Farm Environmental Management Plan: Quailburn Downs (Bellfield Land Co)

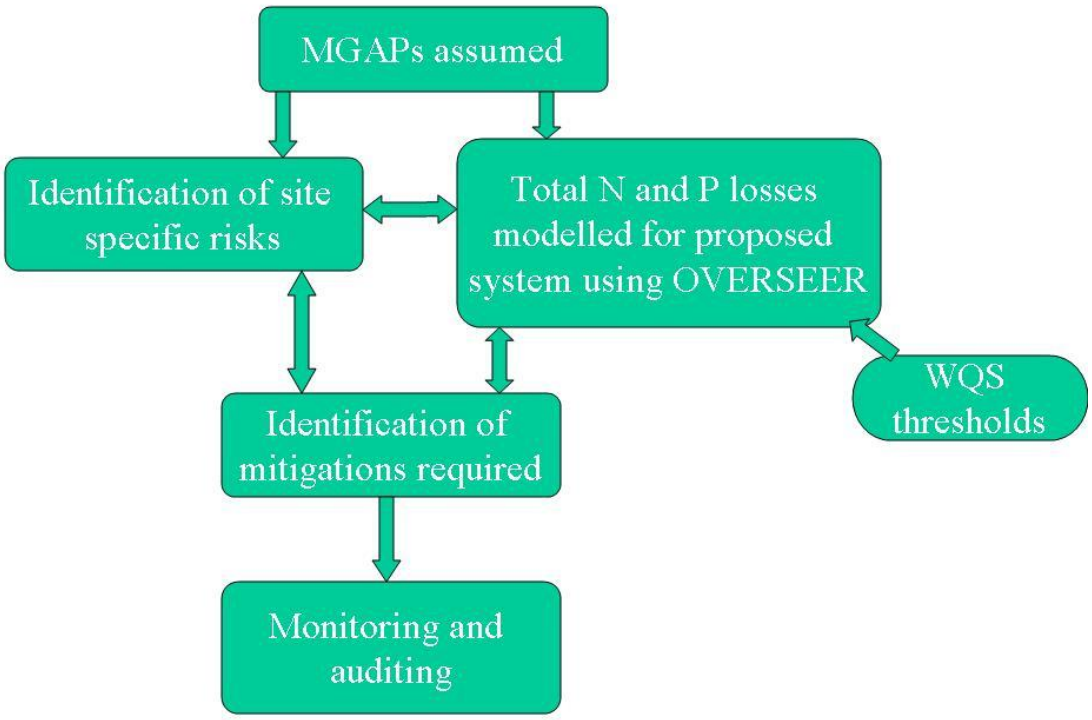
1. Introduction

The Water Quality Study ('WQS') funded by Mackenzie Water Research Limited ('MWRL'), found that the additional irrigation proposed in the catchment could take place without significant adverse effects on the environment providing that nutrient reduction occurred on the farms.

The process that was advocated for ensuring this on-farm nutrient reduction was through Farm Environmental Management Planning. A clear process for building a Farm Environmental Management Plan (FEMP) was laid out in the Water Quality Study and has been followed here. An overview schematic of the process of building a FEMP is shown in Figure 1.

The responsibility for the implementation, monitoring and auditing of the plan lies with the **farmer**.

Figure 1: Overview schematic of the process of building a Farm Environmental Management Plan



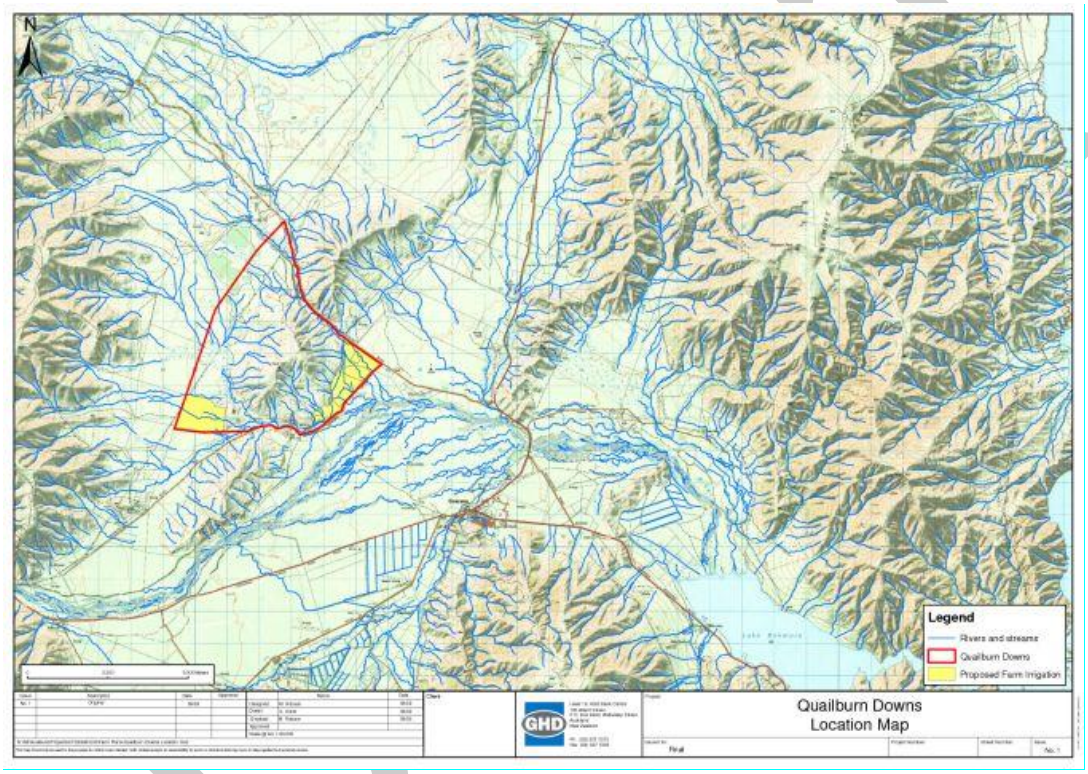
MGAP – Mandatory good agricultural practices

2. Farm Description

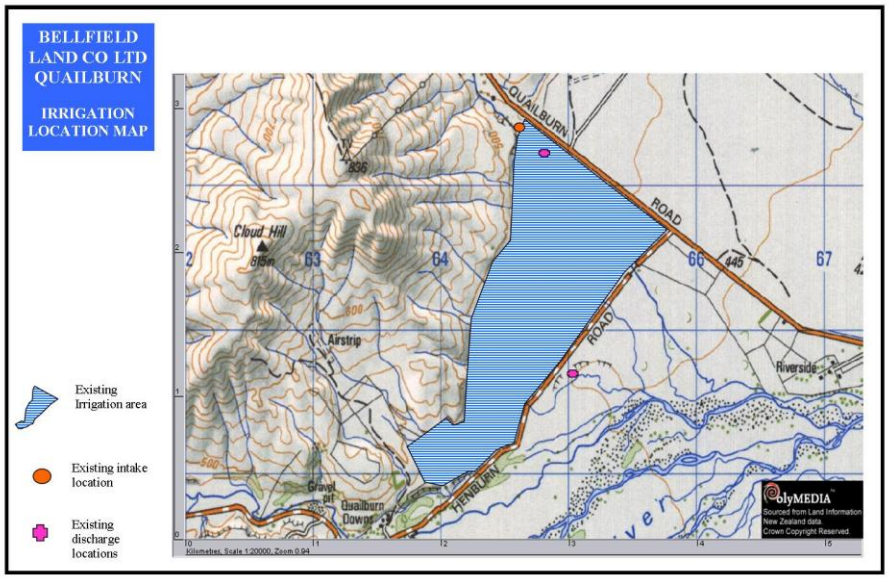
2.1 General farm description

Bellfield Land Company Ltd operates Quailburn Downs; a 2200 ha freehold hill country property near Omarama. The farm is merino sheep and beef cattle with 22% of the stock made up of cattle and the remaining 78% of sheep. The farm has approximately 90 ha of existing irrigation made up of spray.

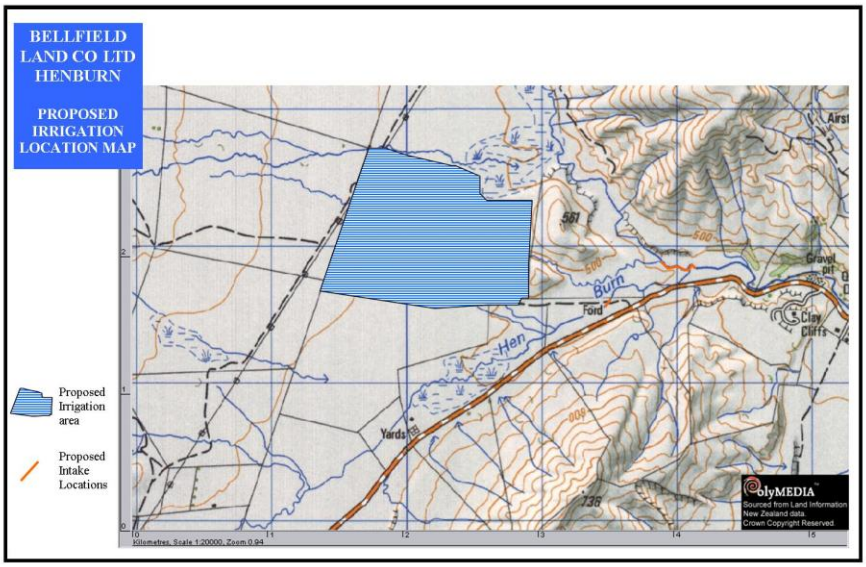
Quailburn Downs is a unique medium altitude property with plenty of natural shelter from the prevailing North West. Natural vegetation includes silver tussock, native grass with oversown clover and briar on hill and native grass on undeveloped lowland. Improved grass and clover cultivars have been sown on heavier soil types within the developed flat. Lucerne stands encompass the very shallow dry soil types of the developed flats. Fencing is of a good standard with post and waratah on hill blocks and post and electric on the flat. Extensive stock water scheme of piping and troughs has recently been developed.



Map A: Location map. The larger command area of irrigation on the East (Quailburn Henburn Road intersection) is an area of replacement.



Map B: Existing Irrigation command area at the intersection of Quailburn and Henburn Roads



Map C: Proposed irrigation development

Table 1. Cover utilisation by season and stock class for current system

	Cover utilisation by season and stock class - CURRENT			
Class of stock	**Spring**	**Summer**	**Autumn**	**Winter**
Ewes	Grass flats	Oversown hill	Native	Oversown hill
Hoggets	Grass flats	Grass flats	hill/grass	ryecorn
R1 Steers	Ryecorn	hill	hill	Hill

Photo A: Existing spray irrigation at Quailburn Downs

2.2 Proposed farming system

The development of an additional 52 hectares of spray irrigation (see above maps).

The replacement of 100ha of existing wild flood/borderdyke irrigation with spray.

The applicant is proposing to continue to farm in a similar manner with this proposed irrigation development. The proposed irrigation development will provide many benefits and some are listed below:

- Improved production and efficiency in existing livestock system
- Fattening cattle - with the increase in irrigation there can be an increase in the growth rates
- Fattening merino hoggets. The applicant currently carries all merino lambs through a winter, shears them and then fattens and sends to the freezing works. The proposed irrigation development will ensure that this can be done in dry years.
- Security in making winter feed.
- Ability to successfully grow crops for winter feed.

Table 2. Cover utilisation by season and stock class for proposed system

	Cover utilisation by season and stock class - PROPOSED			
Class of stock	**Spring**	**Summer**	**Autumn**	**Winter**
Ewes	Grass flats	Oversown hill	Developed flat	Oversown hill
Hoggets	Grass flats	Grass flats	Lucerne/grass	ryecorn
R1 Steers	Grass flats/ryecorn	Grass flats/wet areas on hill	Grass flats	Ryecorn

Continued rotation of regrassing under the irrigated area would occur with an expected area of 24ha direct drilled annually following a break crop of ryecorn and/or short rotation ryegrass.

2.3 Soils

Light to medium depth topsoils on hill, some stone with mixture of soil types on both undeveloped and developed flat land.

Existing Pivot: Large stone with little soil on 60% of pivot area, balance medium to heavier with some stone. The soils where the existing irrigation and the proposed irrigation development are located are a variety with approximately 10 different soil types with PAW ranging from 30-140mm.

Proposed irrigation: Light dry land with some large stone.

2.4 Topography

5% classified as high exposed ridgeline country

55% rolling to steeper hill country, not suitable for cultivation.

20% flat undeveloped variable soils

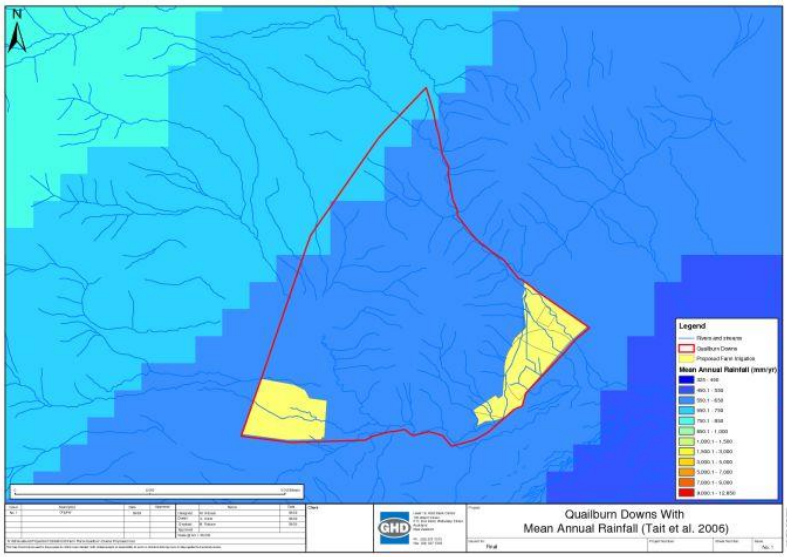
20% flat & terrace country (including irrigated and proposed irrigation area)

Photo B: Showing the topography of Quailburn Downs

2.5 Climate

Winter cold (heavy snow falls common) and summer dry with high evaporation levels.

Northwesterly weather aspect with unreliable rainfall, especially from October to March.



Map D: Mean Annual rainfall

3. Environmental Context

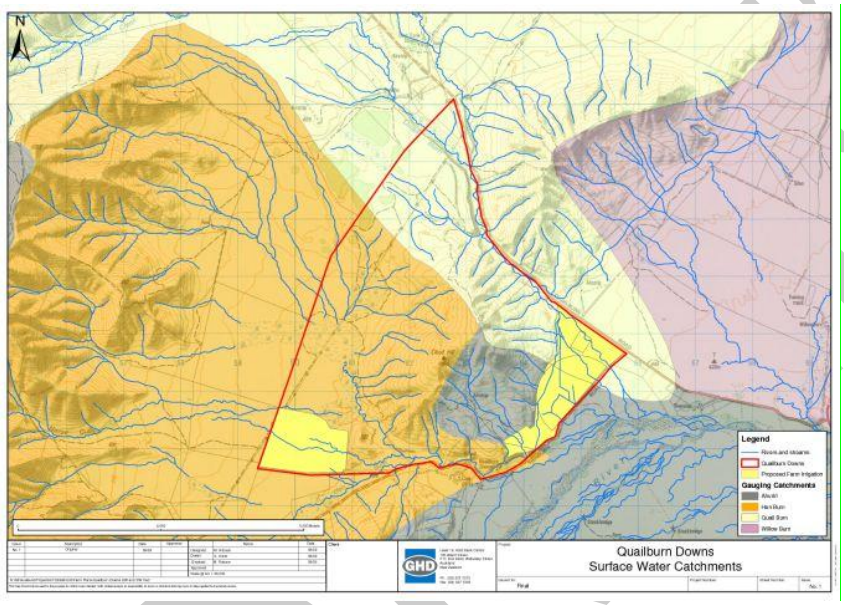
The environmental context of the farm is a reference both to local and wider receiving environments.

3.1 Water Quality Study receiving environments and mitigation requirements

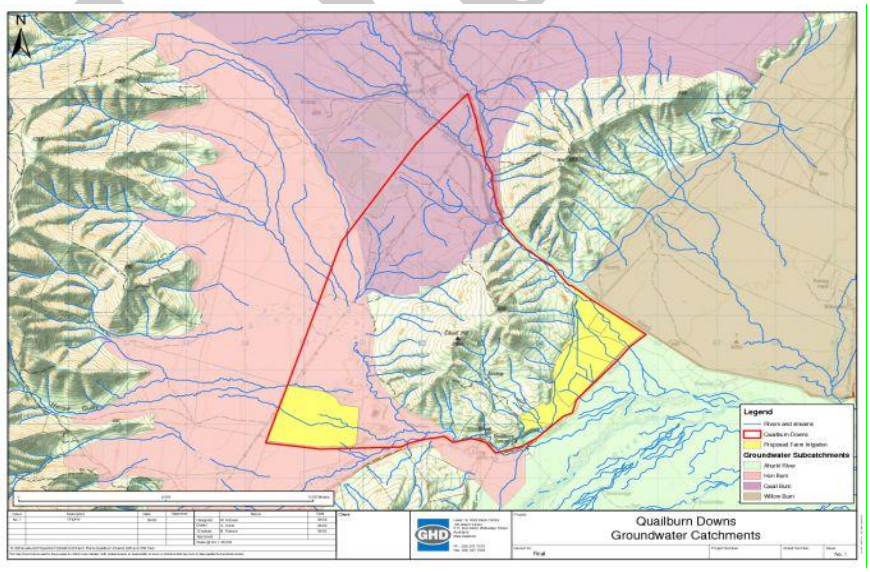
Quailburn Downs, according to the WQS, lies in the Henburn and Quailburn groundwater catchment and Henburn, Quailburn and Ahuriri surface water catchments. These maps are shown above.

Table 3 shows the calculated nutrient mitigation requirement of the receiving environments determined in the WQS and the resulting thresholds for N and P for Quailburn Downs are in Section 4.2.

For this farm, the Lake Benmore mitigation requirements are the most stringent. These mitigation requirements cap Quailburn Downs's nutrient discharges at 7355 kg N per annum and 207 kg P per annum.



Map E: Surface water receiving environment



Map F: Groundwater receiving environment

3.2 Local receiving environments

The proposed new irrigation developments receiving environment is Henburn Stream. The existing irrigation areas receiving environment is Quailburn Stream and the Ahuriri River. The Ahuriri River and tributaries have associated wetlands that have outstanding wildlife values and important freshwater fish habitat and outstanding angling features. The Ahuriri River is covered by a National Conservation (Ahuriri River) Order 1990.

Table 3. Water Quality Study mitigation requirements for Quailburn Downs

	Stream mitigation required for periphyton kg/ha irrigated land		Secondary Stream mitigation required for periphyton kg/ha irrigated land		Stream mitigation required for ANZECC kg/ha irrigated land		Secondary Stream mitigation required for ANZECC kg/ha irrigated land		GWR mitigation required kg/ha irrigated land		Lake Mitigation required kg/ha irrigated land	
	N	P	N	P	N	P	N	P	N	P	N	P
Henburn - Ahuriri			-0.9								-10.7	-1.1
Ahuriri	-0.90										-10.7	-1.1
Quailburn - Ahuriri	-0.30		-0.90								-10.7	-1.1

4. Farm Environmental Management Plan development

4.1 Stage 1 – Mandatory good agricultural practices

The table below shows the mandatory good agricultural practices that will be adopted. These include the base assumptions of OVERSEER and therefore help validate the use of the model on the farm.

Table 4. Mandatory good agricultural practices

Mandatory good agricultural practices	What these practices mean on farm
Fertilisers applied according to code of practice for fertiliser use	The fertiliser users' code of practice aims to ensure that where fertilisers are used that they are used safely, responsibly and effectively and in a way that avoids, remedies or mitigates any adverse environmental effects. The code of practice includes guidance on fertiliser use, application, storage, transport, handling and disposal.
Use a fertiliser recommendation system (nutrient budget) and account for all sources of nutrients including applied effluents and soil reservoirs accounted for	Planning fertiliser applications to all crops, determining crop requirement and accounting for soil nutrients and organic nutrient supplies, all reduce the risks of applying excessive fertiliser above the crop requirement. This maximises the economic return from the use of fertilisers and reduces the risk of causing nutrient pollution of the environment Accounting for all sources of nutrients including imported sources and soil reservoirs is an important management measure in all farming systems and become especially important on farms where manure is produced and applied to the land. The re-application of organic manures to land is often thought of as a disposal of a waste product, and the available nutrients within the organic manures are not accounted for. The use of an integrated nutrient budgeting tool such as OVERSEER automatically accounts for nutrients supplied in organic manures.
Fertiliser application applied evenly	The even application of fertiliser is an assumption of the OVERSEER model as included in the fertiliser code of practice. Fertiliser spreaders should be tested and calibrated in-house at least annually and every 5 years by an independent auditor.
Irrigation and effluent applied evenly	The even application of water and or effluent is an assumption of the OVERSEER model. Irrigators should be tested and calibrated in-house at least annually and then every 5 years in accordance with the code of practice for irrigation evaluation by a qualified irrigation auditor.
Crop, cultivation, nutrient inputs and yield records kept per farm management unit	Maintaining good crop input records is important for: • The calculation of cumulative annual organic fertiliser applications and also their contribution to long term nutrient supply; • The prediction of realistic crop yields that are used to determine crop requirements; • Providing accurate inputs to the OVERSEER nutrient budgeting model that is being used here as a proxy for

	measuring diffuse nutrient losses.
Good design of irrigation systems	Design will match soil properties and low application amounts on shallower soil to prevent summer drainage.
Robust irrigation scheduling	Good irrigation scheduling to prevent summer drainage.
Supplement and feeding out management	To be addressed in the Farm Environmental Risk Assessment.
Winter grazing management	To be addressed in the Farm Environmental Risk Assessment.

4.2 Stage 2 – OVERSEER and meeting WQS mitigation requirements

The WQS thresholds set for Quailburn Downs, using the most stringent nutrient mitigation requirement, are 7355 kg N/year and 207 kg P/year. The table below shows the output from OVERSEER for the modelled proposed farming system at Quailburn Downs. The results illustrate that the proposed farm system losses as modelled by OVERSEER are within the thresholds set out by the WQS. Management or mitigation strategies that have been used to meet this threshold are detailed in Section 5.

Table 5. Total N and P losses modelled by OVERSEER for the proposed farming system on Quailburn Downs and WQS thresholds

	OVERSEER proposed modelled outputs kg/year	**WQS modelled threshold kg/year**
Total N leaching/runoff	7276	7355
Total P leaching/runoff	196	207

4.3 Stage 3 – Identification and mitigation of site specific environmental risks

The Farm Environmental Risk Assessment FERA has been undertaken on the existing farming system at Quailburn Downs and has highlighted potential soil and stock risks. These risks are described below. The full FERA is attached as Appendix A.

The FERA focused on the irrigation areas; existing or proposed and any intensively farmed areas within the farm.

4.3.1 Soil Risk

The risks associated with soil are that although wind erosion wasn't evident there is a potential vulnerability to wind erosion. The continuation of existing irrigation and the establishment of new irrigation will ensure that ground cover levels are upheld and improved and will reduce the risks associated with bare ground and wind erosion

4.3.2 Stock risks

The risks associated with stock are that at present stock are not excluded from Quailburn Stream within the existing irrigation area.

4.3.3 Site specific management measures and existing mitigation measures in place

1. At Quailburn Downs there are culverts placed where stock or vehicles will cross any watercourse.
2. Wooden stock bridges are located on the Quailburn Stream.
3. Access to Quailburn Stream within the existing irrigation area is prohibited on the north side due to fencing.
4. There is good riparian vegetation alongside the banks of the Henburn stream.
5. The proposed irrigation development will be fully fenced.
6. Fodder crops are grown as part of the pasture renewal process, ensuring that organic matter levels are not depleted in only a few paddocks. Regrassing after winter grazed fodder crops will be at the earliest opportunity.
7. A contractor or approved handler if required is used to apply chemicals at Quailburn Downs.
8. Cultivation and Trafficking

Direct drilling is the primary method for renewing pasture. Inversion tillage is used if required to break in (cultivate for the first time) any new pastures and occasionally soil can be left bare over winter. Inversion tillage is used at the most appropriate time to reduce the potential effects of wind erosion

Stock are grazed over winter and trafficking of soils when wet does occur. Annual monitoring and identification of soil compaction and documented remedial actions taken will ensure any soil compaction due to stock grazing over winter is identified.

9. Compaction

Soil around water troughs is not compacted nor does pugging occur at present. If compaction does occur then this will be assessed during the annual soil compaction survey and remedial action taken if required.

10. Runoff

There is no evidence of track runoff entering a watercourse. This will be monitored as part of the annual track survey as outlined in Table 8. Annual monitoring and identification of track runoff and documented remedial actions taken will ensure any track runoff entering a watercourse is identified.

11. Erosion

There is no evidence of stock induced bank side erosion in either the Quailburn or Henburn Streams. This will be monitored as part of an annual survey, as outlined in Table 8.

4.3.4 General issues on extensive high country farming systems

In extensive high country farming systems there are a number of issues that on more intensive farming systems would be assessed as being a risk to water quality but on extensive high country farming systems they have not been defined as a risk due to the extensive nature of the farming systems and the lower stocking rate per hectare. Some of these general issues have been identified below:

1. There will be areas within the farming system where tracks will cross waterways; these are tracks that are used irregularly, in extensive areas of the farm.

2. There are also areas within a high country farming system where stock will have unrestricted access to streams for crossings and stock water. This is essential access for stock movement and stock water. On most farms there are a number of small creeks/streams that flow within the hill country and it would be logistically impossible to place stock crossings on all of these. There is also the need for stock to move across streams/creeks within a block (paddock) for grazing access. A reticulated water system would be unsustainable in the hill country as troughs would freeze solid in the winter months, preventing access to fresh drinking water.
3. Swamps/heavy grounds are an integral area in a high country farming system; they provide a water source and good grazing for stock in dry years. In undertaking the FERA it has been identified that all swamps/heavy ground need to be monitored to ensure that bank erosion, compaction and pugging does not occur.
4. Wind erosion is a significant issue in the upper Waitaki Catchment. The sparse vegetation on large areas of land in the Mackenzie Basin gives little protection to the shallow, friable soils which continue to be eroded by frost heave and westerly winds. A mean soil loss of 0.22 mm/year or 2.2 tonnes of soil lost per hectare across a number of sites within the Mackenzie Basin has been reported. While it cannot be assumed from this information that erosion rates will continue at this level in the future, the results do confirm a strong relationship between the percentage of vegetation cover and erosion risk. The problem of bare ground and exposure to wind erosion has been compounded since the early 1990s by the rapid spread of hieracium particularly on the poorest soils. One of the most significant impacts of further irrigation in this area would be a reduction in the amount of bare ground and corresponding reduction in wind erosion risk. (*Environmental, Economic and social impacts of irrigation in the Mackenzie Basin. Ministry for the Environment, February 2005.)*
5. Monitoring and identification of any problems arising for the above issues has been included in Table 8.

5. Farm Environmental Management Plan for Quailburn Downs

5.1 Mitigation measures and management options adopted on Quailburn Downs

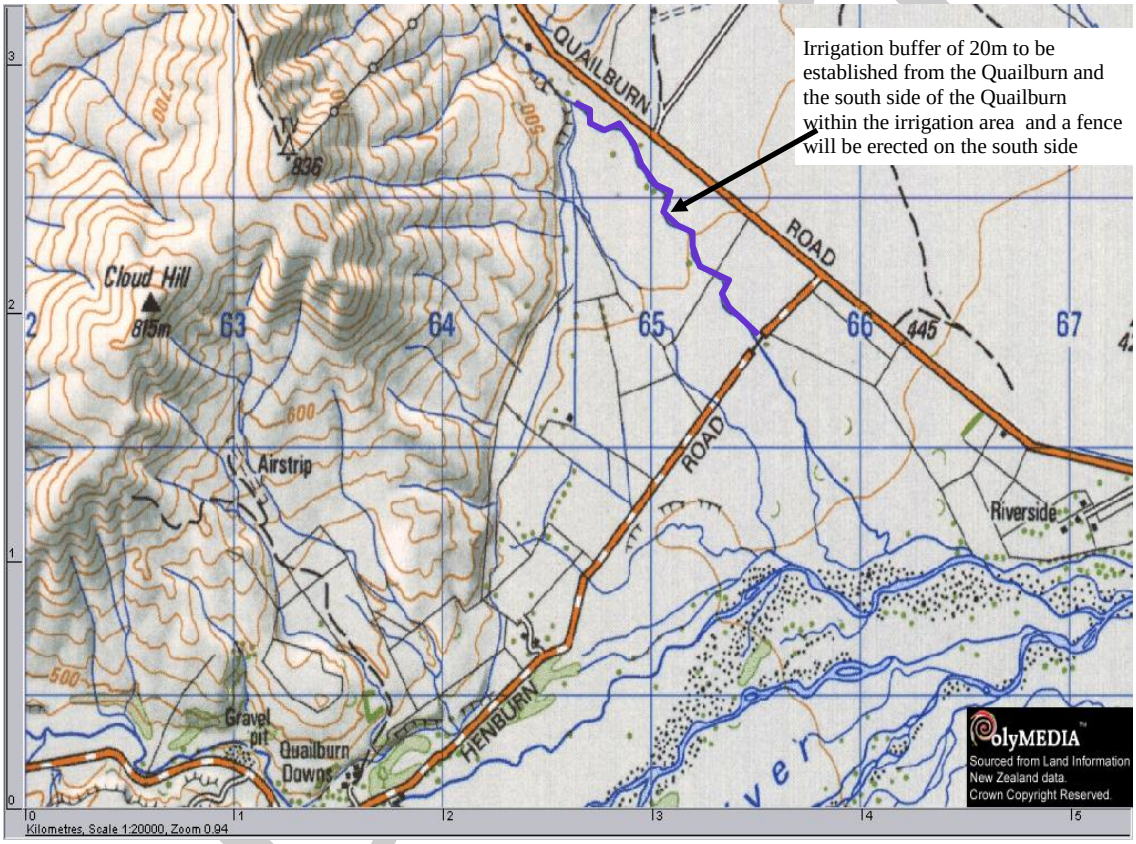
The table below shows the all the mitigation and management tools that are proposed to be undertaken on Quailburn Downs. Measures indicated as **FEMP stage 1 are those identified as Mandatory Good Agricultural Practice**, **measures identified as FEMP stage 2 are those changes that have been modelled in OVERSEER to meet the WQS mitigation requirement (if required)**, and those indicated as **FEMP stage 3 are mitigation measures chosen to ameliorate site specific environmental risks on the farm.**

Table 6 indicates in brief how the measures are to be monitored and audited.

Table 6. Table of mitigation options, monitoring and auditing for Quailburn Downs

FEMP stage	Measure	Monitoring	Auditing
1	Fertilisers applied according to code of practice for fertiliser use		Self certification
1	Accounting for all sources of nutrients including applied effluents and soil reservoirs	Soil and effluent testing and cumulative effluent inputs per management unit	Reconciliation of fertiliser, effluent and soil records with nutrient budget for example blocks. Submission of examples soil and effluent tests
1	Even fertiliser application	Calibrate and optimise fertiliser spreaders annually and every 5 years by an external auditor	Submission of testing and calibration
1	Even irrigation and effluent application	Calibrate and optimise irrigators annually in house and every 5 years by an external auditor	Submission of testing and calibration
1	Record crop, cultivation, nutrient inputs and yields per farm management unit	Upkeep of records	Submission of example block records
1	Good design of irrigation systems	Design of irrigation system by a certified professional	Irrigation system audited by a certified auditor every 5 years
1	Robust irrigation scheduling	Calculation of annual % effective water use	Submission of annual % effective water use
2	No winter application of fertiliser on the irrigation land. Fertiliser on the hill country is usually applied in the autumn	Field records	Signed field records
2	N fertiliser applications split to under 50 kg N/application	Field records	Signed field records
2	No P fertiliser within three weeks of irrigation	Field records	Signed field records
2	Olsen P of below 30 maintained	Regular soil testing (every 3 years)	Submission of soil tests
3	20 metre layback from any water way when applying fertliser by land based application e.g. bulk spreader	Field records	Annual Audit report
3	Irrigation buffer from Quailburn Stream of	Photos and location map	First annual audit report

FEMP stage	Measure	Monitoring	Auditing
	at least 20m		
3	Fence the south side of Quailburn Stream within the existing irrigation area to restrict stock access to the Quailburn	Photos and location map	First annual audit report
3	GPS Spreader and maps to be used when applying fertiliser	Field Records	Annual Audit report
3	Monitor and manage stock access, stock type and stock number from all permanently flowing waterways within other non irrigated intensively farmed areas	Location map of waterways and photos	Location map and photos in first audit report



Map G: Proposed locations of mitigation measures

5.2 Monitoring and Auditing

5.2.1 Baseline monitoring

Baseline monitoring is already underway at Quailburn Downs. ECAN currently monitor water quality of the Quailburn Stream at the Henburn Road bridge.

Table 7. Baseline monitoring on Quailburn Downs

		Location	Frequency	Measured parameters to include
Soil	Soil nutrient testing	All irrigation paddocks and intensive areas in rotation	1 in 3 years	Standard suite of soil nutrients
Water	Surface water quality	Quailburn Stream at Henburn Road	April, June, Oct 2007 and January 2008 by the ECAN	Total Nitrogen, nitrate, ammonia, total Kjeldahl nitrogen, total phosphorus, dissolved reactive phosphorus, suspended solids.
Pasture	Ground cover and species	All blocks	Annually	% Ground cover, species
Weed and Pest		Whole Farm	Annually	Done as part of an annual survey from Ecan

5.2.2 On-going monitoring

On going monitoring and auditing of FEMP are as important as the plan itself.

Table 7 above shows the current monitoring for Quailburn Downs and Table 8 below shows the proposed monitoring plan, frequency, location for monitoring and parameters for the monitoring. Along with triggers and contingency plans if the triggers are exceeded

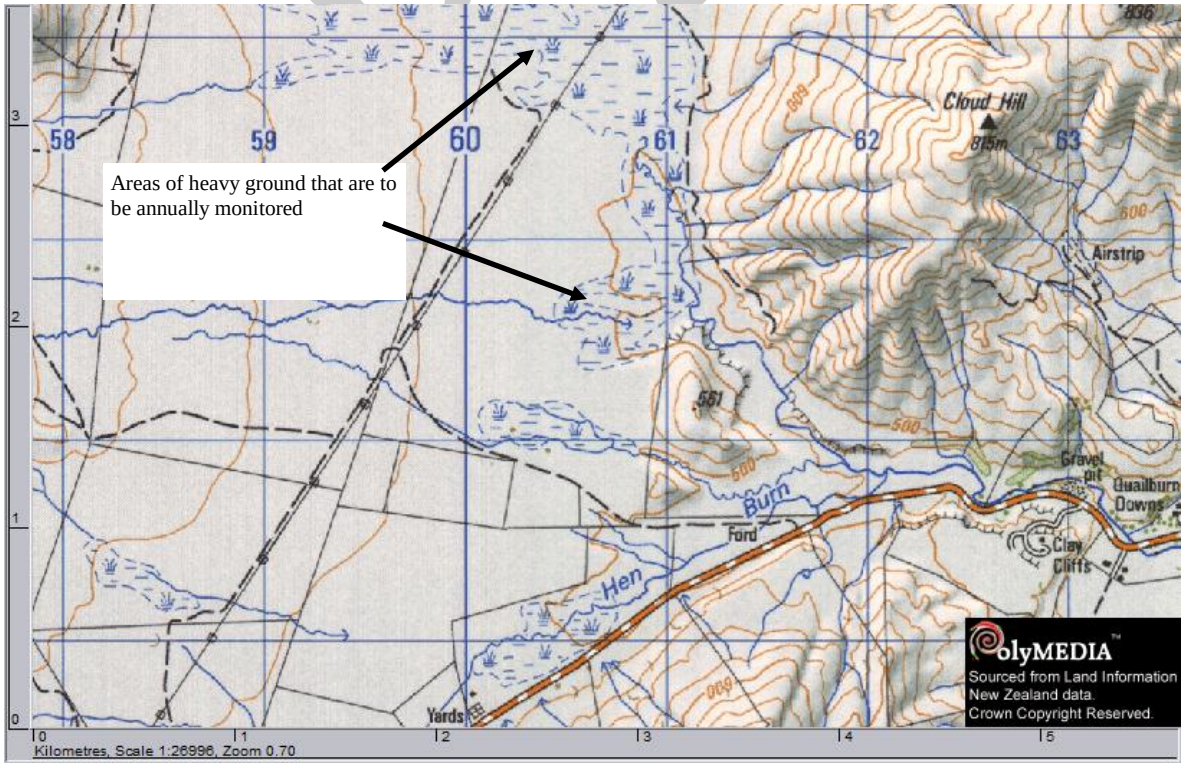
Table 8. Example monitoring plan for Quailburn Downs showing location, frequency and parameters for monitoring

		Location	Frequency	Measured parameters to include	Triggers	Contingency plan if triggers are exceeded
Soil	To include: Soil nutrient testing	All irrigated blocks in rotation	1 in 3 years for soil nutrient status	Standard suite of soil nutrients, pH C, N and organic matter	Olsen P >30	Reduce or stop addition of P fertiliser to the area and monitor
Soil	Soil compaction testing	All irrigated blocks in rotation	Annually for soil compaction testing.	Soil compaction	Compaction, surface capping	Remove compaction with appropriate tool
Soil	Visually monitor swamps/heavy ground	Any swamps/heavy ground (see Map H for locations)	Annually	Visual compaction, extensive pugging or stock induced bank erosion	Any visual sign of compaction, extensive pugging or stock induced bank erosion	Remove stock from the area, assess and rectify with appropriate management tool
Runoff	Wet weather survey	All blocks	Annually	Runoff from tracks	Runoff occurring	Immediately review current runoff mitigation options for tracks. Introduce further runoff removal infrastructure where appropriate.
Water	Surface water quality	Exact locations to be confirmed but will be on the Quailburn Stream, upstream of	Quarterly (Spring/summer/ autumn/winter) for first couple of years to establish patterns and	Total Nitrogen, nitrate, ammonia, total Kjeldahl nitrogen, total phosphorus, dissolved reactive phosphorus, suspended solids.	No significant decrease in water quality	If comparative surface water analysis indicates a decrease in surface water quality then the degraded determinant should be identified while a full root cause analysis

		Location	Frequency	Measured parameters to include	Triggers	Contingency plan if triggers are exceeded
		the intake in conjunction with the neighbouring irrigators	then reviewed.			is undertaken
Water	Irrigation application		Annually in house and 1 in 5 years by an independent	Application uniformity	>80 %	Optimisation of the irrigator performance will be performed at the time of testing
Tracks that cross waterways	Visual assessment of bank/track erosion	All tracks that cross creek/stream within extensively farmed areas	Annually	Visual assessment of bank/stream erosion caused by vehicle crossing or stock	Any sign of extensive visual erosion	Restrict vehicle and stock access until an assessment of the damage and cause can be made
Fertiliser	Fertiliser application		Annually in house and 1 in 5 years by an independent	Application uniformity	>80 %	Optimisation of the spreader performance will be performed at the time of testing
Weed and pest pressures	Weed and pest populations	Relevant blocks	Annually	% or magnitude of infestation	ECAN monitor and communicate if their triggers have been exceeded	Legislative compliance with notice of direction issued by ECAN

Please see Maps B and C for the irrigation location maps for the location of some of the mitigation and monitoring options

Map H: Showing location of heavy ground that is to be annually monitored



Where triggers are exceeded, the immediate contingency plans in Table 9 should be implemented while a 'root cause' analysis is carried out. Any further mitigation measures to be adopted as a result of monitoring should be added to Tables 7, 9 and 10.

1) Is the current mitigation option implemented correctly?

No – Implement and monitor

Yes – to 2)

2) Has anything changed in the farm system?

Yes – remodel and monitor

No – to 3)

3) Have there been abnormal conditions at the time of trigger breach?

Yes – continue monitoring to see if trigger breach continues

No – Seek advice if suitably qualified person to investigate root cause and suggest appropriate mitigation.

If emergency conditions occur that risk a pollution event, such as a catastrophic failure of the irrigation system that is resulting in overland flow to a watercourse, seek immediate guidance from you regional council:

Environment Canterbury 0800 76 55 88

5.2.3 Auditing

The auditing process allows both the farm operator to illustrate, and other interested parties to have confidence that the management practices and mitigations planned for the farm are being implemented. In addition, the audit shows that there is a mechanism for the adaptive management of the property should the chosen mitigation or management not perform to expectations.

An annual audit is proposed, and requires both external and in-house input. The annual audit should be completed and submitted to ECan by end of July each year.

The audit measures and actions in case of non-compliance will be finalised once the FERA is completed. Those pertaining to FEMP stages 1 and 2 are included in Table 9. Therefore those mitigation measures identified in FEMP stage 3, the auditing measures and actions will be completed in Table 9 once the FERA is completed.

Table 9 below shows an example of an annual audit report for Quailburn Downs.

Table 9. Table showing proposed contents of an annual audit report for Quailburn Downs

Mitigation Measure	Audit Measures	Action in case of non compliance
	Annual audit of OVERSEER nutrient budget and report based on previous 3 years. Submission of compliance with thresholds	Should the OVERSEER report show losses exceeding the threshold, further mitigations should be adopted to effect a reduction in nutrient loss to below thresholds.
	Submission and brief interpretation of water quality analysis	Where triggers have been exceeded, immediate contingency plans should have been carried out and a root cause

		analysis conducted. The results of which should be presented here.
	Submission and brief of annual wet weather survey	Any remedial actions proposed after the annual survey should be undertaken.
	Submission and brief of annual tracks that cross waterways survey	Any remedial actions proposed after the annual survey should be undertaken
	Submission and brief of annual compaction survey of the irrigation area	Any remedial actions proposed after the annual survey should be undertaken
	Annual pest and weed survey undertaken by Ecan should be submitted	Legislative compliance
Fertilisers applied according to code of practice for fertiliser use	Self certification	Any issues should be rectified and identified in next audit
Accounting for all sources of nutrients including applied effluents and soil reservoirs	Reconciliation of fertiliser and soil records with nutrient budget.	Where reconciliation is not verified then this should be rectified at next audit
Even fertiliser application	Calibrate and optimise fertiliser spreaders annually and every 5 years by an external auditor. Signed records for verification	Spreaders not performing shall be recalibrated
Even irrigation application	Calibrate and optimise irrigators annually in house and every 5 years by an external auditor	Submission of testing and calibration
Record crop, cultivation, nutrient inputs and yields per farm management unit	Verification of records	If records have not been produced then this should be rectified for next audit
Good design of irrigation systems by a certified professional and audited every 5 years	Irrigation system audited by a certified auditor every 5 years and any changes recommended should be implemented	If changes recommended not implemented then this should be rectified by next audit
Robust irrigation scheduling	Verification of records	If records not received then this should be rectified by next audit
No June/July application of fertiliser on the irrigated area	Field records	If records not received this should be rectified for next audit.
N fertiliser applications split to under 50 kg N/application	Field records	If records not received this should be rectified for next audit
No P fertiliser within three weeks of irrigation	Field records	If records not received this should be rectified for next audit
Olsen P of below 30 maintained	Submission and brief interpretation of soil test results	Where triggers have been exceeded, immediate contingency plans should have been carried out and a root cause analysis conducted. The results of which should be presented here.
20 metre layback from any water way when applying fertiliser by land based application e.g. bulk spreader	Field records and maps	If maps not received with annual audit this should be rectified by the next audit.
Irrigation buffer from Quailburn Stream of at least 20m	Check setback area is present. Photos	Areas of fencing damage should be repaired.
Fence the south side of Quailburn Stream within the existing irrigation area to restrict stock access to the Quailburn	Check fenced area is present. Photos	Areas of fencing damage should be repaired.

GPS Spreader and maps to be used when applying fertiliser	Maps	If maps not provided then these should be provided by the next audit

6. Summary

This FEMP has been written to serve two purposes; to ensure the proposed and existing farm system can meet the nutrient mitigation requirements set out by the MWRL Water Quality Study, and to set out the process for identification of farm specific environmental risks that arise from the inherent characteristics of the farm and from the proposed and existing farm system and its management.

The WQS thresholds and modelled outputs from OVERSEER detailed in Section 4.2 illustrate that this proposed system meets the WQS thresholds identified.

A full on-farm risk assessment was completed in December 2009 with a commitment to address the risks identified. Section 4.3 sets out the risks identified for this property and those issues common to all high country farming systems, along with existing mitigation measures.

The mitigation and management measures detailed in Table 6 set out the measures that have been adopted to mitigate and manage the risks that were identified in the risk assessment along with mandatory good agricultural practices and those measures that have been modelled in OVERSEER.

Baseline monitoring and any additional monitoring proposed for this property are identified and set out in Section 5.2, Tables 7 and 8 allows the performance of the measures chosen to be monitored and where they are performing sub-optimally, these can be addressed through the root cause analysis process.

The auditing of this plan, addressed in Section 5.2.3, Table 9 ensures that the relevant mitigation measures outlined in Table 6 are audited annually either internally or externally and communicated to ECAN by the end of July each year.

References

Ministry for the Environment. 2005. Environmental, Economic and social impacts of irrigation in the Mackenzie Basin.

GHD (2009a). Cumulative Water Quality Effects of Nutrients from Agricultural Intensification in the Upper Waitaki Basin – Mitigation Toolkit.

Webb, T. H. (1992). Soils of the Upper Waitaki Basin, South Island, New Zealand, DSIR.

APPENDIX A: Farm Environmental Risk Assessment

GUIDELINES QUESTIONS FOR THE
COMPLETION OF A FERA November/December 2009

The plan is to focus on those existing/proposed irrigation areas along with any intensive areas surrounding. We also need to keep in mind that this is a whole farm environmental risk assessment and hence other areas of the farm may also be applicable at times. Take notes on wetland areas, swamps, major streams/rivers, location of the yards in relation to watercourses

Some guideline questions for track management and runoff		**Notes/description**
1	Do any regularly used tracks run through streams?	No in the intensive areas. In extensive high country properties there are areas within the farm where tracks will cross streams, these will be tracks that are used irregularly
2	Do any tracks directly runoff to a water course	No
3	Stock crossings?	Stock are generally crossed over the road bridges in the intensive areas of the farm. In extensive high country properties there are areas within the farm where stock will cross streams and use streams for stock water.
4	Any evidence of previous runoff, soil wash or erosion?	No but a potential vulnerability to wind erosion
6	Do you have a silage pit located near a permanent watercourse?	No
Some guideline questions for stock management		
1	Are measures taken to control dietary intakes of N and P? (Intensive beef and dairy)	N/A
2	Are stock restricted from entering watercourses in intensively farmed areas?	No, stock can enter the Quailburn on the north side of the existing pivot
3	Do you graze stock in paddocks that have a hydraulic connection to a watercourse in winter months?	No

4	Yards - do you use water? If yes, details (e.g. is it collected, discharged, what is it used for…?)	Yes, dipping. Water contained in yards. No watercourses near the yards
Some guideline questions for biodiversity		
1	Are there any special areas or species of interest or conservation on the farm?	No
2	Are there any water or wetland features on the farm?	No
3	Are these features actively protected?	N/A
Some guideline questions for chemical usage	*Chemical storage and handling is dealt with under the Hazardous Substances and New Organisms Act*	
1	Are those handling chemicals of 'approved handler status'?	Yes, contractors are used for spraying pasture
Some guideline questions for water		
1	Do you use border dyke irrigation?	No
2	Do you collect wipeoff losses?	N/A
3	Are these wipeoff losses discharged to a watercourse	N/A
4	Is there evidence of bankside erosion in any permanent flowing watercourses?	None evident, streams are stony. Good vegetation buffer right up to the edge of the Henburn that flows through the property.
Some example questions on cropping		
1	Is inversion tillage used? Describe	Yes if required otherwise direct drill
2	Are soils left bare over winter?	no
3	If arable or fodder crops are grown, are measures taken to conserve or build soil organic matter on	None grown

	arable land?	
4	Are remedial measures in place after winter grazed crops?	No break fencing crops
5	Is there a possibility of run off from winter grazed areas reaching a water course?	Potential but not directly or close by, steers wintered on the hill.
6	Other cropping issues or incidences? Please describe	N/A
Some example questions on soil health		
1	Are there compacted, consolidated or capped soils?	None evident, stilty
Some example questions on pest and weed management		
1	Do you undertake any current pest or weed control? E.g rabbits, gorse	Yes, rabbit shooting. Boundary rabbit fenced