Progress of the Canterbury Water Management Strategy and some emerging issues

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SUMMARY

This paper reviews the progress to date of the Canterbury Water Management Strategy and identifies key developments and emerging issues. The paper examines the provision of storage, water use efficiency, environmental flow adjustments, nutrients from land use intensification, biodiversity enhancements and kaitiakitanga. The collaborative process has led to some more sustainable changes. One is the use of off-river storage and tributary storage as alternatives to mainstem storage. A second is improved environmental flow regimes by increasing minimum flows and reducing allocations at low flows; but enabling access to allocations at higher flows and providing time to adjust to new requirements.

The parallel achievement of reduced nitrate loads and increased irrigation areas is proving problematic. Water use efficiency is advancing on some fronts – piped distribution replacing canal distribution and ongoing conversions to spray irrigation – but not on others – soil moisture demand irrigation and reallocation of surface and groundwater use to enhance recharge. Biodiversity enhancements and incorporating kaitiakitanga in water management are showing positive progress.

Some of the key emerging issues include the allocation of nitrate capacity between existing and new users, and, the need for increased capacity for predictive modelling and field measurement to improve management of the use of scarce water and the cumulative effects of its use

Key Words: water storage, water use efficiency, nutrient management, biodiversity, kaitiakitanga

INTRODUCTION

The Canterbury Water Management Strategy (Canterbury Water 2009) was introduced as a new way of working through collaborative approaches because of the failure of the Resource Management Act processes to generate sustainable management solutions to water management issues in the region. Success with catchment scale informal collaborative approaches led to a more formal regional nested approach. This involved the establishment of a regional committee (RC) to address regional issues through the preparation of a regional implementation programme (RIP) and 10 zone committees (ZCs) to address sub-regional and catchment issues through zone implementation programmes (ZIPs). These programmes are considered by the regional council for incorporation in a nested Regional Land and Water Plan.

All ZIPs have now been prepared and the RIP is close to finalisation. This paper considers the progress of the CWMS and the changes to water management in the region from the collaborative processes at the zone and regional levels, the statutory decisions on regional plans incorporating the outcomes of collaborative approaches, and private sector and industry initiatives that have been influenced by the strategy. The CWMS identifies 10 target areas for parallel development. This paper considers the following areas: (1) increased water availability through provision of storage and water use efficiency while addressing environmental flow requirements; (2) the reduction of nutrients from land use intensification; (3) biodiversity enhancements; and, (4) the incorporation of kaitiakitanga into water management.

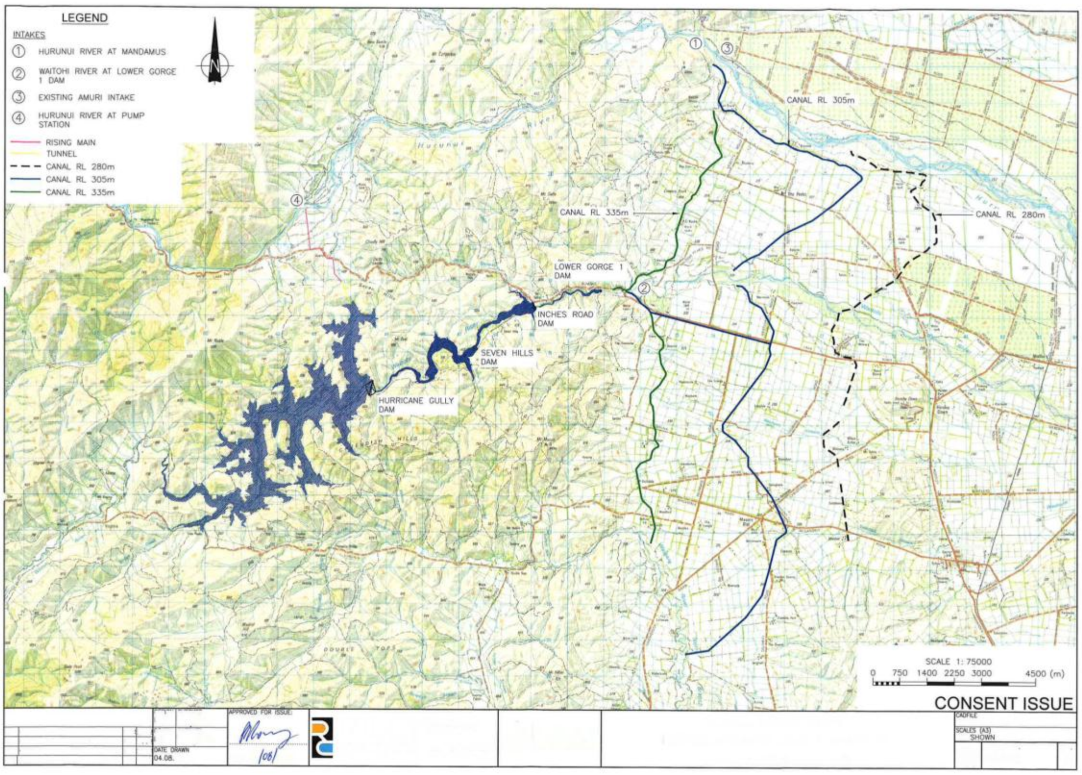
PROVISION OF STORAGE

While storage was seen as a key component of addressing water availability issues in Canterbury, there have been concerns with the sustainability some of the more cost effective forms of storage such as dams on the mainstems of braided rivers (Jenkins 2007). Storage proposals like the dam on the south branch of the Hurunui River (part of the original consent application for the Hurunui Water Project) are in areas of high naturalness, modify downstream flow and sediment transport, have downstream effects on braided character and increased algal blooms, as well as affect recreational uses. Proposals on foothill rivers were also contentious, such as the Orari River (by Rangitata South) which would flood the Orari gorge, and, the Wainiwaniwa River (part of the consent application for the Central Plains scheme).

Collaborative decision processes led to different approaches to storage in the case of the Rangitata South and Hurunui Water Projects (Jenkins 2013). Both processes led to alternatives which were superior in terms of sustainable management, lower impacts and greater community acceptance. Instead of a dam on the Orari River, the alternative of an off-river storage involving the capturing of high flows from the Rangitata River evolved (Figure 1).This is 16.6m m^3 storage capacity (at a cost of $82m) to irrigate 14,000ha with withdrawals when river flows exceed 110m^3/s. In the case of the Hurunui Water Project the alternative of a series of storages on the Waitohi River (a tributary of the Hurunui River) with diversions from the Hurunui River (Figure 2) was selected by a collaborative process. This has a possible capacity of 210m m^3 to irrigate 60,000ha.

<u>Figure 1: Off river storage adjacent the Rangitata River under construction (Source: Timaru Herald)</u>

Figure 2: Waitohi tributary storage proposal Source: (Chris Hansen Consultants 2012)



There have also been private investments in storage, usually at a smaller scale. There have been many on-farm storages, e.g., on a 779ha dairy farm milking 1600 cows, a 2ha storage pond capable of holding 40,000 m^3 of water has been constructed as insurance against weather and water restrictions. The water is enough to irrigate pasture with a 585m centre pivot for 10 days. Irrigation schemes are also putting in storage to offset run-of-river restrictions. Mayfield Hinds Irrigation is constructing a 6.1m m^3 capacity pond at Carew to offset a 20% river restriction for 21 days. Waimakariri Irrigation Limited is seeking approval for an 8.2m m^3 storage at Wrights Road. This will hold enough water for 9 days of full irrigation flow to 18,000ha of farmland. Water will be stored when river flows are high and irrigation demand is low, and used when abstraction is on restriction at times of low river flow. The additional storage would have made the scheme fully reliable for 27 of the past 42 years. Without storage, the scheme would have been fully reliable one year in 42 years. In the dry conditions of last summer an estimated $30m of production was lost because of restrictions to irrigation supply.

WATER USE EFFICIENCY

The CWMS identified opportunities for water use efficiency improvements at the property scale, the scheme or delivery scale, and, at the catchment scale which would reduce storage requirements while increasing water availability (Canterbury Water 2009). Inefficiencies have been identified (Jenkins 2012) in:

- Irrigation methods, for example, the use of centre pivots need between half (for soils with PAW 120mm) and a quarter (for soils with PAW 60mm) compared to border dyke irrigation;

- Application rates and macropore flow – where use of high application rates for irrigation cannot be retained in the soil profile and a substantial proportion passes through the soil to groundwater;
- Reliability of supply – where uncertainty of water availability encourages farmers to irrigate 'just in case' when water is available but not necessarily needed for crop requirements, rather than 'just in time' to meet crop requirements;
- Irrigation water distribution – where piped distribution can reduce water losses from open channel distribution;
- Spatial application of surface and groundwater by irrigating only with surface water in the upper part of a groundwater catchment in order to enhance aquifer recharge and irrigating with groundwater in the lower part of a groundwater catchment.

Water use efficiency has not been considered in detail in the Zone Implementation Programmes and is not one of the "priority issues" in the Regional Implementation Programme despite its significance in the CWMS. In the private sector there is a shift occurring to more efficient irrigation systems, for example, the Ashburton Lyndhurst Scheme was originally designed for border dyke irrigation now has 66% spray irrigation with a current conversion rate of 7% a year. However, little attention appears to have been given to the issue of application rates.

NIWA's work has highlighted the significance of reliability of supply (Duncan 2010). One analysis involved two farms: one with on-farm storage and one without (Figure 3). The analysis compared "ideal" and actual irrigation for the two farms[1]. When the scheme was unable to deliver water because the Waimakariri River was on restriction, the farm without storage was unable to irrigate whereas the farm with storage was able to irrigate when required. The farm with reliable supply was better able to match the "ideal" pattern of irrigation and makes more effective use of irrigation water. For the farm without storage, soil moisture was below 50% field capacity for 10 out of 35 weeks of the irrigation season; whereas the farm with storage was only below 50% of field capacity for 4 of the 35 weeks.

The regional council commissioned an economic analysis of improved reliability (MRB 2011). The analysis was for a mix of pasture for dairy, dairy support, arable and mixed farming with a shift from 80% reliability in water availability to 95% reliability. For the dairy farm considered this achieved an increase from 10,430 kgDM/ha/year to 12,960 kgDM/ha/year. The increased production would generate a 12.1% return with a storage cost of $3,750/ha or 7.9% return with a storage cost of $6,250/ha.

In mid Canterbury there have been projects to upgrade the original open channel system to a piped network to reduce conveyance losses. The Ashburton Lyndhurst scheme has completed the first stage of a piped delivery system and is proceeding with a second stage. The initial scheme (at a cost of $8m) replaced 31km of open channels with pipe servicing 3,500ha of irrigated land and enabling a further 550ha to be irrigated with improved efficiency. A second stage (estimated to cost $95m) involves more than 200km of pipe to supply the remaining 21,000ha of the scheme with the ability to supply a further 4,000ha and with 100ha of land currently in channels returned to productive

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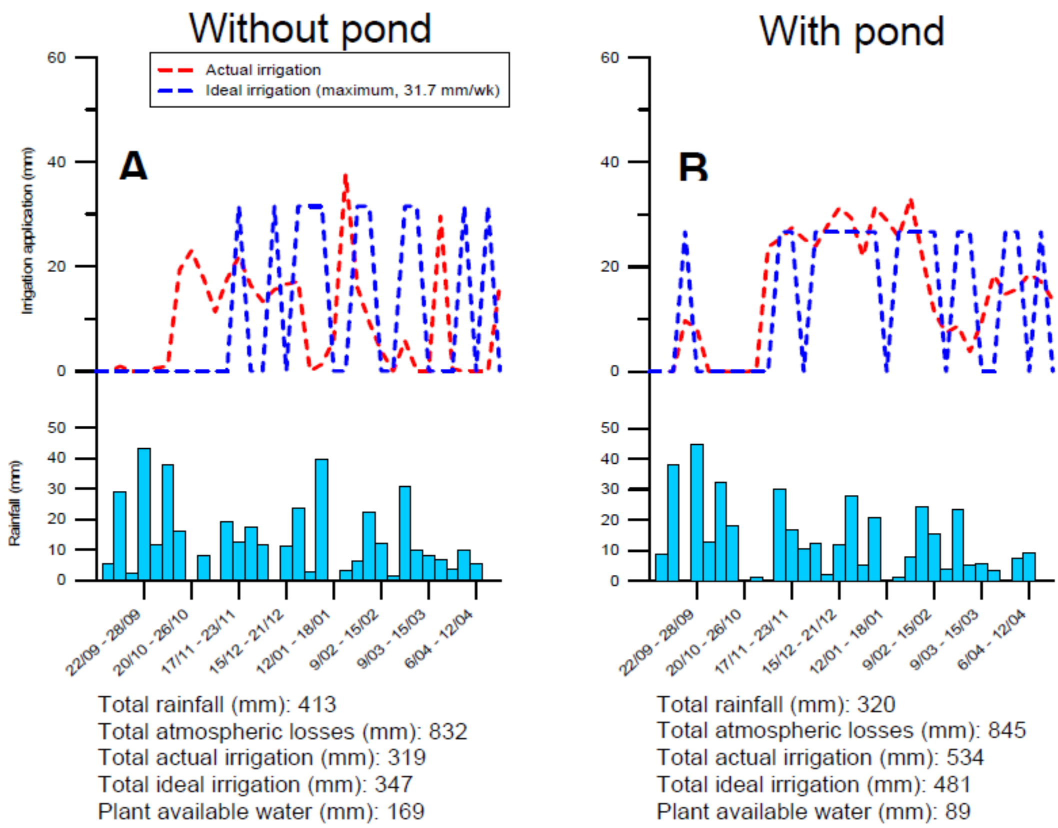
[1] Ideal irrigation was assumed to be irrigation when soil moisture fell to 50% of PAW and the soil was either filled to 80% or 31.8mm/week (whichever was the lower amount) and taking account of rainfall and PET at the sites based on NIWA's virtual climate network.

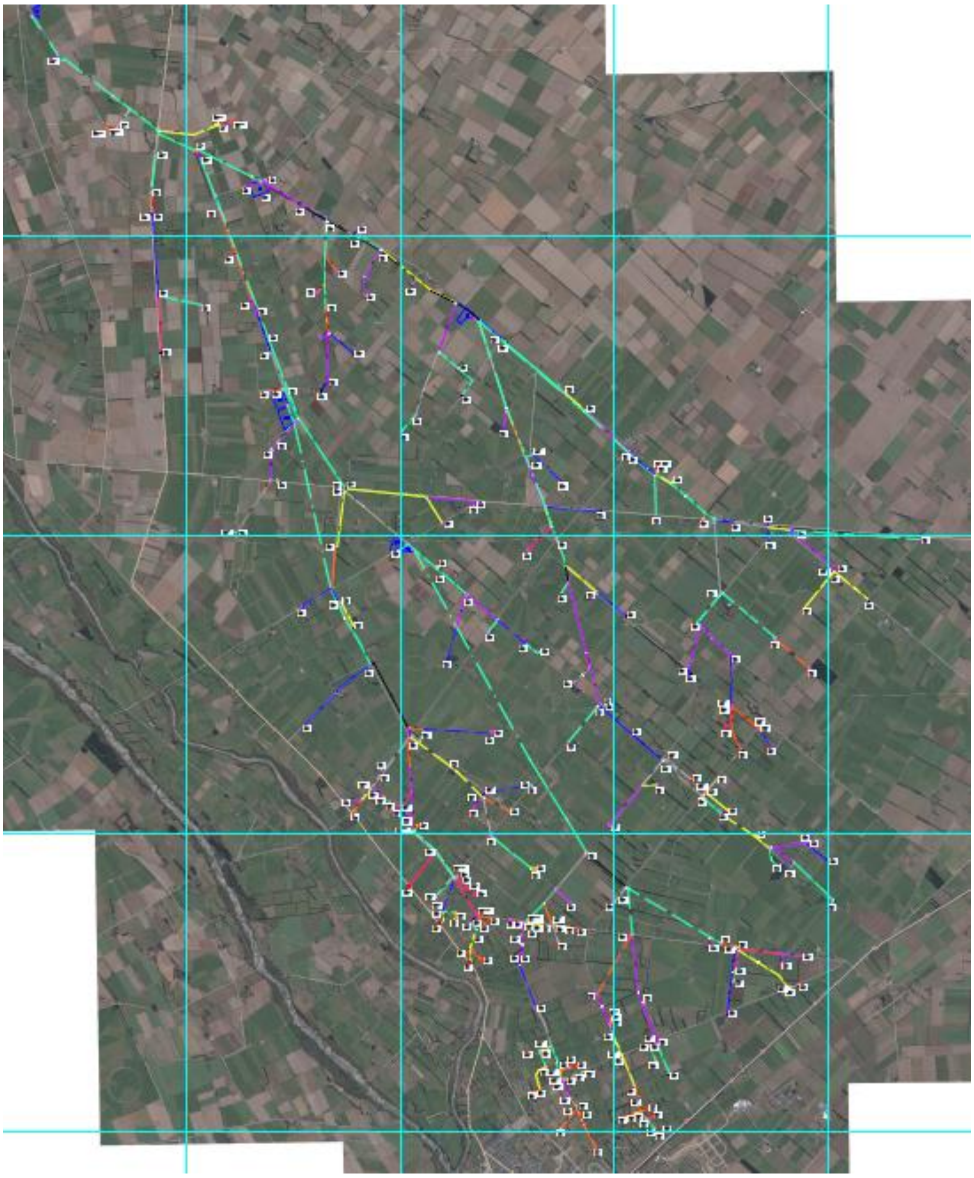
farmland. With the use of a pressurised pipe system there is a reduction in energy requirements for pumping irrigation water. Similar "pipe-replacement-of-open-channel" projects are in progress for the Valetta scheme (13,000ha of irrigated land) and the Mayfield Hinds scheme (32,000ha).

<u>Figure 3: Actual and Ideal Irrigation for Farms with and without Storage</u>



Changes in the spatial allocation of surface water and groundwater have not been incorporated in the regional implementation programme. However there are outcomes being influenced by the relationship between irrigation, surface water and groundwater. One outcome is the amount of irrigation recharge beneath and down gradient of irrigation schemes. The regional council studied the effects of changes in groundwater level downstream of the Valetta Scheme due to shifts from border dyke irrigation to more efficient irrigation methods (Davey 2006). The study showed in periods of low winter rainfall many bores dropping in level over winter and recovering in summer due to infiltration losses from inefficient border dyke irrigation and rainfall on saturated irrigated paddocks (Figure 5). However the study also showed that recharge from the Valetta Scheme was declining (Figure 6). With increasing groundwater use and declining recharge, the expectation is for further decline in groundwater levels. The extent of recharge is important because groundwater recharge from irrigation that has infiltrated past the root zone has been incorporated into the available allocation.

Figure 4: Ashburton Lyndhurst Irrigation – Stage 2 Pipe Replacement of Open Channel Project
Source: Ashburton Lyndhurst Irrigation Scheme



The recent Addendum to the Selwyn Waihora Zone Implementation Programme (Selwyn Waihora Zone Committee 2013) recommends the need for the Land and Water Plan to recognise the strong connection between groundwater and surface water in the Canterbury Plains by managing takes of groundwater and surface water as a combined resource. In particular it is noted in the Addendum that Central Plains Water intends to use "alpine" water from the Rakaia and Waimakariri Rivers to irrigate 30,000ha of dryland (i.e. new irrigation) and replace groundwater takes on 30,000ha of currently irrigated land. This will improve flows in lowland streams and lower reaches of foothill rivers, and provide the opportunity to revise groundwater allocations downwards to address earlier overallocation decisions of independent commissioners. The Addendum also recommends use of managed aquifer recharge to maintain groundwater levels and flows in spring-fed lowland streams.

Figure 5: Decline in groundwater levels within three shallow bores down gradient of Valetta Scheme (1975-2007)

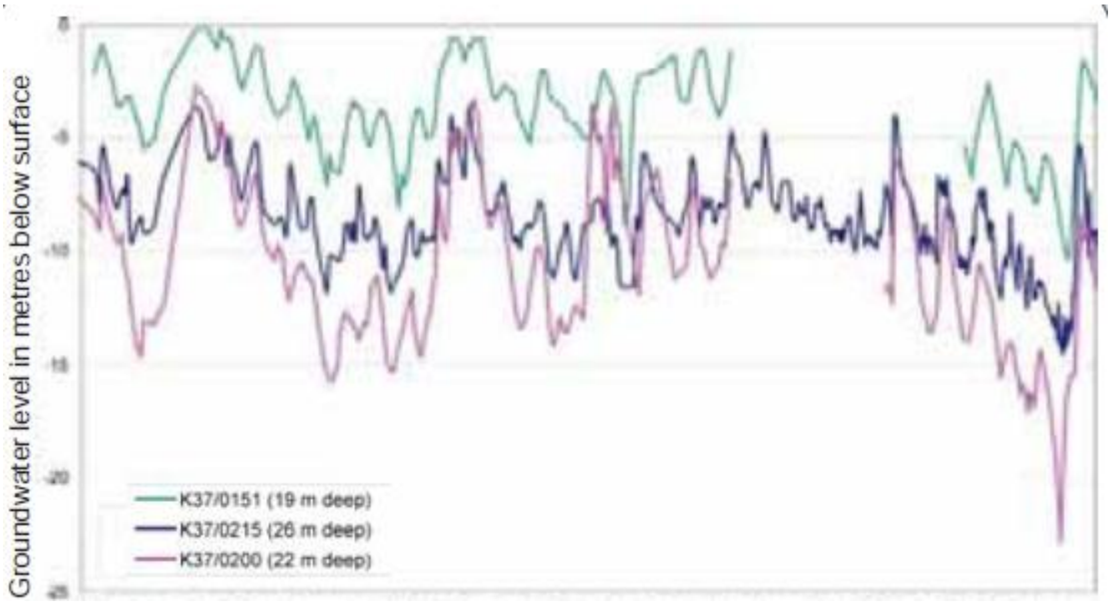
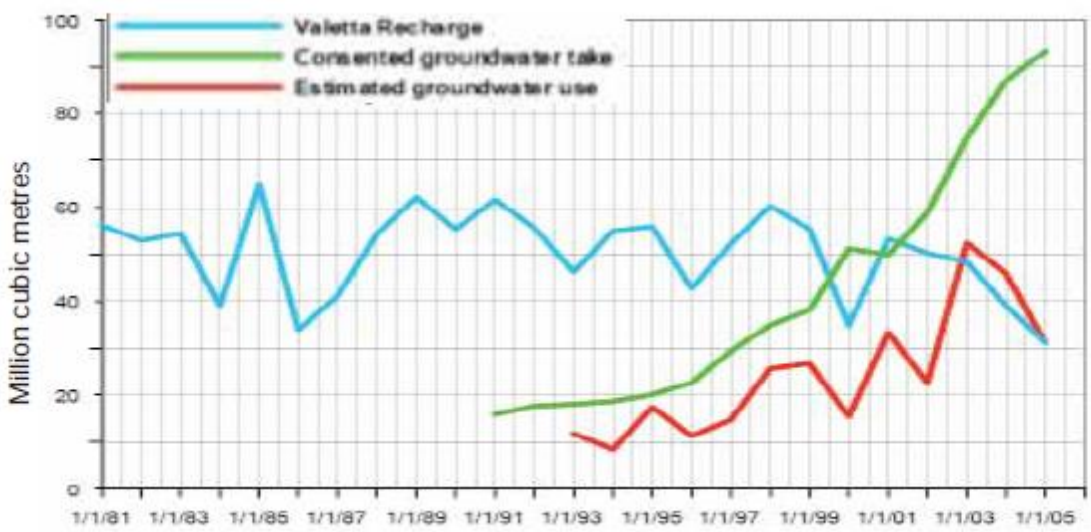


Figure 6: Groundwater use, Recharge and Consented use for Valetta Scheme (1981-2006)



ENVIRONMENTAL FLOW ADJUSTMENTS

Restrictions on the volume that can be taken from the rivers at different flows is the most significant mechanisms for maintaining instream environmental values, such as, aquatic ecology, recreation, natural character and cultural values. Ecologically important components include: minimum flows (the flow at which takes are restricted), flushing flows (flows needed for algae removal from the river bed), flood flows (flows needed for sediment transport and maintaining braided character), and allocation limits (the limit on the volume that can be taken at a particular flow). These components are given statutory backing in regional plans and consents.

Over the past ten years the regional council has been undertaking a review of environmental flow requirements of about 250 environmental flow monitoring points in the region. Many of the minimum flows had been set by catchment boards and have been found to be too low based on more detailed scientific assessments. Attempting to raise minimum flows and lower allocation limits through regulatory processes under the RMA had been contentious. However collaborative processes have achieved some success in addressing environmental flow requirements.

One example is the Pareora catchment. The minimum flow had been set by the catchment board at 300 L/s (which is 45% of the 7 day mean annual low flow) and the total allocation is 940 L/s (which is 142% of the 7 day mean annual low flow). Desirable environmental flow requirements are for a minimum flow of 600 L/s (90% 7DMALF), an A Block allocation limit of 198 L/s (30% 7DMALF), and a flushing flow of 4,900 L/s (three times the median flow).

The outcome of the collaborative process (Environment Canterbury 2010) that commenced in 2005 was to:

- Set the A Block allocation to 30% 7DMALF (198 L/s compared to the existing 940 L/s) but apply the limit in five years' time;
- Create an alternative allocation at a higher flow (1,600 L/s – median flow) for existing users as a source of water for storage;
- Establish a limited B Block allocation (2,500 L/s) with a minimum flow above the flushing flow (5,000 L/s);
- Increase the minimum flow from 300 L/s for total cessation of takes to 370 L/s and increase partial restriction from 400 L/s to 470 L/s;
- Encourage the major user, Timaru District Council, to secure its community supply from an alternative source during the critical period for fish (Oct-Nov) so that the minimum flow can be raised to 440 L/s and partial restriction to 540 L/s; and
- Foreshadow future reviews to further increase minimum flows.

These recommendations were incorporated in the draft Pareora Regional Plan, were effectively endorsed by the hearing commissioners, and, are now in the operative plan.

The collaborative approach has some interesting outcomes:

- There are improvements in environmental flow specifications compared to a previous overallocation. They are not to the full extent of desirable environmental flow requirements but come at a cost to existing users.
- Alternative water allocations at higher flows were incorporated to address the loss of access to water at lower flows for existing users but would require storage.
- The imposition of more restrictive requirements was delayed to allow existing users time to make adjustments to their water infrastructure and management
- Provision has been made for future users but at flows above flushing flows and with low reliability of supply.

REDUCTION OF NUTRIENTS FROM LAND USE INTENSIFICATION

One of the key findings of the CWMS was that if there are to be substantial increases in land uses associated with nitrate leaching then there must be a corresponding decrease in nitrate leaching from existing land. Regional scale modelling indicated that it would only be possible to increase agricultural output while maintaining groundwater quality within acceptable limits as long as land management technologies that reduce nutrients and contaminants are applied across the region. To achieve this outcome would require existing users of water as well as new users to adopt the improved land management practices and technologies.

Two of the Zone Implementation Programmes (ZIPs) have addressed the issue of nutrients: the Hurunui-Waiau (Hurunui Waiau Zone Committee 2011) and the Selwyn-Waihora (Selwyn Waihora Zone Committee 2013). The more detailed analysis of nutrients associated with land use intensification has confirmed the earlier regional analysis.

The Draft Hurunui-Waiau ZIP considered the results of the more detailed analysis of the Land Use and Water Quality Project led by the regional council. It considered that the current water quality of the two sites on the mainstem of the Hurunui (confluence with the Mandamus River and SH1) was acceptable and should be maintained, i.e. average annual load limits should be set at current levels. The ZC also believed that nutrient guidelines should be established for the main tributaries based on dissolved inorganic nitrogen (DIN) concentrations being maintained below the nitrate toxicity level (1.7mg/L) and dissolved reactive phosphorus (DRP) levels that existed in 1990-5. Annual load limits based on these criteria were compared with current estimated mean annual loads (Table 1).

<u>Table 1: Nutrient load limits and current estimates for Hurunui catchment in Draft ZIP</u>

Location	Nitrate (DIN)			Phosphate (DRP)		
	Target concentration (mg/L)	Annual load limit (t/year)	Current estimate (t/year)	Target concentration (mg/L)	Annual load limit (t/year)	Current estimate (t/year)
Hurunui @ Mandamus	current	40	40	current	3.6	3.6
Hurunui @ SH1	current	693	693	current	10.2	10.2
Pahau @ Dazells	1.7	182 +/- 23	196	0.0136	1.46 +/- 0.19	2.2
Waitohi	1.7	86 +/- 43	67	0.0056	0.28 +/- 0.14	0.35
St Leonards	1.7	68 +/- 3	133	0.012	0.48 +/- 0.02	0.6
Dry stream	1.7	53 +/- 16	14	0.012	0.4 +/- 0.12	0.5

Many of the proposed load limits are below current estimates. As reported by the ZC, there was considerable anxiety amongst intensive land users in the Zone about the impact on their financial viability.

The subsequent Draft Hurunui-Waiau Regional Plan (Enviroment Canterbury 2011) included annual load limits for the mainstem sites with the allowance that nitrate levels could temporarily increase up to 20% prior to 2017. This was to provide some headroom for 100,000 ha of irrigation to occur. The tributaries are covered by narrative statements and a policy to progressively set nutrient limits.

At the plan hearings the regional council submitted that land use change after 2017 that did not exceed 125% of the proposed nitrogen annual load limit or 110% of the proposed phosphorus limit should be a discretionary activity (i.e. require a consent). The dairy industry wanted a nitrogen load limit increased by 25% for 2012-2022 and by 50% after 2012. Other submitters argued that allowing any increase was inadvisable.(Enviroment Canterbury 2013)

With the Hurunui River considered to be phosphorus limited in terms of periphyton growth, the hearing commissioners recommended no increase in the phosphorus limit but allowed a 25% increase in the nitrogen limit. The increase in nitrogen limit of 25% would enable 18,600 ha to be converted from dryland sheep and beef farming to dairy. This would allow Ngai Tahu's proposed conversion of Balmoral forest to irrigated dairy (7,000ha) and Stage 1 of the Hurunui Water Project (15,000ha) to proceed if all remaining border dyke irrigation was converted to spray irrigation.

At the time of writing (August 2013), there were High Court challenges to these recommendations on legal grounds. In particular, North Canterbury Fish & Game have argued that the regional council erred in "undertaking a balancing of the risks associated with nitrogen limits imposed with enabling social and economic well being through irrigation"; the Hurunui Water Project have argued that the regional council has erred "in approving a plan which does not provide for the ability for nutrient loads to be allocated pending implementation of resource consents for the storage and reticulation of water".

The Selwyn-Waihora ZIP is at an earlier stage in the process. There has been a recent Addendum (21 July 2013) prior to regional plan formulation. The Addendum acknowledges the time delay between land use change and nitrate contamination reaching the Te Waihora / Lake Ellesmere and indicates a 35% increase in the current load of nitrogen in the next 10-20 years as a result of the effects of recent land use intensification. Lake modelling predicts that a 50% decrease in the current load of both phosphorus and nitrogen is needed to achieve the objective of a trophic lake index of 6.0 or less. A further reduction of 30% of current nitrogen load is predicted to be needed for returning the lake from its phytoplankton (algae) dominated state to a self-sustaining macrophyte (aquatic plant) dominated state. The current and forecast nitrogen loads are set out in Table 2.

Table 2: Agricultural load scenarios for Te Waihora catchment

Scenario	N Load (t/year)	Comments
Current	2,650	Excludes lag effects
2011 Baseline	4,100	Includes lag effects
With CPW and other intensification	5,600	30,000ha CPW irrigation plus other intensification
Proposed ZIP solution package	4,800	12.5% less than good management practice
Te Waihora targets	800	Macrophyte dominated lake

The current nitrogen load on the lake is estimated at 2,650 t/year. With the delayed effect of recent intensification current land use is estimated to generate a nitrogen load of 4,100 t/year. With additional 30,000ha of irrigated land with CPW and other intensification the load would rise to 5,600 t/year. The load to meet Te Waihora targets for a macrophyte dominated lake is 800 t/year. The proposed solution package in the ZIP Addendum targets 4,800 t/year. This represents a 12.5% improvement on "good management practice".

According to Dairy NZ, financial modelling indicates a 5% or less impact on farm productivity, reduction in milk production by 6-7% and a reduction in regional GDP of $30m. This can be compared with the CPW and other intensification which is estimated to contribute about $310m to regional GDP.

Financial modelling was also undertaken of 18 farms representative of land use in the catchment (AgriBusiness Group 2012). This was based on an Overseer analysis for carrying out mitigation strategies and running the results through a financial model for effects on cash position and total equity. The Overseer modelling highlighted the importance of soil type, with light soils showing much higher leaching rates than heavy soils: 65-80 kgN/ha/year for irrigated dairy farms on light soils compared to 15-31 kgN/ha/year for heavy soils. It also showed high leaching rates for irrigated dairy support farms on light soils: 40-52 kgN/ha/year.

In terms of the range of mitigation strategies considered, active water management and reducing stocking rates showed the greatest reductions (57% less nitrate for 15% less cows on light soils, and, 38% less nitrate for soil moisture demand irrigation on light soils). In terms of cost effectiveness, DCD use achieved 14% less nitrate with improved cash position and total equity. Active water management was achieved at low cost. Reduced stocking rates were achieved on improved cash position with reduced expenditure but reduced total equity.

Overseer 6.0 was used. This version incorporates soil drainage which was shown to be important for estimating leaching rates between light and heavy soils. However use of monthly steps and average climate conditions as well as the inability to accommodate water use efficiency limits the ability to model active water management strategies. The accuracy of the modelling of the farms was also highly dependent on data availability from the farmers involved.

BIODIVERSITY ENHANCEMENTS

One of the issues in the CWMS was the decline in freshwater biodiversity. There has been ongoing habitat loss and fragmentation of riparian habitat. Less than 10% of the region's previously extensive wetlands remain. Weeds have been replacing indigenous plants. The immediate steps biodiversity protection and enhancement project was launched in 2010 as an integral part of the CWMS with $2m/year available for five years with two thirds from regional rates and one third from landowners and other stakeholders. Projects of regional significance have been selected by the RC and each ZC recommends priority projects within their zone. The assessment criteria are based on the six goals of the Canterbury Biodiversity Strategy (Environment Canterbury 2008), e.g. to restore the natural character of degraded indigenous habitats and ecosystems, and, the ecological value of the project, e.g. ecological context: projects must provide a benefit to indigenous biodiversity and play an important role in the long term health of the wider ecosystem.

At the regional level three projects are being supported: the Te Waihora / Lake Ellesmere enhancement project, enhancement of the upper catchments of the Rakaia and the Rangitata Rivers, and, the Wainono Lagoon project. At the zone level, smaller scale projects of fencing, riparian planting, willow control and stream crossings are in progress.

KAITIAKITANGA

In the CWMS one of the first order priorities for water is customary use, one of the principles is tangata whenua, and, one of the outcome targets is kaitiakitanga. The practical goals in the CWMS include recognition of Ngāi Tahu Freshwater Policy on environmental flows, direct discharges, unnatural mixing of waters, and non-point source pollution control; involvement in restoration programmes for degraded wahi taonga and mahinga kai waterways; having Iwi Management Plans in place; improving local government capability in kaitiakitanga; and, establishing co-governance arrangements for the management of Te Waihora and its catchment.

Some of the tangible progress in addressing kaitiakitanga includes:

- A restoration programme for Te Waihora / Lake Ellesmere – Whakaroa Te Waihora – with funding contributions from central government ($6m) and regional government, the dairy industry and Ngāi Tahu ($5.6m combined).
- Rununga representation on the Zone and Regional Committees for preparing the Zone Implementation Programmes.
- A relationship agreement between the regional council and Nga Papatipu Runanga – known as Tuia – for ongoing collaboration in water management was signed in February 2013.
- The Mahaanui Iwi Management Plan (covering the area from the Hurunui to the Hakatere/Ashburton) was released in March 2013: the document includes the objectives (ngā paetae), issues of significance (ngā take) and policies to guide freshwater management in a manner consistent with Ngāi Tahu cultural values and interests.
- The undertaking of operational “on the ground” biodiversity projects with each of the 10 Papatipu Runanga as part of the immediate steps biodiversity projects.

There are also techniques being developed to incorporate Maori water management concepts into western-style approaches to water management. This includes concepts like State of Takiwa reporting, Cultural Health Index, and, Cultural Opportunity Mapping, Assessment and Response. The minimum flows to protect cultural interests are determined to be those thresholds to protect values such as mauri, mahinga kai and wahi taonga. Some of the cultural flow recommendations are above the minimum flows considered sufficient to provide for instream ecological values. For example, Waikekewai and Taumutu Creek are of high cultural significance and it is considered inappropriate to be abstracting water for irrigation from the catchment because of wahi tapu associations. The Selwyn Waihora ZIP Addendum recommends prohibiting, on expiry, of surface and groundwater takes that have a hydraulic connection to the creek, while enabling consent holders to move to deeper non-stream depleting groundwater sources.

In addition to the regional council led restoration projects there are also collaboration with private interests. For example the land owner of Minimoto Lagoon (near Amberley Beach), which has biodiversity and cultural significance, has recently withdrawn stock and fenced the wetland with support of the QEII Trust and Immediate Steps funding.

CONCLUSIONS AND EMERGING ISSUES

There has certainly been a significant change in the approach to water management in Canterbury with the introduction of collaborative processes for resolving water management issues. While it is still early days in terms of implementation, this paper has identified some different approaches.

Firstly in relation to water storage, there have been some innovative ways to be able to store water to access alpine water but without storages on mainstems. The off-river storage at Arundel and the tributary storage on the Waitohi represent changes in approach.

Secondly in relation to water use efficiency, the replacement of distribution canals with pipe and the continuing shift from border dyke to spray irrigation are improving water use efficiency. However there is insufficient attention to other aspects of water use efficiency, in particular the use of soil moisture demand management and the spatial reallocation of surface and groundwater to enhance recharge.

Thirdly with respect to environmental flows, collaborative processes have led to raising minimum flows and reducing allocations at low flows. These changes are not to the full extent of desirable environmental flows but they come at a cost to existing users. Collaborative outcomes have recognised the need for allocations at higher flows but involve storage for their effective use. There has also been the recognition of time needed for existing users to adjust.

The situation in relation to the fourth issue of nitrate levels is being shown to be problematic. Further irrigation will increase nitrate levels. Existing users will need to adopt better than good practice management and incur costs. However, the parallel targets of increased irrigated area and reductions in nitrate loads appear unlikely to be achieved. The question of how nitrate capacity is allocated between existing and new users is an emerging issue. Other emerging issues in relation to nitrate management include the high leaching rates of light soils and their suitability for intensification, and, the nitrate reduction potential of reduced stocking rates and improved irrigation management.

There is an opportunity cost associated with inefficient use of scarce resources with poor water use efficiency and with the constraints on new entrants from high nitrate loads from existing users. This is in addition to the $2.5b opportunity cost from “poor technology uptake” in the dairy sector identified in the briefing to incoming Minister of Agriculture (Ministry of Agriculture and Forestry 2011).

The target areas of biodiversity enhancement and kaitiakitanga are showing progress. However target areas that have taken off the regional priority list: drinking water, recreation and amenity opportunities, and, water use efficiency need attention.

It is noteworthy that the RMA processes to give statutory backing to projects and plans have been less contentious. In addition hearing commissioners are making decisions which are marginal changes to the collaborative proposal.

An emerging issue is the need to for improved integration of surface water and groundwater interaction. This includes the consideration of managed aquifer recharge as a form of storage, targeted recharge to maintain lowland stream flows, and spatial allocation of surface and ground water to enhance recharge.

Two other emerging issues from the CWMS implementation to date are the importance of modelling to predict outcomes both scientific and financial from the decisions being made, and, the related issue of the data available to operate and verify the models. With the need to manage more efficiently and to tighter limits predictive models and field measurement are essential. With increasing reliance on farm management plans and audited self management foreshadowed in the CWMS and now being incorporated into plans and consents the need for modelling and measurement will escalate.

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