Farm Environmental Management Plan: West Edge Ltd

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.

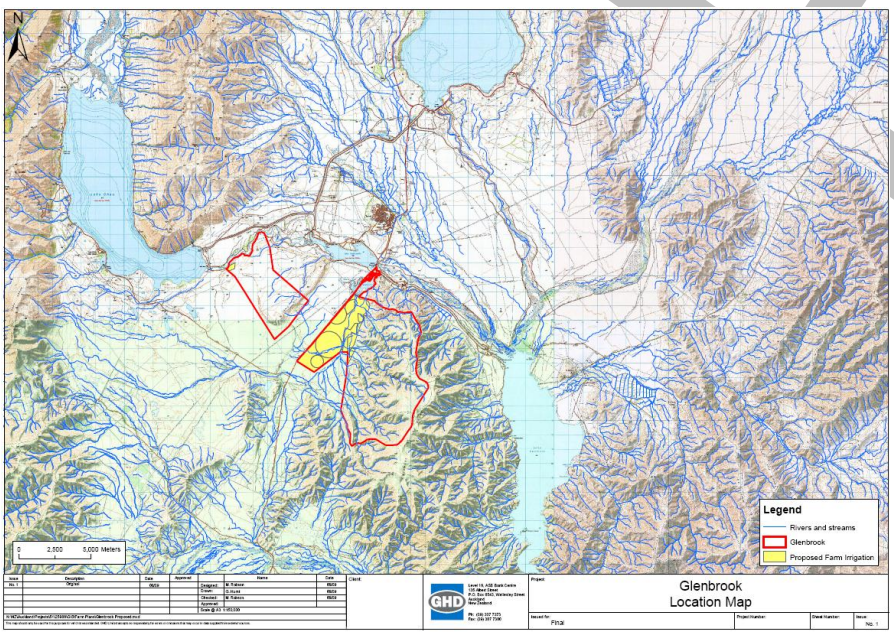
The process that was advocated for ensuring this on-farm nutrient reduction was through Farm Environmental Management Planing. A clear process for building a Farm Environmental Management Plan (FEMP) was laid out in the Water Quality Study and has been followed here. An overview schematic of the process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

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

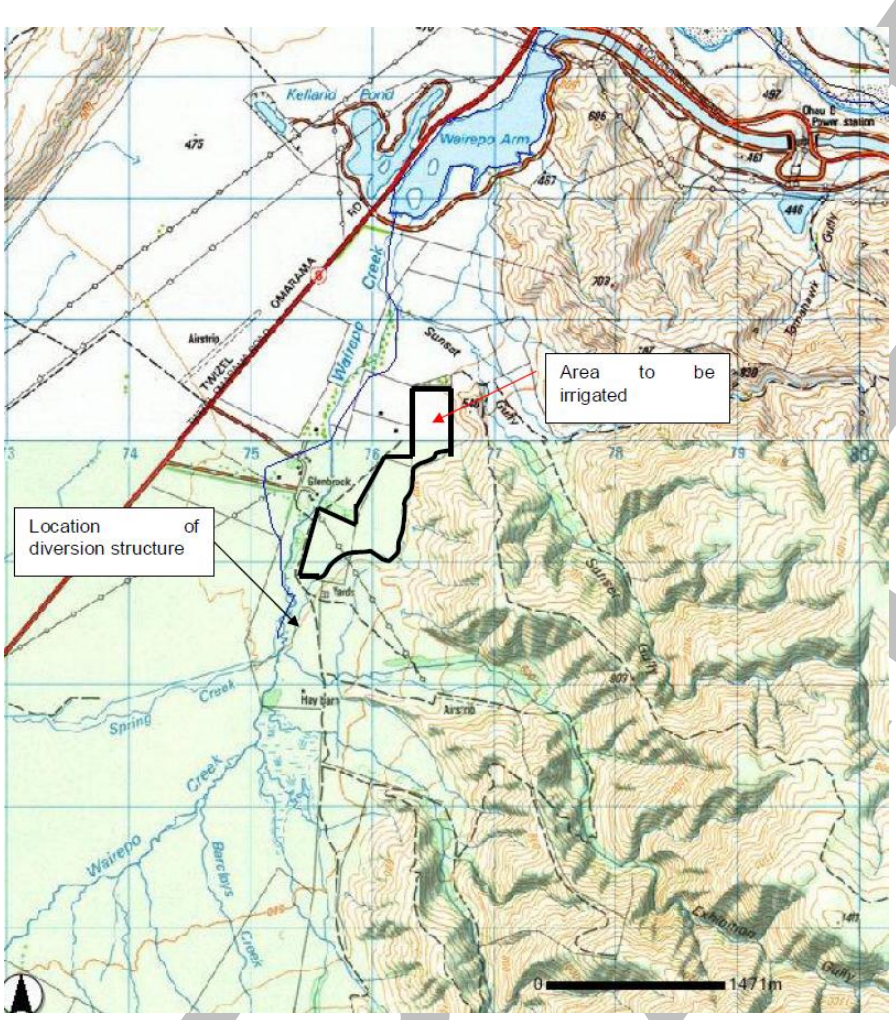
2. Farm Description

2.1 General farm description

The farm has been, in total, a 5,700 ha high country run located on both the western and eastern side of the Twizel-Omarama Road (SH 8) to the south of Lake Ruataniwha. Following the purcase of the property in 2004, extensive development of the property has been undertaken, which has included increasing the area being irrigated using water from the Benmore Irrigaiton Schmem. This development along with existing irrigation on the property has allowed the property to be split into two economic units. Simon Williamson is farming approximately 3,700 ha area and Henry Williamson is farming the other 2,000 ha in area.



Map A: Location map.



Map B: Area currently 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	Oversown hill	Oversown hill	Oversown hill	Oversown hill
Hoggets	Irrigated grass flats	Irrigated grass flats	Irrigated grass flats	Irrigated grass flats
18 month Steers	Grass flats	Irrigated grass flats	Irrigated grass flats	Irrigated grass flats

2.2 Proposed farming system

It is not proposed to change the farming system, as this is a renewal of an existing irrigation system with a farming system already in place.

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	Oversown hill	Oversown hill	Oversown hill
Hoggets	Irrigated grass flats	Irrigated grass flats	Irrigated grass flats	Irrigated grass flats
18 month Steers	Grass flats	Irrigated grass flats	Irrigated grass flats	Irrigated grass flats

2.3 Soils

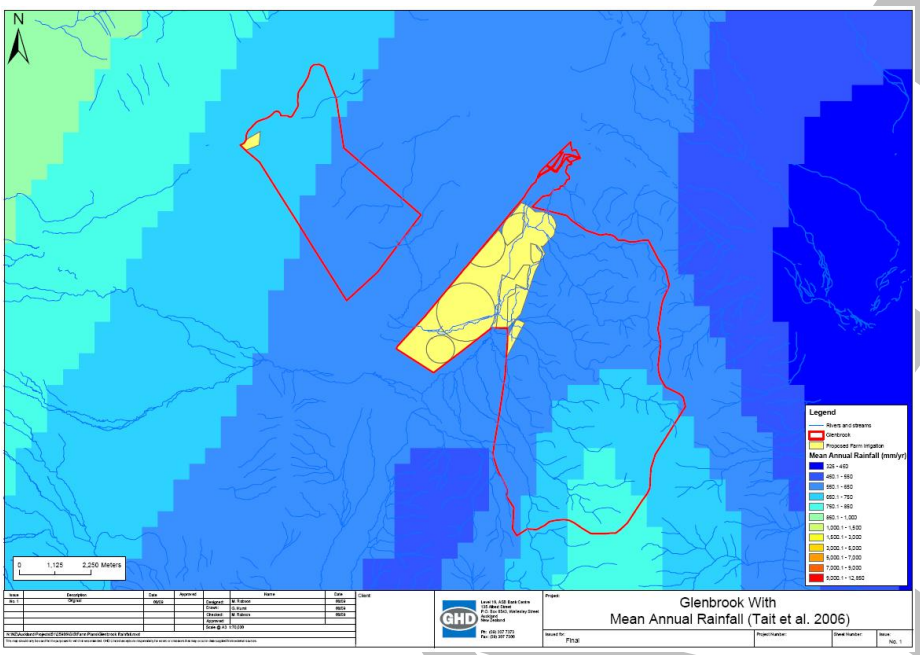
Light to medium dept topsoils on hill, some stone with a mixture of soil types on both undeveloped and developed flat land.

2.4 Topography

Brichwood Run is a mixture of rolling flats and very steep hills country. The Wairepo Arm of Lake Ruataniwha is located at the northern end of the property.

2.5 Climate

Winter cold (heavy snow falls common) and summer dry with high evaporation levels. Northwesterly wether aspect with unreliable rainfall, especially from October to March.

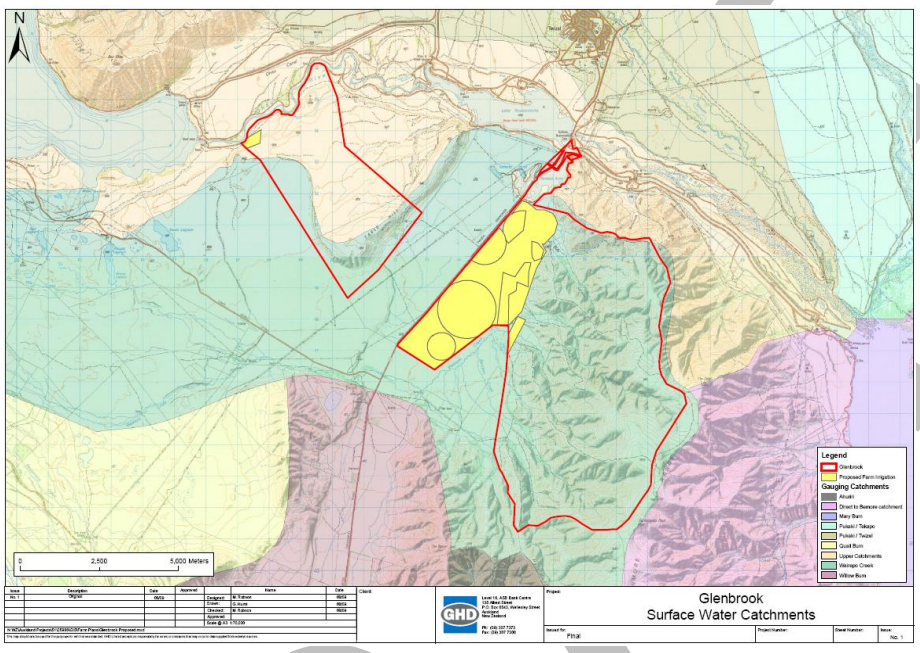


Map C: Mean annual rainfall

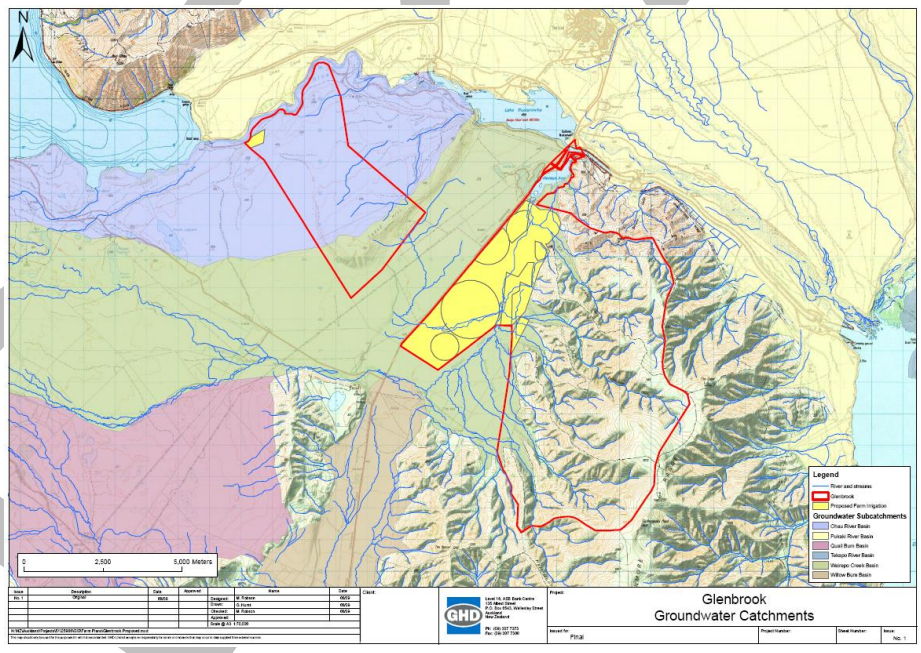
3. Environmental Context

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

Below are maps that show the receiving environments of West Edge Ltd.



Map D: Surface water receiving environment



Map E: Groundwater receiving environment

3.1 Water Quality Study receiving environments and mitigation requirements

The property, according to the WQS, lies in the Ohau River and Wairepo Creek groundwater catchments, and Wairepo Creek 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 Glenbrook Station.

For this farm, the Lake Benmore mitigation requirements are the most stringent. These mitigation requirements cap the properties nutrient discharges at 24,031 kg N per annum and 795 kg P per annum.

3.2 Local receiving environments

The area irrigated receiving environment is the Wairepo Creek which flows to the west of the area irrigated.

Table 3. Water Quality Study mitigation requirements for Glenbrook 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
0	0	0	0	1.90	1.00	0	0	16.40	00.70	0	0

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

Mandatory good agricultural practices	What these practices mean on farm
	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 Glenbrook Station, using the most stringent nutrient mitigation requirement, are 24,031kg N/year and 795 kg P/year. The table below shows the output from OVERSEER for the modelled proposed farming system at the property. The results illustrate that the proposed farm system losses as modelled by OVERSEER are within the thresholds. Management or mitigation strategies that have been used to meet this threshold are detailed in Section 5.

A list of OVERSEER model inputs and outputs are given in Appendix B.

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

	OVERSEER modelling outputs kg/year	WQS threshold kg/year
Total N leaching/runoff	6,988	24,031
Total P leaching/runoff	260	795

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

Due to insufficient time before, a full Farm Environmental Risk Assessment (FERA) will be conducted on the farm within 12 months of the consent being granted or before irrigation commences by an independent and suitably qualified professional in conjunction with the farmer. The FERA will assess risks associated with soil, fertiliser, effluent, cropping, stock, water, irrigation, runoff, tracks, pest and weeds, waste disposal and biodiversity.

All environmental risks identified will be addressed and have an appropriate monitoring and auditing strategy. All management strategies chosen to mitigate the site specific environmental risks identified in the FERA will be included in Section 5.

In a workshop held on 17-19th August the following potential issues were highlighted.

a) Runoff from winter feed crops

b) Laybacks from waterways from fertiliser application

c) Timing of fertiliser application

d) Track runoff – Check

e) Buffer from Wairepo Creek; identify

f) Location of troughs

g) Wairepo Arm of Lake Ruataniwha – Check

h) Tailgate water from border dykes; where does is go- check

i) Races outside of irrigation area; do they need fencing??

The FERA will need to address these issues specifically when carried out.

5. Farm Environmental Management Plan

5.1 Mitigation measures and management options adopted on the property

The table below shows the all the mitigation and management tools that are proposed to be undertaken. 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.** Where the full FERA has not been carried out, the final part of the table will be completed once the assessment has been made.

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

Table 6. Table of mitigation options, monitoring and auditing

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	**e.g.** No winter application of fertiliser	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	Reduce annual volumes of water on border dyke systems to 600 mm/year	Water metering	Submission of water meter readings
2	Olsen P of below 30 maintained	Regular soil testing (every 3 years)	Submission of soil tests

FEMP stage	Measure	Monitoring	Auditing
3	**e.g.** Fencing stock out of waterways through riparian fencing and planting where appropriate	Surface water testing of race/waterway as it enters and exits the property	Annual auditing visit.
	To be filled in once the FERA is completed		

Insert annotated map showing where mitigation measures are to be implemented. E.g. indicating 20 m lay beck for fertiliser spreading, or location of riparian planting and fencing, or location of improved stock crossing.

Annotated map with key mitigation options and locations on the station

5.2 Monitoring and Auditing

5.2.1 Baseline monitoring

Baseline monitoring is already underway

Table 7. Baseline monitoring on Glenbrook Station

		Location	Frequency	Measured parameters to include
Soil	Soil nutrient testing	Irrigated pasture	2-3 years	Standard suite of soil nutrients, pH C, N and organic matter
		Hill and dry land	5 yearly	
. Water	Surface water quality	At specific pints marked on the plan attached	Every two months	Total Nitrogen, nitrate, ammonia, total Kjeldahl nitrogen, total phosphorus, dissolved reactive phosphorus, suspended solids, Ph, Conductivity, Turbidly, dissolved organic carbon, e.Coli.
Pasture	Ground cover and species	All blocks		% Ground cover, species
Complete with other current on farm monitoring eg groundwater monitoring				

5.2.2 On-going monitoring

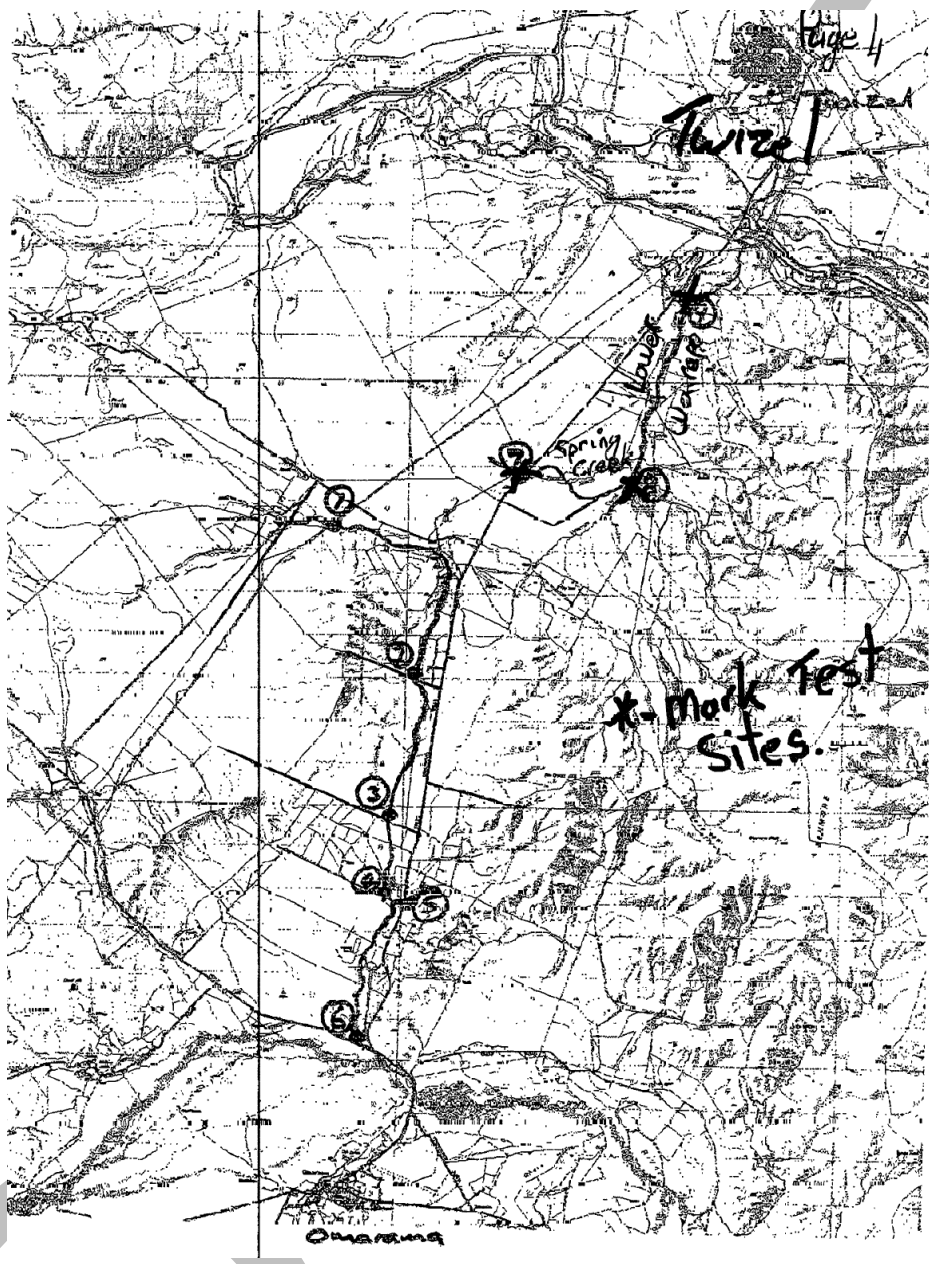
On going monitoring and auditing of FEMP are as important as the plan itself.

Table 7 above shows the monitoring suggested for the mitigation and management options chosen for Glenbrook station and Table 8 below shows the frequency and parameters for the monitoring. The triggers and contingency plans will be finalised in consultation with farm consultants once the FERA has been completed and all the mitigation measures identified.

Table 8. Example monitoring plan for Glenbrook 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 blocks in rotation	1 in 3 years for soil nutrient status	Standard suite of soil nutrients, pH C, N and organic matter		
Soil	Soil compaction testing	All blocks in rotation	Annually for soil compaction testing.	Soil compaction	Compaction, surface capping	
Runoff	Wet weather survey	All blocks	Annually	Runoff	Runoff occurring	
Water	Surface water quality	Spring Creek, lower Wairepo and Wirepo that drains into the Ahuriri River. Points marked on plan contained in Appendix B.	2 monthly. Has been occurring since 2005	Total Nitrogen, nitrate, ammonia, total Kjeldahl nitrogen, total phosphorus, dissolved reactive phosphorus, E Coli and suspended solids.	No significant deterioration in water quantity.	
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
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
Pasture	Ground cover and species	All blocks	2 x per year	% Ground cover and species	>80 %	Soil nutrient and compaction testing should be performed to identify possible causes of poor groundcover
Weed and pest pressures	Weed and pest populations	Relevant blocks	Annually	% or magnitude of infestation		
Complete table with other monitoring planned to include the monitoring of FEMP stage 2 measures						

Map showing location of monitoring points on Glenbrook station



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 here.

Table 10 below shows an example of an annual audit report for Glenbrook Station.

Table 10. Table showing proposed contents of an annual audit report for Glenbrook Station

Audit measures	Action in the case of non-compliance
Additional auditing that must be done externally	
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.
Check riparian planting and fencing is present where it should be and that it is intact, plus photographs	Any failure in the integrity of the fencing should be repaired immediately or a barrier placed around gap to prevent stock access until repair is made
Check fertiliser storage and filling area.	There should be no possibility of loss of fertiliser to drains or direct discharge to ground. Any drains should be covered, or the filling area moved to where no discharges will occur.
Fertiliser spreader and irrigation testing and calibration 1 in 5 years by independent auditor	Spreaders and irrigators not performing should be recalibrated
Additional auditing that can be done either externally or internally	
Reconciliation of fertiliser and soil records with nutrient budget and fertiliser recommendations	Where reconciliation is not possible and an over application has occurred, this should be rectified in the following year

Audit measures	Action in the case of non-compliance
Submission and brief interpretation of soil, water quality, supplement and machinery calibration tests	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 of example irrigation schedules and calculated water use efficiency	Where calculated water use efficiency is such that the trigger is exceeded, remedial action of how the system is to be optimised should be submitted, and followed up in the next audit
Annual soil compaction survey, submission broad findings and remedials	Where poor soil structure is found and cause assessed, the remedials should be implemented and followed up in the next audit
Annual wet weather survey, submission broad findings and remedials	Where runoff is found and cause assessed, the remedials should be implemented and followed up in the next audit
Annual fertiliser spreader and irrigation testing and calibration	Spreaders and irrigators not performing should be recalibrated
Auditing that must be done internally	
Self certification for application of fertiliser according to code of practice	Any failures in observing the code of practice for applying fertiliser should be rectified and followed up in the next audit
Submission of proof of 'approved handler' status	Inappropriate handling of chemicals should cease until an approved handler is in place

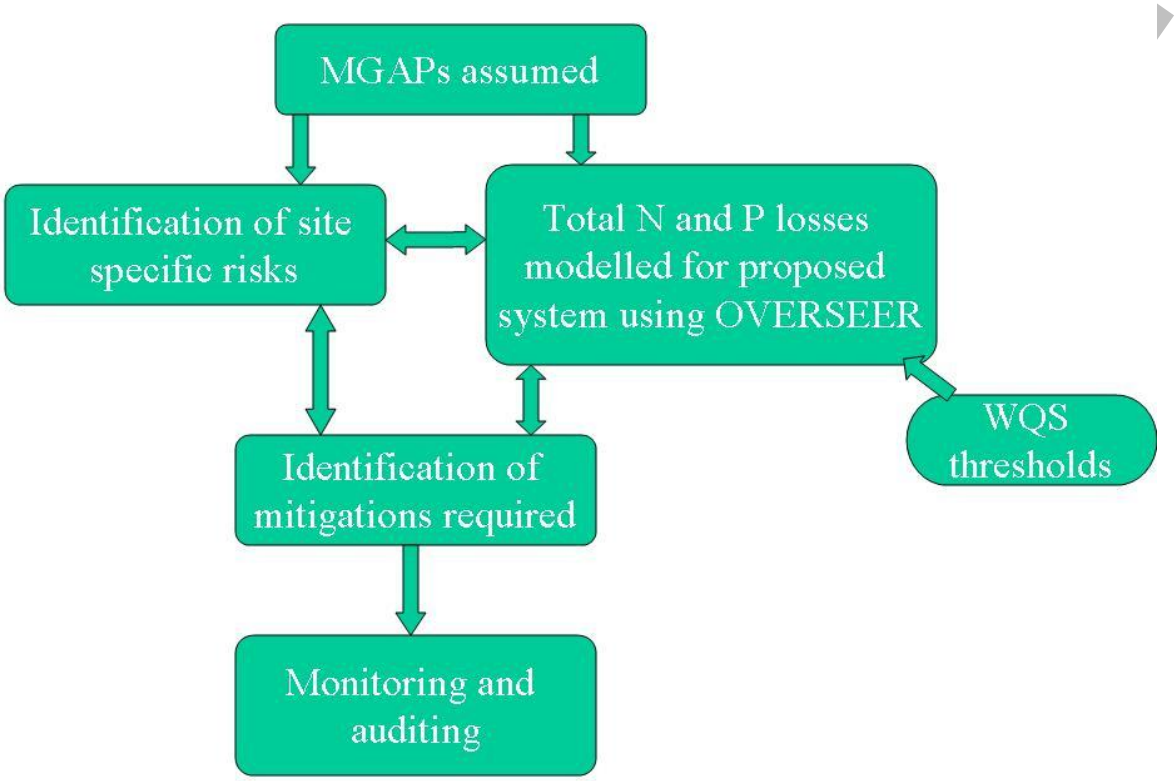
6. Summary

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 Water Quality Study, and to lay out the process for identification of farm specific environmental risks that arise from the inherent characteristics of the farm or from the proposed farm system and its management and mitigate other. A commitment to complete the full on-farm risk assessment within a pre-determined timeframe has been undertaken as well as the commitment to address the risks identified. These farm specific risks include uncontrolled discharges that are not identified in farm nutrient budget modelling but that may still have an environmental effect.

The mitigation and management measures detailed in Table 6 will lay out the techniques that have been adopted to fulfil these two objectives once the FERA has been completed. The WQS thresholds and modelling outputs from OVERSEER detailed in Section 4 illustrate that the proposed farming system meets the WQS thresholds, and the risk assessment process laid out in Section 4.3 illustrates how site specific environmental issues, including uncontrolled discharges, will be identified and mitigated.

The monitoring and auditing of this plan, addressed in Section 5 allow 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.

Appendix A: Overview schematic of the process to build a Farm Environmental Management Plan



Appendix B: OVERSEER