

Farm Environmental Management Plan: Lilybank Station

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1. Introduction

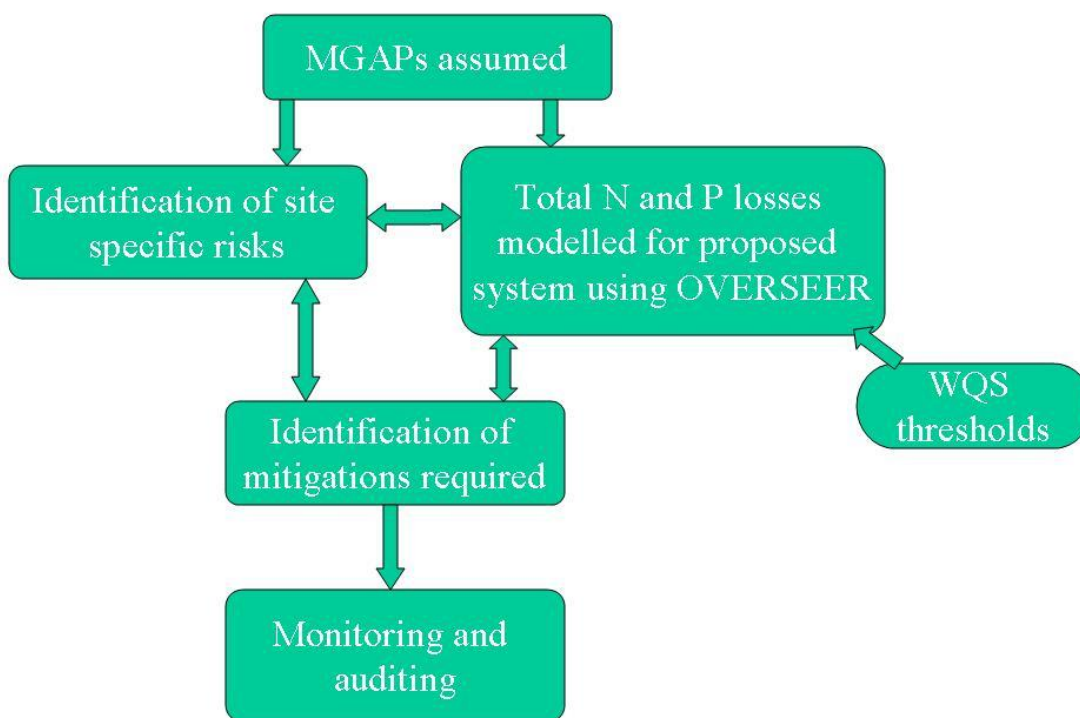
The Water Quality Study ('WQS') funded by Mackenzie Water Research Limited ('MWRL'), found that the additional irrigation proposed in the catchment could take place without significant adverse effects on the environment providing that nutrient reduction occurred on the farms.

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.

MWRL also commissioned a Cultural Impact Assessment which identified a number of cultural issues associated with the additional irrigation. On examination and analysis it was found that most of the identified cultural issues were largely generic in nature, whereby water quality appeared to be the main concern. In formulating this FEMP for Lilybank Station those cultural issues related to water quality and relevant to the operation of Lilybank Station have been considered and taken into account.

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



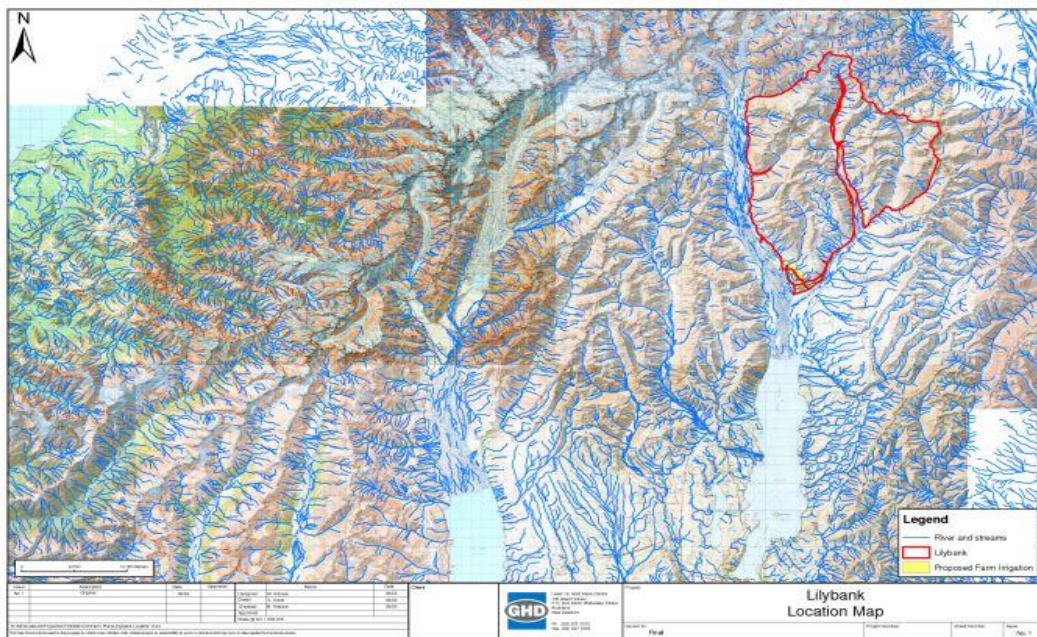
MGAP – Mandatory good agricultural practices

2. Farm Description

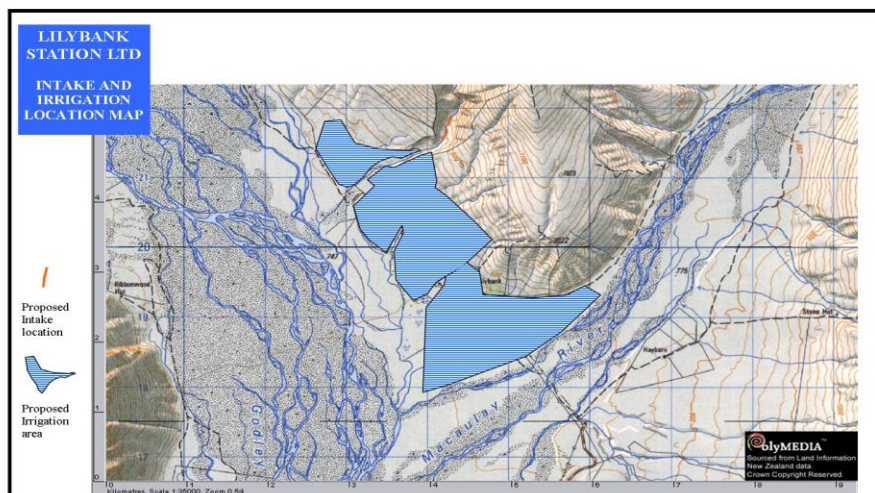
2.1 General farm description

Lilybank Station is located at the head of Lake Tekapo between the Godley and Macaulay Rivers. The property is 2,246 ha predominantly leasehold high country station which comprises of 500 ha of gently sloping land. Of which approximately 400 ha has been cultivated and the remaining flats and hill country are typically grazed high country land.

Lilybank currently runs approximately 5000 SU made up of approximately 70% deer, 25% beef cattle and 5% sheep.



Map A: Location of Lilybank



Map B: Proposed Irrigation development area

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	Oversown Hill	Over sown hill	Native	Grass Flats
Hoggets	Oversown hill	Oversown hill	Native	Grass flats
Breeding cows	Oversown hill	Native	Native	Oversown hill
R1/R2 Heifers	Grass flats	Oversown hill	Oversown hill	Grass flats
MA Hinds	Oversown hill	Oversown hill	Oversown hill	Grass flats
R2 Hinds	Oversown hill	Oversown hill	Oversown hill	Grass flats
R1 Stags/Hinds	Grass flats	Grass flats	Grass flats	Grass flats



Photo A: Existing landcover of proposed irrigation development area

2.2 Proposed farming system

The proposed irrigation development is for 172 hectares within a command area of 400ha.

The intention of Lilybank is to increase their deer stock units with the proposed irrigation development. There is also the potential that a links type gold course could be developed in the future however agriculture is the predominant activity.

The proposed irrigation will provide security for winter with the production of quality dry matter in the growing season which can then be made into 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	Oversown Hill	Over sown hill	Native	Grass Flats
Hoggets	Oversown hill	Oversown hill	Native	Grass flats
Breeding cows	Oversown hill	Native	Native	Oversown hill
R1/R2 Heifers	Grass flats	Oversown hill	Oversown hill	Grass flats
MA Hinds	Oversown hill	Oversown hill	Oversown hill	Oversown hill
R2 Hinds	Grass flats	Grass flats	Grass flats	Grass flats
R1 Stags/Hinds	Grass flats	Grass flats	Grass flats	Grass flats

2.3 Soils

Free draining stony soils = 200.73 ha, Medium/ heavy soils 133 ha, native light soil 890ha. Medium soil (oversown hill) 503 ha, river silt 47 ha.

Irrigation soil description: The area of land proposed for irrigation by this application is predominantly Cass, Craigieburn, Dobson and Tasman. These soils are mainly silt and sandy loams. The soil profile available water (PAW) capacity is in the order of 40-100 mm.

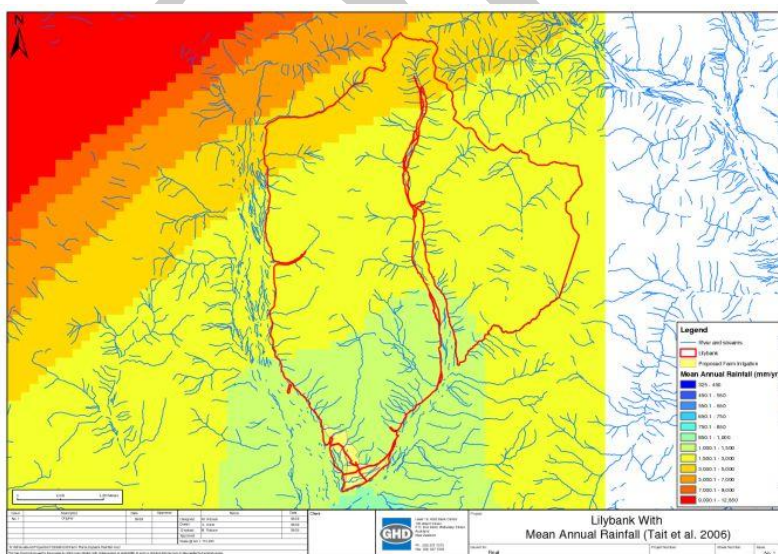
2.4 Topography

Typical high country elevations ranging from 700m to 1380m. Topography ranges from steep hill country to rolling country and then to flat land.

2.5 Climate

Spring – prone to norwest winds cold and warm. Summer – likely to be hot and dry. Autumn – mild with frosts. Winter – can be heavy frosts with heavy snow falls.

From 1950 to 1970 the Meteorological Service had a rainfall station on Lilybank Station. During these 20 years the mean annual rainfall was 1,140mm, with the highest being 1,541mm and the lowest being 812mm. Since then the current owners have been taking rainfall records in 2004 the annual rainfall was 1,035mm and in 2005, 712mm.



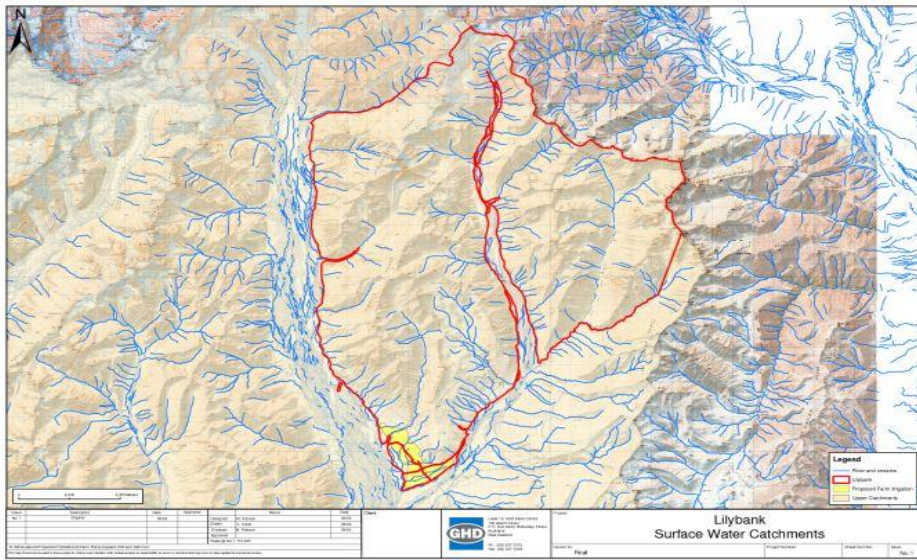
Map C: Mean Annual Rainfall for Lilybank Station

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

Lilybank Station, according to the WQS, lays in the Upper Catchment surface water catchments. This map is shown below.



Map D: Receiving environment

3.2 Local receiving environments

The Godley and Macaulay River, along with the DOC conservation land and Station Stream are the local receiving environment directly beside Lilybank Station. The Godley and Macaulay River are the headwaters of Lake Tekapo. Any tributaries of Lake Tekapo are classified as High Natural Character water bodies, because they are either currently largely unmodified parts of the catchment or contain rare or important species and habitat or habitat assemblages.

As can be seen below, Lilybank has no specific mitigation requirements from the WQS but the mitigation as described in Table 6 provides specifically for the local environment.

Table 3. Water Quality Study mitigation requirements for Lilybank Station

	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
Lilybank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

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	<p>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</p> <p>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.</p>
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	<p>Maintaining good crop input records is important for:</p> <ul style="list-style-type: none"> • 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 Lilybank Station using the most stringent nutrient mitigation requirement are 37,714 kg N/year and 2,900 kg P/year, as seen below. The table below shows the output from OVERSEER for the modelled proposed farming system at Lilybank Station. The results illustrate that the proposed farm system losses as modelled by OVERSEER are within the thresholds set out in the WQS.

Management or mitigation strategies that have been used to meet this threshold are detailed in Section 5.

It must be noted that 'deer pacing fence lines' has been left selected within Overseer to ensure a worst case scenario for P losses has been presented for Lilybank Station. The risk assessment however did not identify any evidence of deer pacing fencelines.

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

	OVERSEER Proposed modelled outputs kg/year	WQS threshold kg/year
Total N leaching/runoff	13,389	37,714
Total P leaching/runoff	2,229	2,900

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 Lilybank and has highlighted potential soil, stock and track 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 in the farming system.

4.3.1 Soil Risk

The current soil risks identified are that although wind erosion wasn't evident there is a potential vulnerability to wind erosion and bank side erosion was evident along Wool wash creek. The establishment of irrigation will ensure improved ground cover levels which 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 all watercourses within the proposed irrigation area.

4.3.3 Track risks

The risks associated with tracks are that the main vehicle track at Lilybank runs through Wool wash creek.

4.3.4 Site specific management measures and existing mitigation measures in place

1. At Lilybank there are culverts placed in most areas where stock or vehicles cross watercourses.
2. Riparian fencing has been undertaken in one area, Wool wash creek due to bank erosion. (See photo C). Bank erosion will be monitored as part of an annual survey, see Table 8.
3. 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.
4. A contractor or approved handler if required is used to apply chemicals at Lilybank.
5. 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.

6. 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.

The main class of stock at Lilybank are deer. There was no evidence of compaction due to fence walking by the deer. Annual monitoring of soil compaction will include all paddocks to check for compaction due to fence walking.

7. Runoff

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

4.3.5 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 an 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.

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5. Farm Environmental Management Plan for Lilybank Station

5.1 Mitigation measures and management options adopted on Lilybank Station

The table below shows the all the mitigation and management tools that are proposed to be undertaken on Lilybank. 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 Lilybank Station

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 June/July application of fertiliser on the irrigation area	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	Fencing stock out of permanently flowing waterways within the proposed irrigation area	Photos and surface water testing of race/waterway as per below monitoring location plan – prior to the irrigation development and 4 times per year as per below monitoring plan	Annual auditing report
3	Monitor and manage stock access, stock type and stock number from all permanently flowing waterways within non irrigated	Photos and location plan of waterways	Photos and location plan in first audit report

FEMP stage	Measure	Monitoring	Auditing
	intensively farmed areas		
3	Natural regeneration supplemented with infill riparian planting in two locations (subject to LINZ approval) (see Map E)	Photos of planting and location map	Provide photos as part of annual audit report for first 5 years then biannually
3	20m layback from waterways when applying fertiliser within irrigation area by land based application e.g. bulk spreader	Provide map to spreader company	Records to show where fertiliser was applied
3	Maintain existing crossing at Wool Wash Creek	Photos and location map	First year annual audit report
3	Irrigation buffer from the Godley River has been increased as per the location plan	Photos of fence location and map	First year annual audit report
3	Irrigation buffer of 20-30m from the Macaulay River bed.	Photos of fence location and map	First year annual Audit report

See Map E and photos for mitigation measure locations and monitoring locations

Photo B: Wool wash Creek where the track crosses, additional gravel and planting on the south side is to be completed



Photo C: shows the fencing that has been undertaken to reduce erosion around the waterways. The land below the pine trees shows an area that has been fenced for some time, hence the ground cover. In the foreground is an area of land that has been recently fenced note the erosion due to stock access, it is anticipated that the ground cover will increase via natural regeneration as is evident on the other side of the fence (Taken September 2009)



Photo D: Shows the natural regeneration that has occurred over a 3 month period in 2009, of the same areas as Photo C.



Photo E: Shows the small ponded area on the right and the DOC swamp area on the left of the photo. The ponded area is one area where strategic planting will be undertaken.



5.2 Monitoring and Auditing

5.2.1 Baseline monitoring

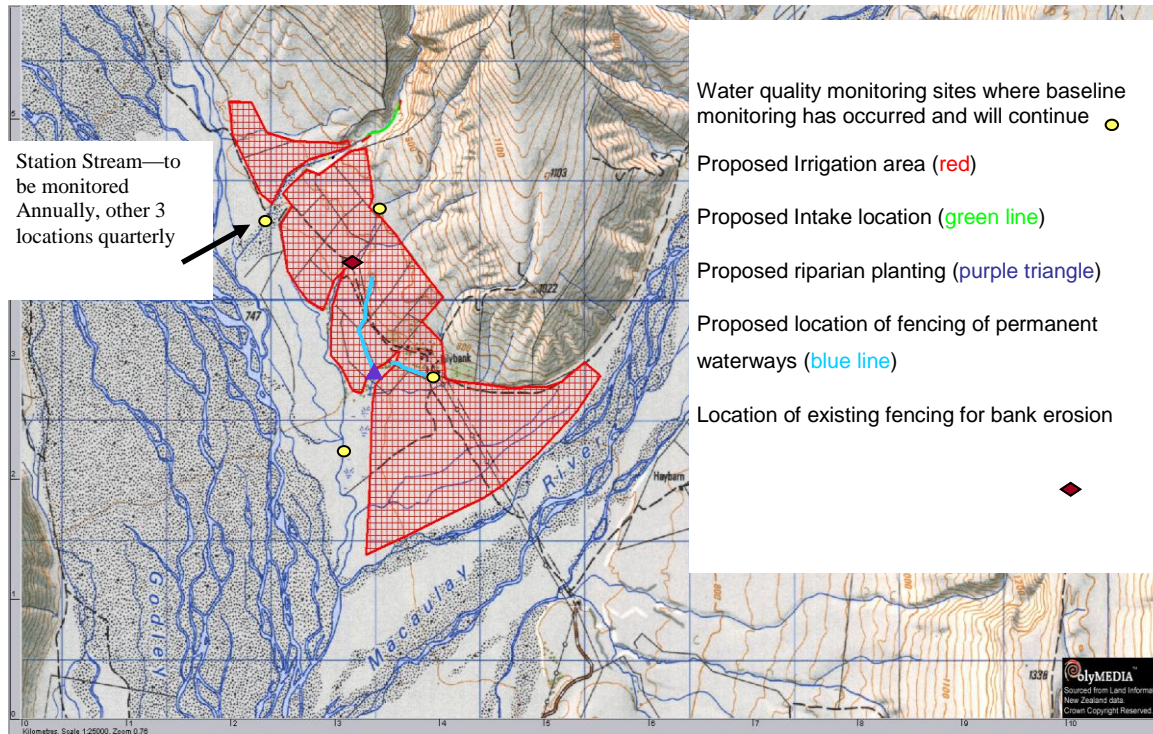
Baseline monitoring is already underway on Lilybank Station. An ecological survey was undertaken on Station Stream in February 2009 by Dean Olsen of Cawthron. This report was undertaken to survey the existing values of Station Stream including the fish, macroinvertebrate and periphyton communities.

Table 7. Baseline monitoring on Lilybank Station

		Location	Frequency	Measured parameters to include
Soil	Soil nutrient testing	All intensive blocks in rotation	1 in 3 years	Standard suite of soil nutrients
Water	Surface water quality	4 Locations (see map E)	In 2008 and then again in spring 2009	Total Nitrogen, nitrate, ammonia, total Kjeldahl nitrogen, total phosphorus, dissolved reactive phosphorus, suspended solids.
Weed and Pest		Whole Farm	Annually	Done as part of an annual survey from Ecan

Map E: Monitoring and mitigation locations

Land to the left of the irrigation area, close to the Godley River is the irrigation area that has been reduced to act as a buffer to the Godley River (see mitigation above)



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 undertaken for Lilybank Station and Table 8 below shows the proposed monitoring plan, frequency, location for the monitoring along with the triggers and contingency plans if triggers are exceeded.

Table 8. Example monitoring plan for Lilybank Station 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 irrigation blocks in rotation	1 in 3 years for soil nutrient status	Standard suite of soil nutrients	Olsen P >30	Reduce or stop the application of P fertiliser to the area and monitor
Soil	Soil compaction testing	All irrigation blocks in rotation	Annually for soil compaction testing.	Soil compaction	Compaction, surface capping	Remove compaction with the appropriate tool
Runoff	Wet weather survey	All irrigation blocks	Annually	Runoff from tracks	Runoff occurring	Immediately review current runoff mitigation options for tracks. Introduce further runoff removal infrastructure where appropriate.

		Location	Frequency	Measured parameters to include	Triggers	Contingency plan if triggers are exceeded
Water	Surface water quality	4 locations (see Map E)	Station Stream to be monitored annually if the irrigation development occurs to the NW of Station Stream then the monitoring frequency will be increased to quarterly Four times per year (Spring/summer/autumn/winter), for the other three locations an initial period of 5 years and then reviewed	Total Nitrogen, nitrate, ammonia, total Kjeldahl nitrogen, total phosphorus, dissolved reactive phosphorus, E Coli and 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 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 from ECAN

- Please see above proposed water quality monitoring sites and the proposed irrigation development area map for location of other monitoring sites.

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.

Table 9. 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 Lilybank Station.

Table 9. Table showing proposed contents of an annual audit report for Lilybank Station

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.
Fence stock out of permanently flowing waterways within the proposed irrigation area	Check fenced areas are present. Photos	Areas of fencing damage should be repaired.
Natural regeneration supplemented with infill riparian planting in two locations (subject to LINZ approval) (see Map E)	Check riparian planting is present. Photos	Any areas not planted should be rectified by the next audit
20m layback from waterways when applying fertiliser within irrigation area 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.
Maintain existing crossing at Wool Wash Creek	Photos	Any maintenance required should be completed at the earliest convenience
Irrigation buffer of 20-30m from the Macaulay River bed.	Check irrigation setback. Photos	Areas of fencing damage should be repaired.

6. Summary

This FEMP has been written to serve two purposes; to ensure the proposed 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/or 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.

7. 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.

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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?	Yes, Woolwash Creek
2	Do any tracks directly runoff to a water course	No
3	Stock crossings?	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?	Yes. An area of erosion has been identified and fenced, photos show the extent of regeneration of vegetation
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 - exclusion is part of the mitigation measures outlines
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...?)	NO

Some guideline questions for biodiversity		
1	Are there any special areas or species of interest or conservation on the farm?	Lilybank is designated a high natural character area.
2	Are there any water or wetland features on the farm?	Bordered by the Godley and MaCauley rivers with Station Stream running through Lilybank station itself.
3	Are these features actively protected?	Irrigation developed includes a buffer zone from the MaCauley, and Godley Rivers and Station Stream
Some guideline questions for chemical usage	<i>Chemical storage and handling is dealt with under the Hazardous Substances and New Organisms Act</i>	
1	Are those handling chemicals of 'approved handler status'?	Yes, contractors 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?	Yes but this is natural caused by excess rainfall, all of the streams are stony, fast flowing streams. Woolwash Creek and been identified and fencing to exclude stock has been commenced
Some example questions on cropping		
1	Is inversion tillage used? Describe	Yes, plough/discing is used if needed otherwise direct drilled
2	Are soils left bare over winter?	Occasionally
3	If arable or fodder crops are grown, are measures taken to conserve or build soil organic matter on arable land?	Yes
4	Are remedial measures in place after winter grazed crops?	Yes, oats are drilled into grass paddocks to get baleage, these grown quickly in the early spring to uptake the nutrients deposited from winter grazing

5	Is there a possibility of run off from winter grazed areas reaching a water course?	Yes, but not directly
6	Other cropping issues or incidences? Please describe	No
Some example questions on soil health		
1	Are there compacted, consolidated or capped soils?	Not evident but potentially due to deer and cattle being the main stock class. There was no evidence of fence walking.
Some example questions on pest and weed management		
1	Do you undertake any current pest or weed control? E.g rabbits, gorse	Yes, rabbit and hare control by shooting. Gorse is sprayed

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