energy during the period 2000 – 2004 and finally abandoned at the stage resource consents had been applied for but not processed.

The scheme proposed diverting flows from below the Waitaki Dam to a canal on the south bank of the Waitaki and generating power at six stations between Kurow and state highway one with the flows being returned to the river above SH1.

One of the effects of this scheme would have been to lower the ‘normal’ flows in the river bed, modifying the shingle carrying and vegetation control effects of those flows.

The investigations into this project produced significant studies into the geomorphic impacts, coastal effects and vegetation impacts on the river system both from the existing regime and the regime if Project Aqua was built. The investigations and discussions also raised public awareness and expectations for the future of the river and development opportunities to enhance recreation and commercial use of the river bed.
This expectation and/or other development proposals, including Hunter Downs Irrigation, North Bank Tunnel and other water abstraction consents could require a modification to the level of service, funding, and objectives of the Lower Waitaki River Control Scheme in the future.

Section 2: Service Levels

2.1 Objective

To maintain the Lower Waitaki River system downstream of the Waitaki Dam so that it has the capacity to convey a flow of up to 1700 cumecs before over-flowing onto adjacent berm and terrace lands flanking the active bed and to limit erosion of the active bed vegetated margin.

2.2 Historic flood sizes

The following floods have been recorded or estimated over recent years.

Waitaki River at Kurow.
26/11/57  1735 cumecs
23/12/84  1825 cumecs
15/12/95  2956 cumecs
30/4/09   1400 cumecs
19/5/09   1545 cumecs
1/1/11    1740 cumecs
9/2/11    1550 cumecs
14/1/13   1215 cumecs

2.3 Potential Damage

River control works are constructed in a very high-energy environment with the purpose of resisting and absorbing some of that energy. No matter what the standard of maintenance, damage to such systems is inevitable.

The active riverbed, comprising cleared fairway and vegetated buffer zone (including groynes and ponding banks), is the area where erosive activity is at its greatest and where major exposure to damage exists. Damage can arise in flood events above the mean annual flow of 850 cumecs (controlled by hydro developments) or when periods of extended high flow occurs (600 cumecs/4 weeks or more). NB: Floods on the Lower Waitaki River can occur either from:

(a) Controlled releases through the hydro lake system, or
(b) The routed outflows from Lake Ohau, Pukaki and Tekapo merging with flows from the Ahuriri, Otamatapaio, Otematata Rivers and other smaller mid catchment tributaries, or
(c) Lower Catchment tributaries, primarily Hakataramea, Kurow, Maerewhenua, Otiake, Otekaieke, Penticotic, Elephant Hill, Awamoko and Henderson-Waikaura Diversion Channel.

Generally upper catchment floods are generated by nor-west conditions and snow melt in the main divide and do not coincide with lower catchment floods, which occur
primarily from south-south east storms. The possibility does exist for great floods to occur from outflows from both parts of the catchment where nor-west systems back to the south-south east and the lagged outflow from the upper catchment results in super-positioning of flood peaks with lower catchment flows. Some opportunity exists through the use of catchment hydro storage to modify up-country inflows by routing them through the hydro lakes storage and reducing downstream flow levels. The opportunity for such intervention will depend on the availability of up-catchment storage, event size, rainfall, forecasts and energy demand/supply factors. Flow modification of this kind is at the sole discretion of Meridian Energy.

An assessment of maximum damage potential in a single flood event is $4.5m or about 35% of the value of the scheme assets (May 2014, refer to Part A, Section 5.2 and Appendix D).

2.4 Reporting On Performance Levels

The monitoring and reporting procedure outlined in Section 3 (and Part A, Section 7.4) will be used to assess the standard of maintenance carried out and the performance of the scheme.
Section 3: Reporting

3.1 Annual Asset Management Plan Compliance Report For Lower Waitaki River Rating District

The asset management plan adopted by the community and Environment Canterbury:

- Defines the service level for the Lower Waitaki River Rating District
- Defines the level of maintenance needed to retain the service capacity of the rating district's river control assets managed by Environment Canterbury
- Provides a base against which the Council's performance in maintaining the service capacity of the rating district's river control assets can be measured
- Requires Environment Canterbury to report to the rating district's liaison committee annually.

The matters to be reported to the rating district's liaison committee annually are:

<table>
<thead>
<tr>
<th>Action required</th>
<th>Report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepare maintenance programme and budget.</td>
<td>As presented to liaison committee meeting on…………………….........</td>
</tr>
<tr>
<td></td>
<td>Copy attached to minutes of the meeting.</td>
</tr>
<tr>
<td>Prepare ten-year forward projection of maintenance and funding requirements.</td>
<td>As presented to liaison committee meeting on……………………………..</td>
</tr>
<tr>
<td></td>
<td>Copy attached to minutes of the meeting.</td>
</tr>
<tr>
<td>Report on works undertaken and costs.</td>
<td>As presented to liaison committee meeting on……………………………..</td>
</tr>
<tr>
<td></td>
<td>Copy attached to minutes of the meeting.</td>
</tr>
<tr>
<td>Inspect all groynes and ponding banks for erosion, damage, or active berm erosion. Report on inspection, noting all cases of erosion of these structures or berm erosion within 100 m of these structures and the programme for dealing with these problems.</td>
<td>No erosion of groynes, ponding banks, or active berm erosion within 100 m of these structures observed, or ..................................................................................................................</td>
</tr>
<tr>
<td></td>
<td>Programme for spraying and snagging as presented to liaison committee on …………………………….</td>
</tr>
<tr>
<td>Inspect the cleared fairway and assess the extent of willow growth and prepare a programme for spraying and snagging.</td>
<td>Programme for spraying and snagging as presented to liaison committee on …………………………….</td>
</tr>
<tr>
<td>Inspect the vegetated active bed margin for signs of active erosion and prepare a programme for remediation.</td>
<td>Programme for remediation of active erosion of vegetated active bed margin as presented to liaison committee on …………………………….</td>
</tr>
<tr>
<td>Report on condition of system to liaison committee. Report to specifically identify any deferred maintenance that will impact on the performance of the scheme.</td>
<td>The protection system is in ................. condition, (however future issues will be ............) No maintenance which will impact on the performance of the scheme has been deferred, or Deferred maintenance comprises .......... And the effect on the performance of the scheme is likely to be .................</td>
</tr>
<tr>
<td>Report to liaison committee on the performance of the river control system for floods exceeding 1700 cumecs at Kurow.</td>
<td>No floods exceeding 1700 cumecs at Kurow have occurred over the last 12 months, or: As presented to liaison committee meeting on…………………………….. Copy attached to minutes of the meeting.</td>
</tr>
</tbody>
</table>

Prepared by .........................................................(Area Engineer) ......................... Date
3.2 Six Yearly Asset Management Plan Compliance Report For Lower Waitaki River Rating District

The asset management plan adopted by the community and Environment Canterbury:
- Defines the service level for the Lower Waitaki River Rating District
- Defines the level of maintenance needed to retain the service capacity of the rating district's river control assets managed by Environment Canterbury
- Provides a base against which the Council's performance in maintaining the service capacity of the rating district's river control assets can be measured
- Requires Environment Canterbury to report to the rating district's liaison committee six-yearly.

The matters to be reported to the rating district's liaison committee at six-yearly intervals are:

<table>
<thead>
<tr>
<th>Action required</th>
<th>Report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Review asset management plan.</td>
<td>As presented to liaison committee meeting on…………………………….. Copy attached to minutes of the meeting.</td>
</tr>
<tr>
<td>No cross sections where the width of protection planting has reduced by greater than 20% of previous survey unless programmed.</td>
<td>The width of protection planting has not reduced by greater than 20% of previous survey, or</td>
</tr>
<tr>
<td></td>
<td>...........................................................................................................</td>
</tr>
<tr>
<td>No cross section where more than 15% of the active bed is obstructed by vegetation greater than 2m in height.</td>
<td>No more than 15% of the active bed is obstructed by vegetation greater than 2m in height, or</td>
</tr>
<tr>
<td></td>
<td>...........................................................................................................</td>
</tr>
<tr>
<td>No reduction in quantities of infrastructural assets unless a reduction was identified as intended in the asset management plan.</td>
<td>There has been no reduction in the quantities of infrastructural assets, or</td>
</tr>
<tr>
<td></td>
<td>Reasons for and the reductions in quantities of infrastructural assets are as presented to liaison committee meeting on…………………………….. Copy attached to minutes of the meeting.</td>
</tr>
</tbody>
</table>

Prepared by ………………………………………………(Area Engineer) ………………….. Date