

REPORT

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Subject: Surface Water Quality and Future Waterway Protection

1. Précis

Surface water quality in Otago is under threat from current and changing land use practices. Previous national reports have pointed to the intensification of farm land as a major cause of the deteriorating water quality in some of New Zealand's streams, rivers and lakes. This paper is divided into four, Parts A – C draw together current understanding of water quality and results from two areas of Council activity to enhance waterway quality while Part D provides recommendations from Parts A – C.

Part A of this paper reports on the Surface Water Quality State of the Environment draft publication (a copy has been circulated separately). Spatial and temporal trends in water quality from 77 sites monitored by the Council (between 1995 and 2006) are reported.

From the monitoring a spatial Water Quality Index shows that in general surface waters in Otago are good or very good, particularly in the mountainous country and the large lakes. However, some sites in the low pastoral country, especially those with tile and mole drainage, have fair or even poor water quality. The results are further analysed spatially including using the River Environment Classification System. Temporal trend analysis detected both improving trends for some parameters at some sites but also deterioration in other parameters at the same and other sites.

Water quality parameters and trends in water quality are discussed in relation to land use and recent land use changes. Intensification was seen as a major factor in some of the deterioration in water quality

Part B of this paper focuses on the findings from the SOE report that many streams in south and west Otago have only poor or fair water quality. The trend analysis also shows some of these streams deteriorating further. However, there are some water quality parameters which show an improving trend that can be linked to improved farming practices. A major part of the land use problem is seen as dairy farm effluent management, in particular on tile and mole drained land.

The water quality concerns in some of these streams have been known for a while and initiatives to date have included annual compliance inspections, legal actions, education through publications and field days and initiatives with industry and farmers.

To achieve water quality improvements the Council will need to continue to raise awareness of best management practice as well as take a more stringent compliance role

to farm dairy effluent discharges. Council is, and has been working, with the dairy industry to minimise impacts from dairying on water quality.

It is appropriate and timely to also address the impacts of other stock types on waterways. This is the purpose behind **Part C** of this paper.

It is widely accepted that intensive deer farming and beef operations, as well as stock (dairy, beef, deer, sheep) grazing on winter crops can have a detrimental effect on water quality and waterway health. **Part C** recommends that Council promotes two Otago wide targets for waterway protection:

1. 100% of waterways protected from intensive beef, intensive deer and dairy stock on non milking platforms by 2011 with interim targets of 30% by 1 May 2008, 50% by 1 May 2009 and 100% by 1 May 2011.
2. 100% of waterways protected from all intensively grazed stock on winter crops by 1 May 2009, with an interim target of 75% exclusion by 1 May 2008.

In many instances these targets will require fencing waterways. However, if farmers can demonstrate that the waterway is not detrimentally affected by their stock through other best management practices, or stock are excluded by natural barriers, fencing may not be required.

Part D draws all recommendations from Parts A – C for Council consideration.

It should be noted Parts B and C have focussed on a series of land use activities, but this is not intended to suggest that they are the only areas impacting on water quality, for example nitrate leaching in general from animal urine and dung is not discussed at this stage. Urban input, such as stormwater is also not included.

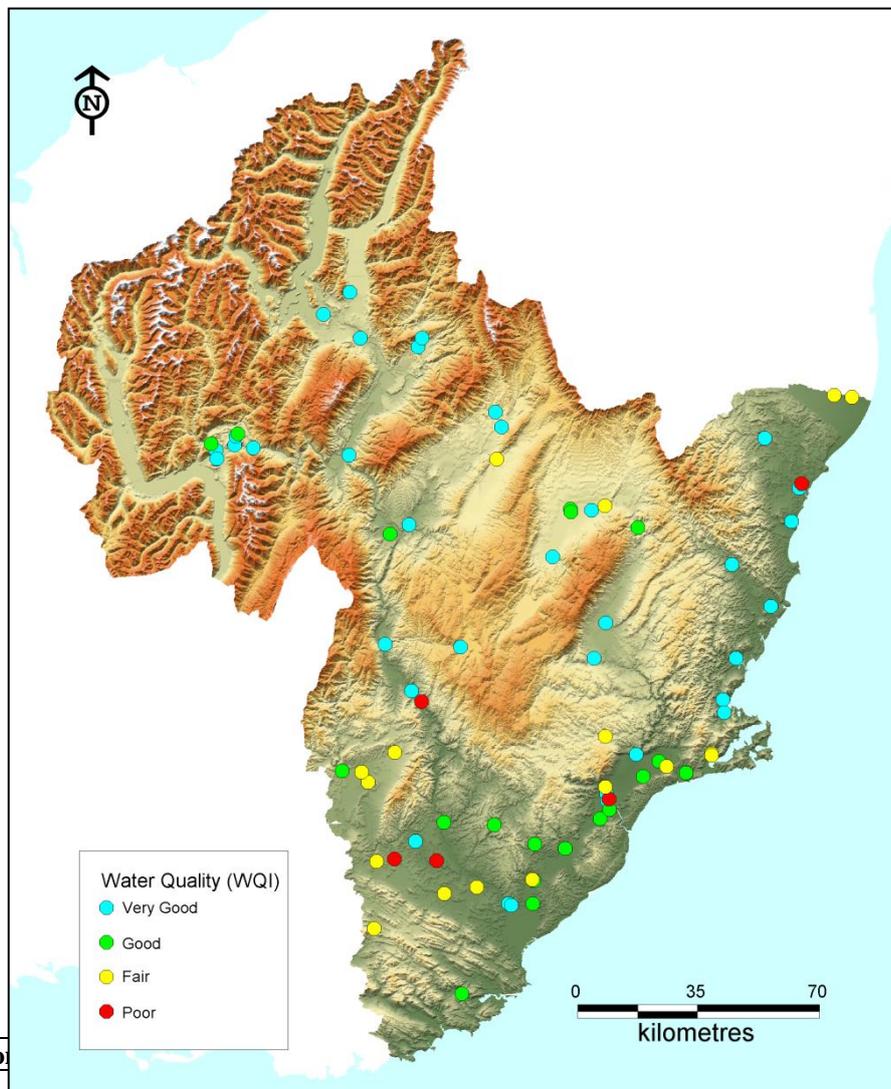
2. Part A: State of the Environment Surface Water Quality in Otago

A.1 Introduction

The state of the environment surface water quality monitoring has been reported with the primary objectives being an assessment spatially, by comparing results to national water quality guidelines using the Water Quality Index (WQI), and a comparison using the River Environment Classification (REC) system. Significant trends in water quality were also analysed and reasons for the trends discussed.

A.2 Spatial Analysis

Spatial analysis has been undertaken using four methods, the WQI, the River Environment Classification System (REC), hierarchical cluster analysis (HCA) and principal components analysis (PCA). The WQI classified sites into one of four categories, with the 'poor' category including the Waiareka Creek, Main Drain, Wairuna Stream and Washpool stream. Sites with the best water quality were generally in upper catchments of large rivers and the large lakes. The REC system further classified sites according to source of flow and land use. Water quality was best at sites with high or mountainous elevation and in areas of low intensity farming. Water quality was poorest in low elevation pastoral sites, particularly in areas that are prone to saturated soils and have a high occurrence of tile and mole drains (e.g. south and west Otago) catchment.



Classification	
Very Good	
Good	median values for five of the six variables comply with guideline values (DO is one variable which must comply)
Fair	median values for three or four of the six variables comply with guideline values.(DO is one variable which must comply)
Poor	median values for two or less of the six variables comply with guideline values.
WQI variables	
<i>Turbidity</i> – caused by suspended matter and interferes with the passage of light through water	
<i>DO</i> – important indicator of the ability of water to support aquatic life	
<i>DRP</i> – a growth-limiting nutrient affected by e.g. wastewater effluent, fertilizers and animal waste	
<i>NH4</i> – can be toxic to fish depending on temperature and pH conditions. Affected by runoff of animal wastes, dairy shed effluent and fertilizer	
<i>NNN</i> – nutrient essential for growth. Affected by e.g. wastewater effluent, agricultural runoff and animal wastes	
<i>E.coli</i> – indicator of faecal contamination, affected by e.g. wastewater effluent, animal waste, sediment load	

Figure 1. Water Quality Index classification for SOE sites monitored between January 2000 and June 2006.

A.3 Temporal Analysis

Temporal analysis, to detect trends in water quality over time, was undertaken. Overall the sites with a trend of declining water quality were in agriculturally intensive catchments, including tributaries of the Pomahaka which stand out as some of the worst sites (Washpool, Wairuna Stream, Heriot Burn, Crookston Burn). These sites had increasing trends in nutrient concentrations. The sites with few trends and generally excellent water quality are the large lakes (Wakatipu, Dunstan, Wanaka, Hawea) and the upper catchments of the larger rivers (Taieri at Stonehenge, Manuherikia at Blackstone Hill, and Pomahaka at Glenken).

A summary of water quality trend results is given in Section 6.8 of the main report.

A.4 Policy Requirements

There is a specific policies in the Regional Plan: Water (RPW) for the enhancement of water quality to support primary contact recreation (7.6.1). Eight of the sites listed in the RPW had >50% non-compliance with this target value. These sites included the Waipahi at Carins Peak, Minzion Burn, Washpool and Wairuna River which drain low elevation country whose agricultural activities are intensive.

3. Part B: Farm dairy effluent management and water quality in south and west Otago

B.1 Introduction

Instream surface water quality in South West (SW) Otago is of increasing concern. Intensive farming activities are the main cause of concern, in particular the ongoing pressure from a change to intensive dairying. The Council's dairy farmer education, annual compliance inspection of dairy farm sheds and significant number of infringement notices (in the past 5 years) have resulted in a substantial reduction in farm dairy effluent related incidents in the Otago Region.

Part B of this report provides a summary of: known water quality in south west Otago watercourses; industry initiatives taken to improve farming practices; and educational programmes at the farm level. A revised action plan by the Council to further improve water quality in south west Otago is then presented.

B.2 Background

Water Quality

According to the (draft) State of the Environment Report - June 2007 streams and tributaries in the lowland areas of South and West Otago have elevated levels of nutrients (N&P), faecal bacteria and suspended solids. These streams are: Washpool, Wairuna, Main Drain (on the Taieri Plain), Heriot Burn, Crookston Burn, Kaihiku, Waiwera, Waipahi, Lovells, and Owhiro. The trend analysis for water quality showed that overall there is generally a deterioration in water quality occurring.

Land Use

- The land uses in these catchments are dairy, beef, sheep and deer farming and forestry.
- The lowland flat terrain in the catchment is intensively farmed, with dairy farming most common. (*Intensive farming* in Otago refers to higher stocking rates on sheep, beef and deer properties, dairy grazing or dairy farming.)
- In the Crookston burn, Heriot burn, Wairuna, Washpool and Main Drain catchments, lowland accounts for a large portion of the catchment (50% or greater).
- Other catchments with a more rolling, hilly terrain have a combination of dairy, sheep, beef and deer, with dairy farms on the flatter country (Waiwera, Kaihiku, Waipahi, and Lovells, Tokomairiro).

The low sheep prices and higher dairy pay outs have renewed interest in further dairy expansion in the south and west Otago.

Soil Conditions and Nutrient Movement

Dairy units are located on a range of broad soil groups comprising brown, pallic and recent soils. Pallic soils within the 650 to 800mm rainfall band have a solid pan in the subsoil starting at 400/450mm below the ground surface. Tile and mole drains are a necessary prerequisite on these pallic soils pasture production. These soils become saturated during wet weather conditions (particularly during winter) due to the lack of evapotranspiration in association with poor drainage above the solid pan. Paddock soil moisture regularly remains at or near field capacity conditions from the beginning of the milking seasons until late spring, in most cases for nearly three months on a non-continuous basis. During higher soil moisture conditions tile and mole drains act as a contaminant pathway for irrigated dairy effluent and animal excreta from paddock grazing.

The level of contamination risk is determined by a number of factors including soil and weather conditions, tile and mole drainage, stocking rates, grazing practices, nutrient inputs and effluent irrigation practices.

Generally nitrogen excreted as dung moves slowly through the environment and is not readily available as the soluble form nitrate. In contrast nitrogen excreted as urine (75 – 80% excreted as N) moves quickly through the environment and is discharged to drainage water as nitrate. These 2 pathways are interconnected and they dictate how many farming practices can affect water quality.

B.3 Council and Dairy Farmer Initiatives to Date

In response to the water quality issues in south and west Otago, Council has implemented a series of extension initiatives through the Land Resource team with the aim of changing farming practices to improve water quality. Activities and programmes carried out since 2000 include:

- Three catchment programmes, Clydevale Waipahi, Tokomairiro and Crookston Heriot, aimed at raising awareness of water quality, make recommendations about best practice, personalise impacts on water quality and use community and personal responsibility as mechanisms to achieve best practice adoption.

- The launch of the Dairy Waterway Protection Programme by Council. This involved strong public launch of the target to have all waterways protected from dairy stock by 2005.
- Publication of the booklet: *Environmental Considerations for Dairy Farming in Otago*. Mailed to all dairy farmers.
- Publication of the booklet *Environmental Considerations for Managing Dairy Effluent Application in Otago*. Mailed out to all dairy farmers.
- Dairy Focus farm project, which involves demonstrating emerging best practice options on 4 farms and the promotion of the results through newsletters, field days and partnering with AgResearch, CaDB.
- Establishing a soil moisture monitoring aquaflex unit at Clydevale with Dairy industry funding to provide guidance for improved effluent application management.
- The regular participation and organisation of industry field days.
- Two Cluster group projects, Flodden Creek and Pomahaka tribs: These were council driven programmes working with farming neighbours to explore the impacts on water quality of farm activities and best practice recommendations.
- Production and publication of the booklet *Environmental Considerations for Clean Streams - A Guide to Managing Waterways in Otago*. Mailed out to all dairy farmers.

Due to Otago's more recent and ongoing expansion into dairy the infrastructure on farms is relatively modern and well planned. Many farmers have made changes to their systems and farm management to achieve better environmental performance.

There is a heightened farmer awareness of poor water quality in the south and an understanding of the impacts farming practices or accidents can have on the health of their streams. The incorporation of best practice techniques to prevent contaminants reaching waterways is being carried out by the early adopters (leading farmers); however there is still a large number of farmers who need to make change to reduce the negative impacts of their activities on water quality. A few of the key practices required include:

- The ability to defer effluent irrigation due to wet soil conditions with the use of effluent storage. Based on the South-West Otago low evapotranspiration losses and rainfall it has been estimated that on average **at least 2** months (preferably 3 months) storage is necessary to prevent effluent runoff or entry into tile & mole drains on pallic soils.
- Periodic cleaning out of ponds to remove the solid fraction at the base of the pond and recover the original storage capacity.
- Stormwater diversion during the non milking part of the season to prevent excess water entering the effluent pond during the winter and other water saving options in the shed and yard cleaning procedures.
- Machinery maintenance schedule for all effluent irrigation equipment.
- Staff training and adequate supervision on effluent management to avoid excessive irrigation.
- Location map for tile and mole drains which will assist in efficient effluent management and grazing practices.
- Application plan for effluent irrigation in relation to risk of water entering tile drains.

- Low pressure effluent irrigation system (e.g. K-line) to match local soil infiltration rates to avoid runoff and effluent entry into tile and mole drains.
- Contingency plan for stock during wet weather and higher soil moisture conditions to reduce stocking pressure and minimise soil compaction.
- Leachate collection on silage pads, wintering and stand-off pads.
- Effluent volume reduction through reduced water use.

Council has two agreements to work co-operatively with Fonterra to address water quality impacts from dairy. They are:

- *Clean Streams Accord, Regional Action Plan for Otago* which reiterated our already adopted fencing target, signed in 2005.
- *Memorandum of Understanding for dairy farming on tile and mole drained land (MOU)* which requires dairy farms on tile and mole drain land to have completed an environmental management system by Sept 2006, signed in 2005.

The Council and Clean Stream Accord target of, 100% of waterways protected from dairy stock was audited in 2006. The results showed that 93% of water ways (during the milking period) on dairy farms were protected on both sides from stock. Follow-up phone calls to farms identified as having unprotected waterways, resulted in an overwhelmingly positive response that, “fencing was currently being completed” or “planned to be done in the near future”. Fencing of waterways on the milking platform is now an accepted and established practice.

The outstanding targets of the Clean Streams Accord are:

1. The fencing of waterways on wintering or dairy run-off blocks; (See Part C, Intensive stock and wintering grazing waterway protection.) and,
2. The compliance with permitted activity rules in relation to dairy effluent disposal on wet soils.

The MoU between Council and Fonterra was designed to act as a mechanism to drive widespread adoption of good practice in tile and mole drained areas and to encourage completion of the Environment Management Systems (EMS) during the 05/06 season a series of workshops were held, information was posted to farmers and a Consultant trained. The EMS will contain best management on-farm practices for tile and mole drain areas to improve water quality through appropriate management of soil, grazing, fertiliser and effluent. Fonterra audit the completion and implementation of the EMS annually. The audit results for the completion of the EMS are contained in Table 1.

Table 1. Farms with Environmental Management Systems (EMS)

Number of farms which have:	West Otago	South Otago	Milton
Completed the EMS	13	4	2
Partially completed the EMS	15	29	9
Not started the EMS	4	8	7

This level of EMS completion is very disappointing. However, in some cases good practices are being introduced into the farming system but recorded as required by the EMS. Given there have been considerable research on on-farm practices to improve water quality in the past 4-5 years these new and practical solutions should also be included in the EMS.

B.4 Regional Plan: Water Policies and Rules

The farm dairy effluent rule in the Water Plan which is relevant when considering mechanisms for improving water quality in South and West Otago is as follows:

12.8.1.3 The discharge of contaminants that have been collected in any animal waste collection system, onto production land not in Zone A of a Groundwater Protection Zone (as identified on Maps C1-C17), is a permitted activity, providing:

- (a) Any collection or storage system is sealed so as to prevent any contamination of water in any water body, drain, or water race; and*
- (b) No hazardous substance is added to the material to be discharged; and*
- (c) The discharge occurs more than 50 metres from any surface water body or mean high water springs; and*
- (d) The discharge occurs more than 50 metres from any bore used to supply water for domestic needs or drinking water for livestock; and*
- (e) The discharge does not occur on saturated soils; and*
- (f) There is no direct discharge of animal waste to water in any drain, or water race, or to groundwater; and*
- (g) Effluent from the discharge does not run off onto any other person's property; and*
- (h) Ponding of animal waste from the discharge does not occur; and*
- (i) The discharge does not cause flooding of any other person's property, erosion, land instability, sedimentation or property damage; and*
- (j) The Nitrogen loading due to the discharge does not exceed 150 kg N per hectare per year*; and*
- (k) The discharge does not exceed the application requirements identified in Schedule 8.*

When considering water quality issues in the tile and mole drained areas the following permitted activity rule on discharge of drainage water is critical:

12.5.1.1 The discharge of drainage water to water, or onto or into land in circumstances where it may enter water, from any drain, is a permitted activity, providing:

- a) The discharge does not cause flooding of any other person's property, erosion, land instability, sedimentation or property damage; and*

- b) The discharge, after reasonable mixing, does not give rise to all or any of the following effects in the receiving water:
 - i. The production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials; or
 - ii. Any conspicuous change in the colour or visual clarity; or
 - iii. Any emission of objectionable odour; or
 - iv. The rendering of fresh water unsuitable for consumption by farm animals; or
 - v. Any significant adverse effects on aquatic life.

Given the saturated conditions and the intensity of farming in the tile & mole drained areas it is doubtful the above permitted activity could be met consistently. Therefore it could be argued that technically intensive farming in the tile & mole drained areas may require resource consents from the Council. If water quality does not improve in the tile & mole drained areas and continue to degrade the Council could use this provision to regulate discharges from tile & mole drained lands with intensive farms.

B.5 Compliance Monitoring

The Compliance team have been carrying out annual inspections of every dairy farm for the last five years. An assessment is made on the day of inspection of whether the farm system is compliant with the Council effluent discharge permitted activity rules, however this inspection may not address the effectiveness of equipment or environmental impacts of discharges. It is important to note that to date there have been no attempts made to check the compliance of the discharge of drainage water permitted activity rule. Each year there have been 5 - 10 incidences of non-compliance relating mostly to the dairy effluent management.

Where repetitive breaches of the rule occurred, infringement notices were issued. In the past five years there have been 40 infringement notices served and one prosecution. An infringement notice of \$750 has been considered a good deterrent for the majority of farmers. However, in several cases (owing to frequent change in share-milkers) more than one infringement notice had been served on a single farm resulting in more than two infringement notices per farm. Under these circumstances legal action against a farm owner (rather than against a share-milker) could only be taken provided there is proof that the farm owner failed to provide adequate systems to the share-milker to manage effluent.

During the 2006/2007 summer milking season it was found that 329 (representing 93%) of the farms were compliant with the effluent discharge permitted activity rules.

On the day of inspection a total of 17 (6 %) dairy farms were found to have one or more breaches of the permitted activity rule that were considered to have the potential to result in minor adverse effects. The most common problem found was ponding of effluent while other problems included runoff due to irrigation practices or mechanical faults, overflowing sumps, overfull ponds, and effluent in drains or ditches. Seventeen farms required follow-up visits to ensure that the identified problems had been addressed.

There were only 5 (1 %) farms where serious non-compliances with potential to have more than minor environmental effects were identified. In nearly all cases the identified problems were quickly remedied on request from inspecting officers. Infringement notices of \$750 each were issued for five of these offences.

An aerial survey of the wintering pads or stand-of pads system is also carried out by Compliance staff. Issues of concern witnessed from the air are followed-up with a farm visit.

B.6 Full Compliance of the Farm Dairy Effluent Permitted Activity Rules

Council's preferred mechanism for achieving good practice is to work alongside farmers and the industry to encourage and inform. This current approach should continue.

However, that advocacy and co-operative extension method will only be successful in looking after the environment if there is a consequence for being non-compliant with Plan rules. The Regional Action Plan agreed between the Council and Fonterra has a target of 100% dairy farms to comply with relevant resource consents or permitted activity rules.

The aim of Council activity is to improve water quality related to farm dairy effluent incidents by improving poor farm dairy effluent practices. If change could be done with normal compliance visits, field days, letters or other extension activities then that would be the preferred choice.

However it is time to increase the compliance surveillance by targeting times of the season when the soils will be at or close to saturation. Soil moisture conditions and the ability to comply with Council rules will vary throughout the spring. Purposely visiting properties when the soil is known to be near or at field capacity would be a more effective and targeted compliance approach. Inspections during these periods would coincide with soil moisture conditions when many farms would have difficulty in adhering to the Regional Plan water rules.

Given non-compliance of the effluent rule has been related to poor effluent storage capacity and poor storm water management, dairy farmers should be warned prior to this year's milking season targeted compliance inspections being carried out. Council staff will continue to recommend best management practices including where prolonged saturated soils conditions exist (particularly south and west Otago) farms should have sufficient storage to contain effluent prior to irrigation.

Also, bearing in mind Council's significant input to farmer education and the number of infringement notices served it is timely to consider more legal actions including prosecution actions.

4. Part C: Intensive Stock and Winter Grazing Waterway Protection

C.1 Background

In the State of the Environment Water Quality Report 2007 several Otago lowland tributaries and streams were assessed as having degraded water quality and poor waterway health. Many of these streams are in intensively farmed catchments. A definition of *intensive* for the purpose of these targets is 14 - 15 Stocking Units. A summary of stock type and equivalent Stock Units is given in Table 2.

The impacts of intensive dairy farming on waterways are well recognised and the dairying industry has made significant advances in protecting waterways from direct stock access, through fencing. Part B summarises progress made to date and acknowledges one of the outstanding targets in the Clean Streams Accord: Regional Action Plan is fencing waterways on wintering or dairy runoff blocks. Therefore, dairy grazing is included in the recommendations for intensive grazing targets in this report.

Intensively grazed beef and deer can also adversely affect waterway health, particularly if stock has direct access to waterways. When stock access waterways bank erosion with resulting sediment and phosphorus entering the stream is common. Intensive grazing over tile and mole drains makes nitrogen readily available to drainage water which travels rapidly into waterways, also.

Table 2. Stocking Unit Equivalent

Sheep	Per Head	Deer	Per Head	Beef Cattle	Per Head	Goats	Per Head
Ewes	1.0 SU	Hinds Breeding	1.9 SU	Cows	5.5 SU	Bucks & Does 1 yr +	0.8 SU
Hoggets	0.7 SU	Hinds 1.5 yr	1.8 SU	Heifers 1.5 yr	4.5 SU	Bucks & Does to 1 yr	0.5 SU
Wethers	0.7 SU	Hinds Weaner	1.2 SU	Heifers Weaners	3.5 SU	Buck	0.8 SU
Rams	0.8 SU	Stags Weaner	1.4 SU	Bulls Weaners	4.5 SU		
		Stags 1.5 yr	1.8 SU	Steers Weaners	4.5 SU		
		Stags Mature	2.2 SU	Steers 1.5 yr	5.0 SU		
				Steers 2.5 yr	5.5 SU		
				Bulls	5.5 SU		
				Dairy Heifers	4.5 SU		

Notes:
Stocking rates refer to the number of animals per hectare. It is common for hill country sheep farmers to have low stocking rates, and for dairy farmers (for example) to have high stocking rates. Low stocking rate are interpreted as being extensive operations while higher stocking rates are intensively run operations. Stocking rates can be measured in the form of Stocking Units (SU).

As identified in Part B, Section B2, land use with deteriorating water quality included the Waiwera, Kaihiku, Waipahi, Lovells and Tokomairiro, which are all catchments which have beef, sheep and deer farming.

Direct deposits of dung and urine, into waterways, occur when stock are on the riparian margin or in the waterway. These deposits result in inputs of nitrogen, phosphorus and E.coli into the waterway. When stock numbers are high, these impacts are multiplied many times over, resulting in deterioration of water quality both locally and downstream. Trampling of the streambed and stirring up sediment and nutrients within the waterway also impacts on in-stream ecology.

Intensive winter grazing of fodder crops also impacts water quality if stock has direct access to waterways or the soils are saturated.

In order to recognise and provide for catchments where waterways are affected by intensive land uses, and to maintain consistency across agricultural industries, a strategy for waterway protection for intensive farming, including intensive winter grazing of crops, is needed.

C.2 Water Plan Provisions Concerning Stock Access to Watercourses

The Water Plan provides for stock access as a permitted activity provided certain conditions are met, being:

Rule 13.5.1.8: The disturbance of the bed of any lake or river by livestock is a permitted activity, providing:

- (a) No lawful take of water is adversely affected as a result of the activity; and
- (b) The activity does not cause or induce conspicuous slumping, pugging or erosion; and
- (c) The activity does not cause any conspicuous change in the colour or visual clarity of the lake or river; and
- (d) The activity does not adversely affect any Type A or B value of any wetland identified in Schedule 9; and
- (e) The activity does not significantly disturb indigenous vegetation or the habitat of indigenous fauna, trout or salmon in, on, or under the bed of any lake or river; and
- (f) No feeding out occurs on the bed of any lake or river.

Excluding intensively grazed stock and deer from waterways is seen as the most effective way that farmers could achieve compliance with these permitted activity conditions.

Also, the Plan provides for drainage as a permitted activity provided certain conditions are met, being:

Rule 12.5.1: The discharge of drainage water to water, or onto or into land in circumstances where it may enter water, from any drain, is a permitted activity, providing:

- (a) The discharge does not cause flooding of any other person's property, erosion, land instability, sedimentation or property damage; and
- (b) The discharge, after reasonable mixing, does not give rise to all or any of the following effects in the receiving water:
 - i. The production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials; or
 - ii. Any conspicuous change in the colour or visual clarity; or
 - iii. Any emission of objectionable odour; or
 - iv. The rendering of fresh water unsuitable for consumption by farm animals; or
 - v. Any significant adverse effects on aquatic life.

Unfortunately, measuring compliance with these conditions has proved difficult as much drainage occurs below land and water surface and is "out of sight".

Note that both Environment Canterbury requires consent for any discharge of effluent while Environment Southland requires consent for any effluent discharge from more than 50 cows. Effectively both Councils require consent before dairy farm can occur.

C.3 Waterway Protection Targets for Intensive Deer, Beef and Dairy Grazers

Council has set a target for the exclusion of intensive deer, beef and dairy grazing on wintering blocks or run-off from waterways to maintain and enhance waterway health.

A representative survey carried out by Council in 2006 found that deer have free access to 82% of waterways on deer farms in Otago. This figure includes waterways on both extensively and intensively run operations. It was observed during the survey, that generally the waterways on the extensively run properties were not effected by stock. Extensively run properties tended to be in hill or high country in Central Otago. Streams in these areas were rocky bottom streams in catchments covered by tussock and bracken fern, and generally had good water quality. The larger paddocks, lower numbers of deer per hectare and some natural topography barriers resulted in much less pressure from deer on waterways.

Intensive farm operations occur where additional fencing and greater pasture production is achieved. Greater numbers of deer in a smaller area, where they were given free access to waterways resulted in a greater impact on those waterways. While we do not have specific information on what percentage of intensive deer farm operations have no waterway fencing, from field observations and discussions with deer farmers, many waterways in Otago are not fenced to exclude intensive deer. Likewise, we believe that many intensive cattle operations do not exclude cattle from waterways.

It is suggested that a target for all waterways to be protected from intensive deer and beef and dairy grazing on non-milking platforms by the 1st May 2011 is achievable and practical. Interim targets could be offset for 30% exclusion by 1 May 2008, 50% by 1 May 09, and 100% by 1 May 2011. In many instances this will require fencing waterways.

However, if farmers can demonstrate that the waterway is not detrimentally affected by their stock through other best management practices, or by natural barriers preventing access, fencing will not be required.

C.4 Winter Grazing of pasture and crops by stock

It is a common farming practice in Otago to feed stock on a fodder crop (common crops used include swedes, turnips, kale) or mob graze throughout the winter months as ways to budget feed and maintain stock health. Typically management of stock on crop involves intensive mobs and controlling the area to be fed, by electric fencing. Crops are generally planted in the spring months and it is common for crop to be planted up to the edge of a waterway.

The impact of intensive stock on pasture or winter feed crops with saturates soils and where stock have direct access to waterways is likely to fail the Water Plan permitted activity rules and result in a deterioration in water quality and stream health.

It is recommended that the Council should set a target for excluding intensive stock from waterways when mob grazing pasture or winter fodder crop. This would apply to all intensive stock types, including dairy grazers, beef, deer and sheep. In addition, a target to have a riparian buffer strip between the winter crop and the waterway should also be adopted.

It is recommended that farmers are provided with the right information to make an informed decision on the width of the riparian buffer at the time of erecting the fence. Also, stock management should ensure grazing is not undertaken over tile and mole drained areas when soils are saturated

As the water quality impacts are so well recognised, and exclusion of all stock types with electric fencing fairly straight forward, it is recommended that the target is “100% of waterways protected from all intensively grazed stock on winter crops by 1 May 2009, with an interim target of 75% exclusion by 1 May 2009”.

C.5 Promotion of the Target

It is recommended that the Council promote these targets, and avoiding grazing over drained soils while saturated, through an educational campaign including field days, discussion groups, focus farms, and a media campaign. Best practice advice will be given to help farmers make informed decisions on the width of riparian buffers needed between winter crops and waterways. Also, farmers need to identify drained areas. An important part of the campaign would be to work with the deer, beef and sheep industries to achieve these targets.

C.6 Dairy conversions and increasing nitrate levels in surface water

As stated before, polluted surface water in grazed catchments are characterised by elevated levels of faecal bacteria, ammoniacal-N, nitrate-N, suspended solids and phosphorus. In such catchments through good effluent management practices and riparian management surface water clarity could be improved and contaminants such as faecal bacteria, phosphorus and ammoniacal-N entering waterways could be minimised. However, reduction in nitrate-N levels in waterways can not be achieved solely by the above practices. This is because nitrate is generated from grazed pasture mainly from animal urine patches. Nitrate-N leaches with percolating water and contaminates ground water and subsequently surface water. If the drainage water is intercepted by tile and mole drains direct and instant contamination of surface water occurs.

As land use intensifies from sheep to dairying nitrate leaching increases with greater levels of nitrate-N being present in surface water. This is because due to large urine patches dairying leaches three to four times nitrate-N than sheep farming. If surface water nitrate-N levels are already at elevated levels increasing land use intensity will only accentuate nitrate water pollution. Without the Water Plan drainage rule being effectively implemented it is difficult to maintain status quo on nitrate-N levels in polluted catchments – one option is to discourage further dairying in catchments with elevated nitrate-N attributed to land drainage.

In the past decade there has been extensive research in New Zealand to minimise nitrate leaching from grazed pasture systems. Some of these measures could reduce nitrate-N leaching substantially and hence could be used as an alternative to discouraging dairy conversions. The following methods are identified as being effective in minimising nitrate leaching and N input to waterways:

- Use of nitrification inhibitors (e.g. Eco-n) which will reduce the rate of nitrification.
- Replacing rye grass with deep rooted grass species which will increase the uptake of N.

- Zero grazing during autumn and winter periods with feeding on feed or wintering pads which will avoid grazing on saturated soils.
- Introducing high carbohydrate and low protein feed (e.g. maize, fruit residues) which will reduce N output into urine.
- Introducing salt in stock water to induce greater water intake which will reduce N concentration in urine.
- Reduce fertiliser-N input which will reduce available N.
- Reduce stocking rate which will reduce dung and urine production.
- Stripping nitrate-N from drainage water by slow or nil flowing large scale constructed wetlands which will reduce the discharge of N to surface water.

Using one or many of the above methods a substantial reduction in release to the environment of nitrate-N could be achieved. Therefore, requiring dairy farms to leach nitrate-N at or lower than sheep farm rates (i.e. 10 kg N/ha/year) would not be onerous. Several methods bring about 'win-win' outcomes because methods such as the use of nitrification inhibitors, use of high carbohydrate and low protein feed and zero grazing during autumn and winter also boost milk solid production. The above measures could be introduced, implemented and monitored on all existing and new dairy conversions in tile and mole drain areas in the Otago Region, with the assistance of Fonterra and farmers without costly regulations.

5. Part D: Recommendations

4. The State of the Environment Surface Water Quality in Otago report be noted.
5. Increase compliance surveillance in south and west Otago region in relation to dairy effluent irrigation.
6. Inform all dairy farmers in the Otago Region that from 1 January 2008 prosecution will be considered on any repeat or significant breaches of the effluent discharge permitted activity rules.
7. 100% of waterways protected from intensive beef, intensive deer and dairy stock on non milking platforms by 2011 with interim targets of 30% by 1 May 2008, 50% by 1 May 2009 and 100% by 1 May 2011.
8. 100% of waterways protected from all intensively grazed stock on winter crops by 1 May 2009, with an interim target of 75% exclusion by 1 May 2009.
9. In collaboration with the industry and farmers introduce, implement and monitor measures to minimise nitrate leaching on all intensively farmed land in the tile and mole drained areas by January 2009.



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