# Farm Environmental Management Plan: The Glens (Ellis-Lea Farms)

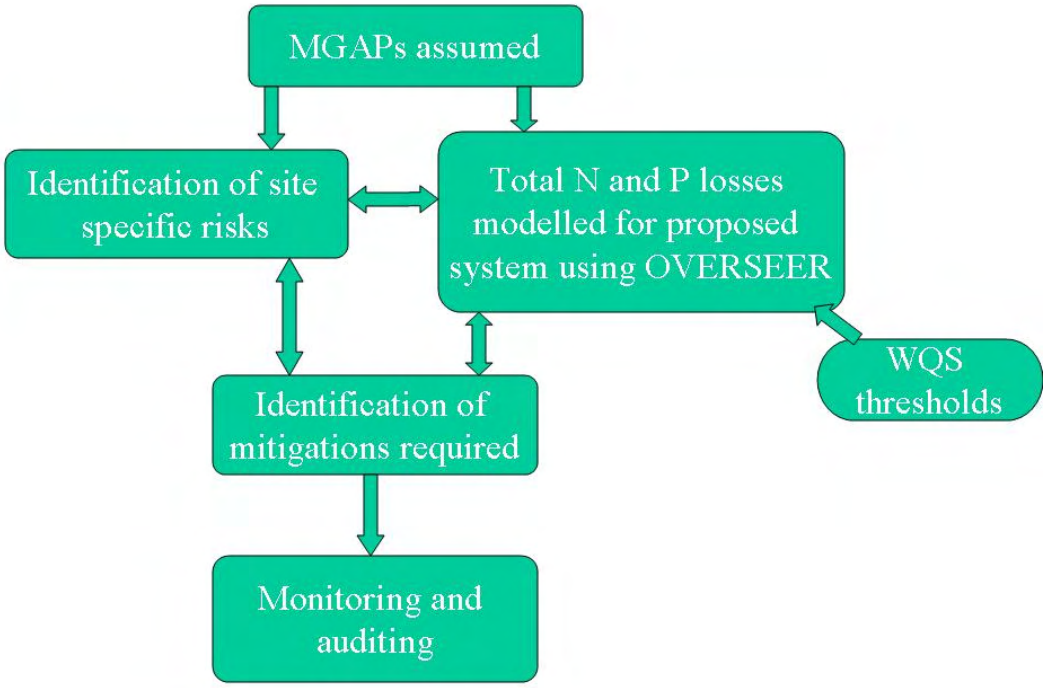
# 1. Introduction

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 Figure 1.

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

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



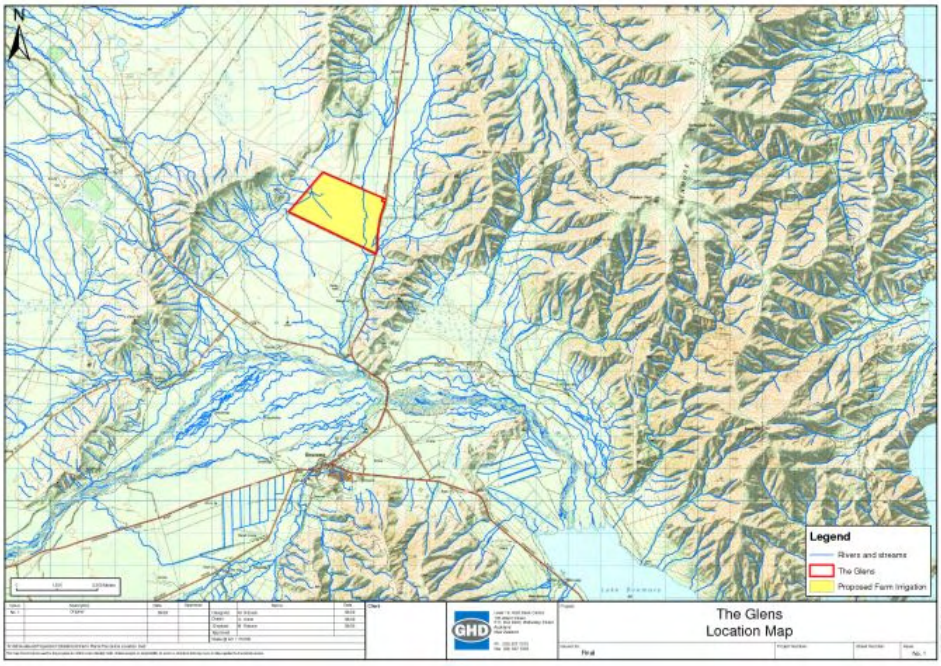

MGAP – Mandatory good agricultural practices

# 2. Farm Description

## 2.1 General farm description

The Glens is a fully developed dairy farm of 414 hectares, milking 1,000 cows. The property is situated between Omarama and Twizel, adjacent to SH79.

The land area is fully irrigated with water sourced from Benmore Irrigation Scheme and the Quailburn Government Race.




**Location Plan**


**Aerial Photograph of "The Glens"**

**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** |

| | | |
|---|---|---|
| **Dairy Herd** | Rotated around 31 paddocks | Grazed off farm |

## 2.2 Proposed farming system

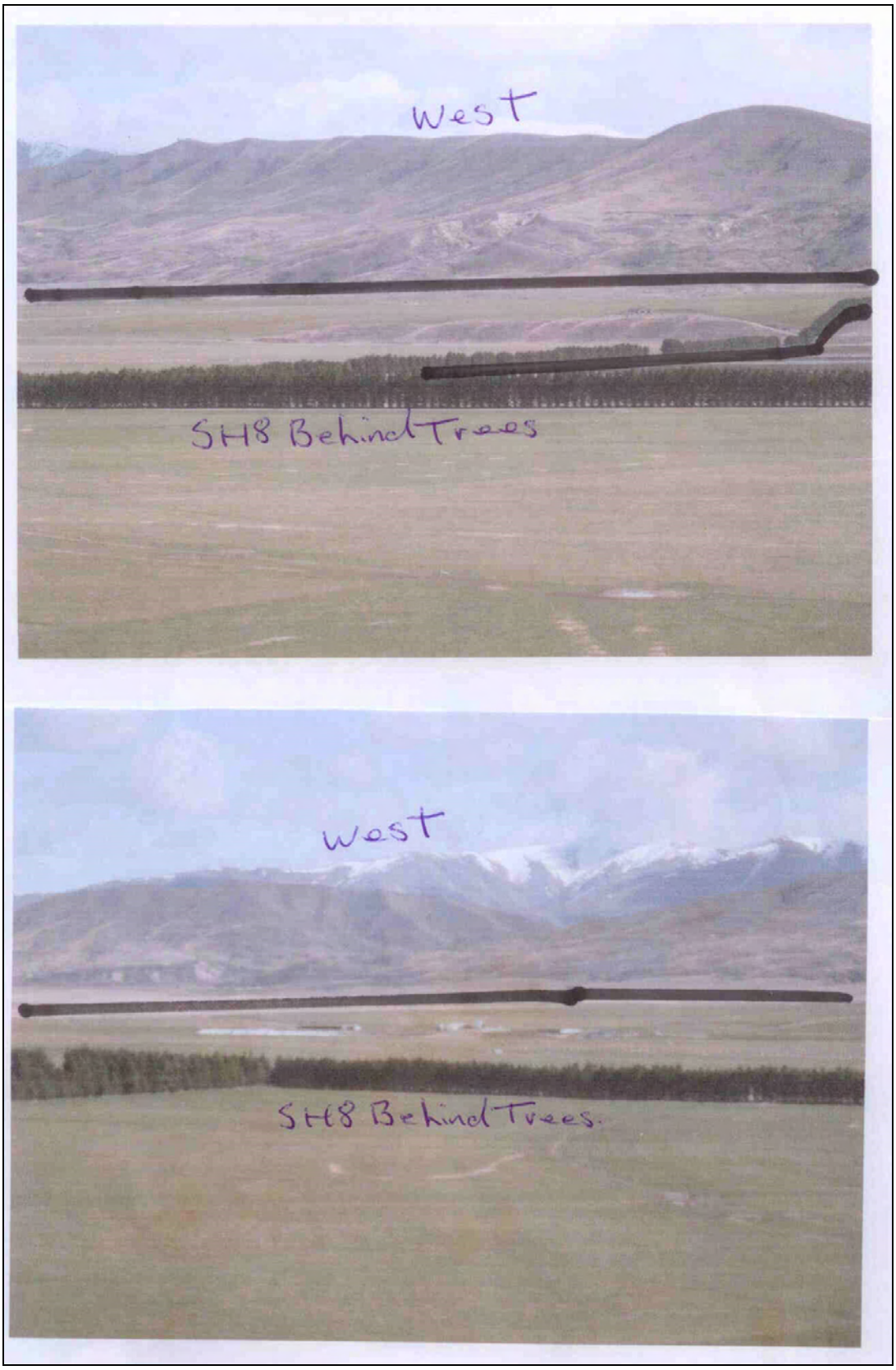
There are no changes to the farm system proposed.

## 2.3 Soils

The soils on the glens are light to medium silt, with water holding capacity of 40mm to 75mm.

## 2.4 Topography

The Glens has a flat, to gentle rolling contour.



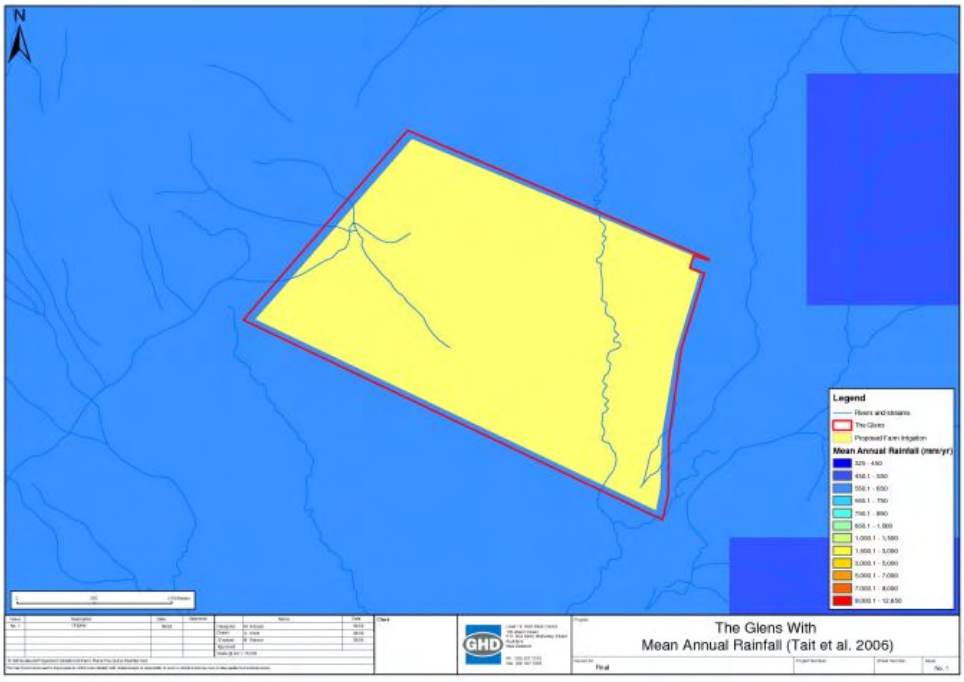

**Topography of 'The Glens"**

## 2.5 Climate

Annual rainfall is approximately 579mm. Summers are very dry.

Snow occurs most winters of depths between 100mm and 500mm.

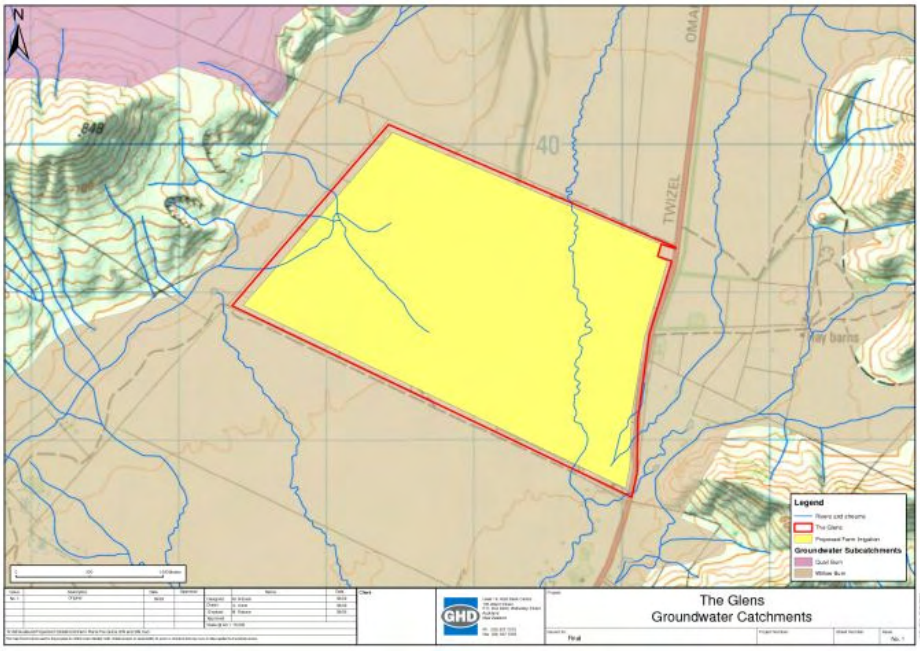
Temperatures range from -15 degrees to 40 degrees.



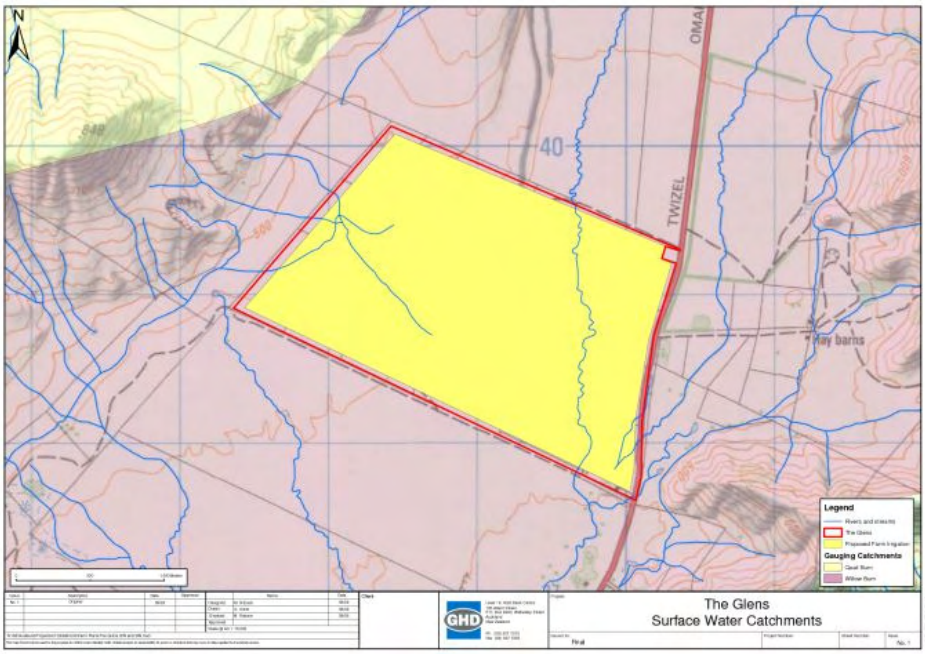

**Rainfall Map**

# 3. Environmental Context

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




**Groundwater Receiving Environment**




**Surface Water Receiving Environment**

## 3.1 Water Quality Study receiving environments and mitigation requirements

The Glens, according to the WQS, lies in the Willowburn groundwater catchment, and the Willowburn "Ahuriri Arm" and Ahuriri surface water catchments.

The following table shows the calculated nutrient mitigation requirement of the receiving environments determined in the WQS and the resulting thresholds for N and P for The Glens. Please note that no groundwater mitigation is required.

| Ahuriri Arm Mitigation required kg/ha irrigated land | Willowburn Stream Mitigation required kg/ha irrigated land | Ahuriri Stream Mitigation required kg/ha irrigated land |
|---|---|---|
| N -10.70<br>P -1.10 | N -0.70<br>P -0.10 | N 1.10<br>P -0.90 |

For this farm, the Ahuriri Arm mitigation requirements are the most stringent. These mitigation requirements cap The Glens nutrient discharges at 11,858 kg N per annum and 82 kg P per annum.

## 3.2 Local receiving environments

The Quailburn Catchment is located approximately 15km North-west of Omarama and drains the Diadem and Ohau Range. It has a catchment area above the minimum flow site of 82km$^2$ which is located at the Henburn Rd. The altitude of the upper catchment ranges from 500m to 1900m above MSL.

Several tributaries, including the East Diadem and Serpentine Stream, feed into the Quailburn upstream of the gorge, then into the Ahuriri River. Flows at the minimum flow site are usually continuous, however below the site is often dry, with surface flows often not continuous to the Ahuriri River.

The Quailburn provides a limited fishery for spawning and rearing habitat of rainbow and brown trout.

Willowburn Stream also passes through the property,

# 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 2. 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<br><br>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:<br>• The calculation of cumulative annual organic fertiliser applications and also their contribution to long term nutrient supply;<br>• The prediction of realistic crop yields that are used to determine crop requirements;<br>• 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 The Glens, using the most stringent nutrient mitigation requirement, are 11,858 kg N/year and 82 kg P/year. Table 3 below shows the output from OVERSEER for the modelled proposed farming system at The Glens. The results illustrate that the proposed farm system losses as modelled by OVERSEER are within the thresholds as set out by the WQS. Management or mitigation strategies that have been used to meet this threshold are detailed in Section 5.

**Table 3: Total N and P losses modelled by OVERSEER for the proposed farming system and WQS thresholds**

| | Nitrogen Threshold (kg/farm) | Phosphorous Threshold (kg/farm) |
|---|---|---|
| MWRL Water Quality Study Property Thresholds needs + buffer | 13,858 | 85 |
| OVERSEER® outputs | 12,656 | 78 |

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

### 4.3.1 Farm Environmental Risk Assessment (FERA)

**4.3.1** All streams are fenced off from stock and all tracks, vehicle and stock are culverted on the property.

**4.3.2** No tracks have any direct runoff into any permanent waterways.

**4.3.3** The water from the dairy shed is contained within the yards in an effluent pond. However the water that is used in the cattle yards has no evident drainage or storage, therefore it is my understanding that the water is allowed to drain into the neighbouring paddocks.

**4.3.4** There are no special areas or species of interest on the property. The only real area that is of some interest is the Willowburn stream, which begins in the property, this stream is fully fenced off and no stock have access to the stream for water.

**4.3.5** There are also small man made holding ponds (water) that are located on the property, these ponds are all fenced off from stock, and some are planted as well.

**4.3.6** Spraying contractors are brought in to do any spraying out; however the amount of spraying is minimal, as the majority of the property is in permanent pasture.

**4.3.7** No border dyke irrigation, all centre pivots.

**4.3.8** There is very minimal to no evidence of any sought of bankside erosion, and if there is any it is not stock induced.

**4.3.9** Direct drilling is the preferred method of planting, but if an area that has not been planted before is being planted then the soil may be turned over to help break it in.

**4.3.10** Soils are not left bare over the winter, as there is grass on them all year. If an area is intensively stocked over the winter, the area is then usually drilled coming out of winter, this taking up the excess nutrients. Stock are not often held on the property over the winter period, and are sent off farm.

**4.3.11** In the areas that have been used for holding stock and grazing stock there is very little chance of runoff into any streams, as the areas that have previously been used are located a long distance from any waterway.

**4.3.12** There is no evidence of compacted or consolidated soils on the property.

**4.3.13** Pest control measures on the property currently are; Night shooting, and poisoning for rabbits. Pest control for rabbits is not undertaken that much as there is not huge numbers of rabbits on the property. There is a small amount of weed control (spraying) on Briar, gorse, and broom, again this is not all that common as there are no large numbers of weeds on the property.

**4.3.14** Fertilisers used are; 50 kg of Nitrogen per hectare every year, and 500 kg of Super Phosphate every year. Lime is also applied to a large number of the property.

**4.3.15** There appeared to be no real buffer zone between the streams and the application of these fertilisers.

# 5. Farm Environmental Management Plan for The Glens

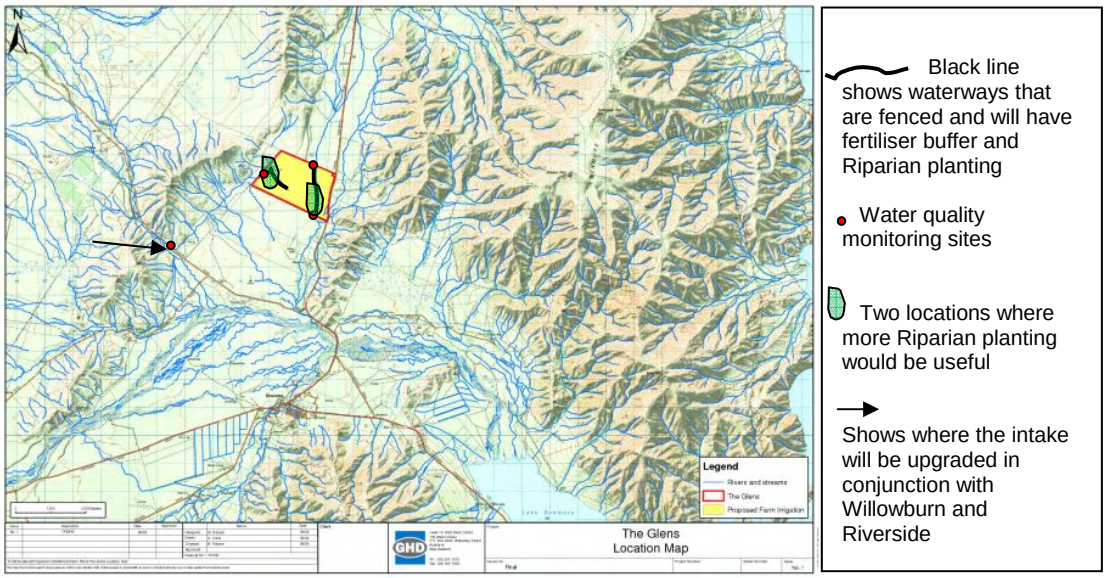
## 5.1 Mitigation measures and management options adopted on The Glens

The table below shows all the mitigation and management tools that are proposed to be undertaken on The Glens Station. 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 4 indicates in brief how the measures are to be monitored and audited.

**Table 4. Table of mitigation options, monitoring and auditing for Station The Glens**

| FEMP stage | Measure | Monitoring | Auditing |
|---|---|---|---|
| 1 | Fertilisers applied according to code of practice for fertiliser use | 3 years | 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 | 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 | Increase the riparian planting as indicated in the 2 green shapes in the map below, as well as within the existing fenced area | Surface water testing of race/waterway as it enters and exits the property | Annual auditing visit/report. |

| | | | |
|---|---|---|---|
| 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 | Re-drilling of areas that may have been heavily stocked over the winter months (or any other areas where pugging is a problem) | Field Records, and or site visits | Annual Audit visit/report |




The Above map is showing where the mitigation areas will be undertaken

## 5.2 Monitoring and Auditing

### 5.2.1 Baseline monitoring

Baseline monitoring is already underway on The Glens.

**Table 5. Baseline monitoring on Station The Glens**

| | | Location | Frequency | Measured parameters to include |
|---|---|---|---|---|
| Soil | Soil nutrient testing | All blocks in rotation | 1 in 3 years | Standard suite of soil nutrients |
| Pasture | Ground cover and species | All blocks | As needed | % Ground cover, species |
| Water | Groundwater quality in Bore H39/0139 as required By resource consent CRC070306 (dairy effluent) | | October, January, April and July each year | Nitrate Nitrogen, dissolved reactive phosphorous, E.coli and electrical conductivity. |

| | | Location | Frequency | Measured parameters to include |
|---|---|---|---|---|
| Water | Surface water quality in Willowburn Stream where It first enters The Glens, Immediately upstream of the Confluence with the Buscot Station tributary, within the Buscot Station tributary prior To it entering Willowburn Stream, and The point where the stream exits The Glens | | October, January, April and July each year | Nitrate Nitrogen, dissolved reactive phosphorous, dissolved oxygen, turbidity, temperature, E.coli and electrical conductivity. |

### 5.2.2 On-going monitoring

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

Table 5 above shows the current monitoring undertaken on The Glens and Table 6 below shows proposed monitoring plan, frequency, location for the monitoring and parameters for the monitoring along with the triggers and contingency plans if the triggers are exceeded.

**Table 6. Example monitoring plan for The Glens 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 | Olsen P >30 | Reduce or stop the application of P fertiliser to the area and monitor |
| Soil | Soil compaction testing | All blocks in rotation | Annually for soil compaction testing. | Soil compaction | Compaction, surface capping | Remove compaction with the appropriate tool |
| Runoff | Wet weather survey | All blocks | Annually | Runoff | Runoff occurring | Introduce runoff removal infrastructure where appropriate. |
| Water | Surface water quality | As per consent conditions | As per consent conditions | As per consent conditions | No significant decrease in water quality | If comparative surface water analysis indicates a decrease in surface water quality then the particular contaminant should be identified while a full root cause analysis is undertaken |
| Water | Surface water quality | As per consent conditions | As per consent conditions | As per consent conditions | No significant decrease in water quality | If comparative surface water analysis indicates a decrease in surface water quality then the particular contaminant should be identified while a full root cause analysis is undertaken |
| Water | Groundwater quality | Groundwater bore location Bore H39/0139 as required By resource | October, January, April and July each year | Total Nitrogen, nitrate, ammonia, total Kjeldahl nitrogen, total phosphorus, and dissolved reactive phosphorus, | No significant decrease in water quality | If comparative surface water analysis indicates a decrease in surface water quality then the particular contaminant should be identified while a full root cause analysis |

| | | Location | Frequency | Measured parameters to include | Triggers | Contingency plan if triggers are exceeded |
|---|---|---|---|---|---|---|
| | | consent CRC070306 (dairy effluent) | | | | 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 |
| 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 | | |

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 7 below shows an example of an annual audit report for Bog Roy Station.

**Table 7. Table showing proposed contents of an annual audit report for The Glens**

| 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 |
| 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 | Where triggers have been exceeded, immediate contingency plans should have |

| | | |
|---|---|---|
| | results | been carried out and a root cause analysis conducted. The results of which should be presented here. |
| Increase the riparian planting as indicated in the 2 green shapes in the map below, as well as within the existing fenced area | Check fenced area is present. Photos | Areas of fencing damage should be repaired. |
| 20 metre layback from any water way when applying fertliser 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. |
| Re-drilling of areas that may have been heavily stocked over the winter months (or any other areas where pugging is a problem) | Maps and photos | If maps not received with annual audit this should be rectified by the next audit. |

# 6. Summary

This FEMP has been written to serve two purposes; to ensure the 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 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 4 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 5 and 6 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 6 ensures that the relevant mitigation measures outlined in Table 7 are audited annually either internally or externally and communicated to ECAN by the end of July each year.