Farm Environmental Management Plan: Twin Peaks Station

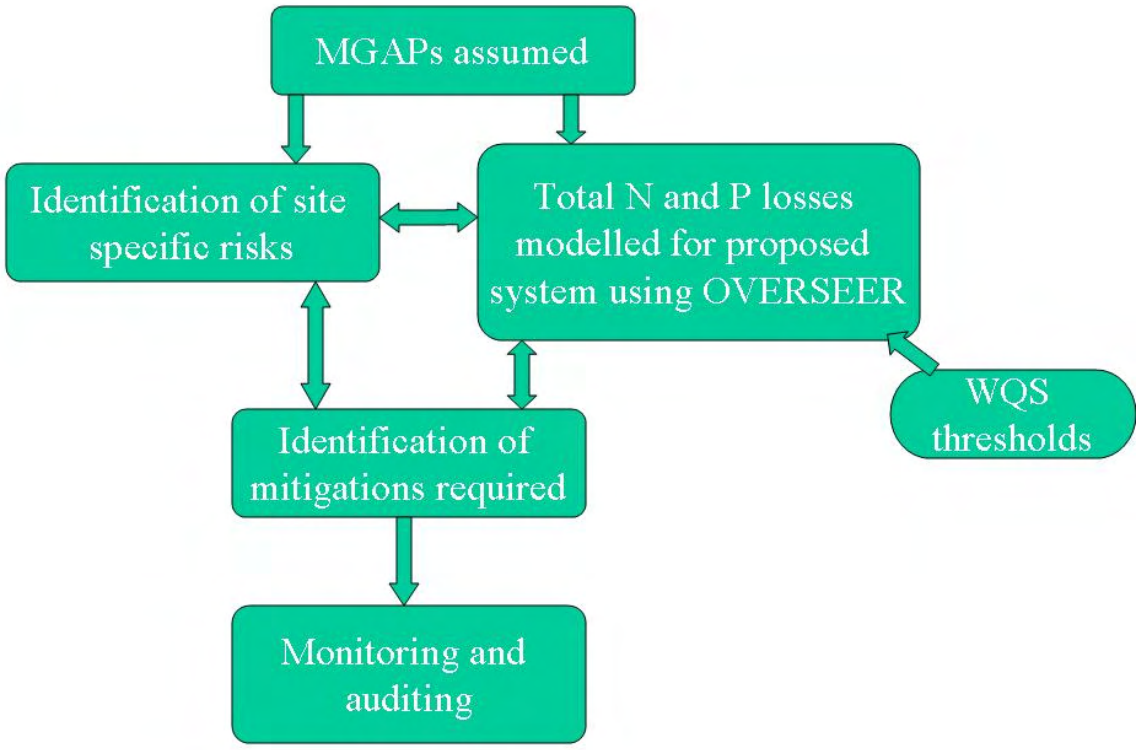
1. Introduction

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 to build a Farm Environmental Management Plan



MGAP – Mandatory good agricultural practices

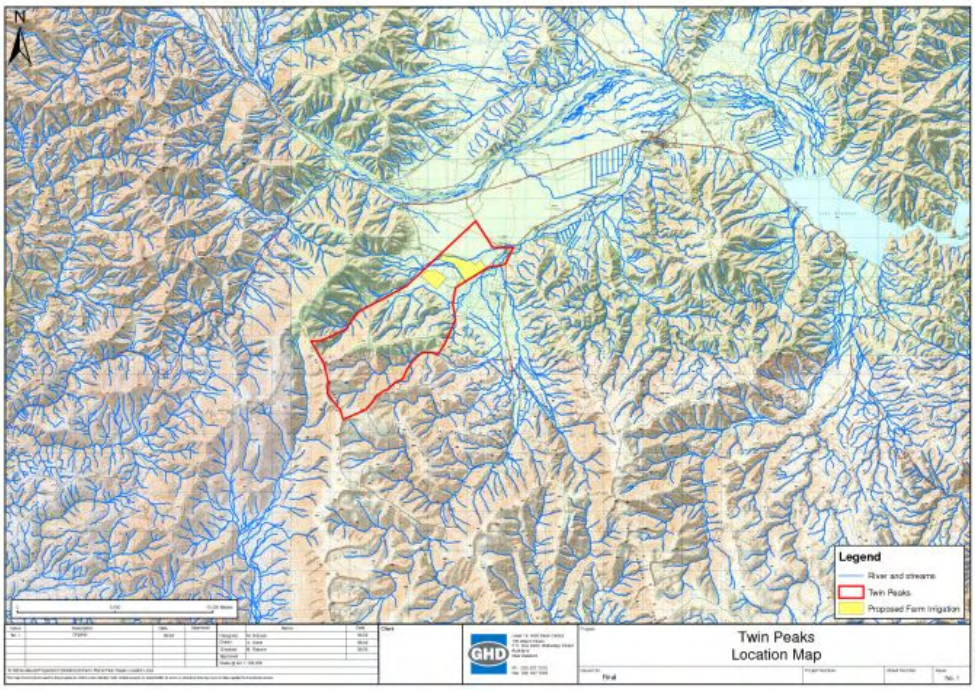
2. Farm Description

2.1 General farm description

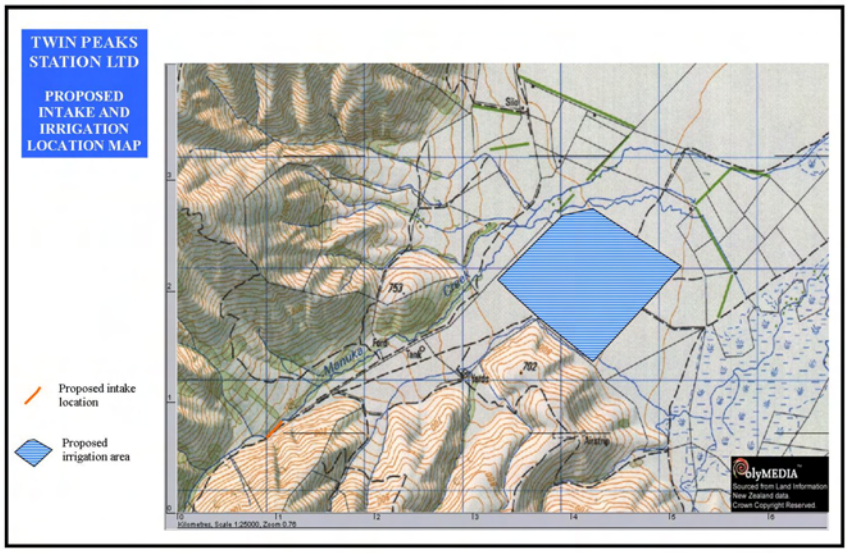
Twin Peaks Station is a 3500 ha leasehold high country station comprised of 600ha of flats and the balance 2900ha of hill; country located between Broken Hutt Road and the Lindis Pass.

The applicant currently holds consent CRC960044.2 which allows them to take and use up to 40L/s from the Clifton Downs Swamp Drain. The water taken pursuant to this consent is used to irrigate approximately 130 hectares of land via spray irrigation.

The station currently runs 6000 stock units with approximately 90% of these being merino sheep and 10% cattle. The ewes are put out onto the hill country in September and come back down onto the flats in August. The lambs are brought down on to the flats at weaning and stay down. At particular times of the year (i.e. for weaning and shearing) the stock in the hill country are brought down to the flats.



Map A: Existing irrigation and proposed irrigation development locations. The existing irrigation is the larger area of yellow on the right.



Map B: Proposed irrigation development location

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	Native	Oversown hill/ryecorn
Hoggets	Grass flats/irrigation	Grass flats	Grass flats/irrigation	Ryecorn
Breeding cows	Grass flats/oversown hill	Oversown hill	Native	Native
R1 and R2 cattle	Grass flats	Grass flats/irrigation	Grass flats/irrigation/oversown hill	Oversown hill

Photo A: Existing landuse and groundcover at the proposed irrigation development location

2.2 Proposed farming system

Twin Peaks is proposing to irrigate a further 72 hectares of land.

Farm practices are not predicted to change. Twin Peaks will carry more hoggets through the winter. The new irrigation development is proposing to support the existing farm practices

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	Native	Oversown hill/ryecorn
Hoggets	Grass flats/irrigation	Grass flats	Grass flats/irrigation	Ryecorn
Breeding cows	Grass flats/oversown hill	Oversown hill	Native	Native
R1 and R2 cattle	Grass flats	Grass flats/irrigation	Grass flats/irrigation/oversown hill	Oversown hill

2.3 Soils

Soils on Twin Peaks are; steep lands 50% yellow brown earths also yellow grey earths. Hill soils 18% above 900m upland yellow brown earths, below 900m yellow grey earths. The rolling and fan country 18% yellow grey earths stony and shallow. Flood plain and terrace soils are a mixture of wetland soils.

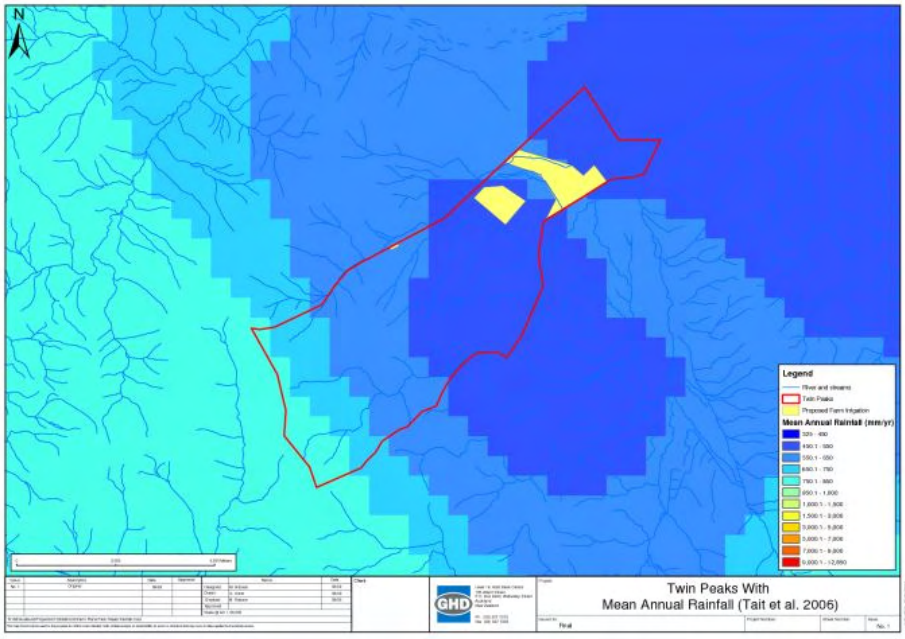
The land proposed for irrigation is a combination of Edwards moderately deep soils and Sawdon and Glenrock stony soils with an average PAW of 90mm.

2.4 Topography

Twin Peaks starts at an elevation of 500m rising up to 1800m. Twin Peaks consists of 600ha of flats, 1200ha of rolling to medium hill and 1700ha of steep hill. Most of the hill country is north facing.

2.5 Climate

Twin Peaks has quite a harsh climate with hot dry summers and cold winters. In the summer temperatures can rise into the mid 30's. In the winter it can drop as low as -18oC. Rainfall on the flats is 500mm a year increasing as you increase in elevation. Snow falls at least once a year which lies around the house.



Map C: Mean Annual rainfall

3. Environmental Context

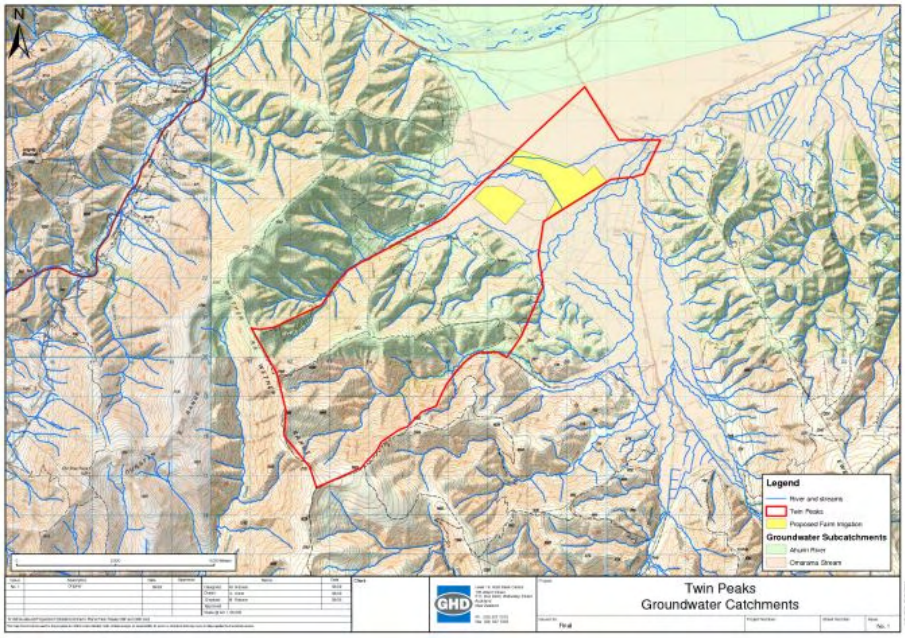
The environmental context of the farm is a reference both to local and wider receiving environments.

3.1 Water Quality Study receiving environments and mitigation requirements

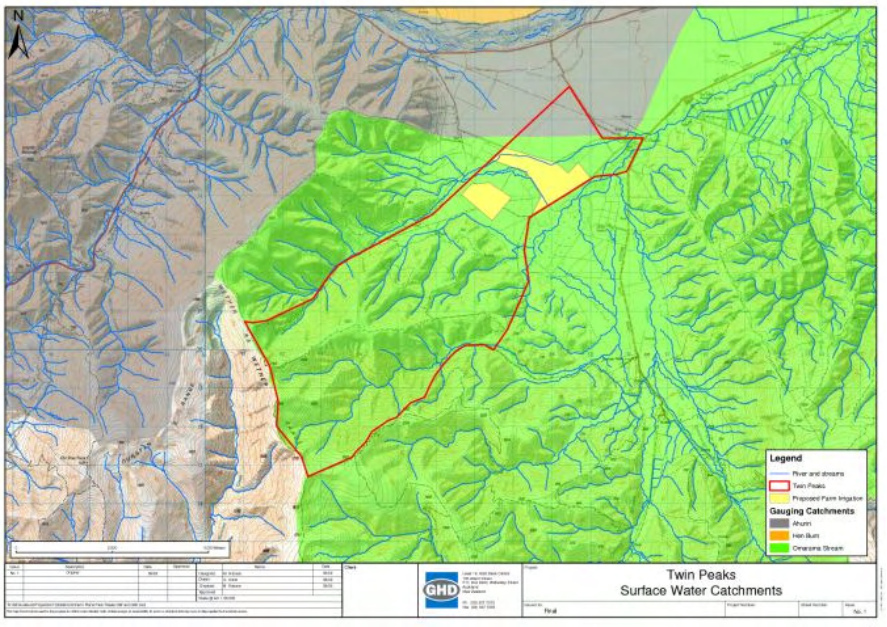
Twin Peaks Station, according to the WQS, lies in the Omarama groundwater and predominantly Omarama Stream surface water catchments with a small area of Ahuriri River catchment.

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 Twin Peaks Station.

For this farm, the Lake Benmore mitigation requirements are the most stringent. These mitigation requirements cap Twin Peaks Station's nutrient discharges at 10937 kg N per annum and 200 kg P per annum.



Map D: Groundwater receiving environment



Map E: Surface water receiving environment

3.2 Local receiving environments

The local receiving environment for Twin Peaks is Manuka Creek. Manuka Creek has been described as being in excellent condition with very good water quality. Manuka Creek is generally ephemeral out on the gentle flat farmland.

Photo B: Showing the ephemeral nature of the lower reaches of the Manuka Creek

Table 3. Water Quality Study mitigation requirements for Twin Peaks 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
Twin Peaks				-0.90		-0.10					-10.70	-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 Twin Peaks Station, using the most stringent nutrient mitigation requirement, are 10937 kg N/year and 200 kg P/year. The table below shows the output from OVERSEER for the modelled proposed farming system at Twin Peaks Station. 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 Twin Peaks and WQS thresholds

	OVERSEER modelling outputs kg/year	**WQS threshold needs + buffer kg/year**
Total N leaching/runoff	9685	10605
Total P leaching/runoff	193	211

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 Twin Peaks and has highlighted potential soil risks. These risks are described below. The full FERA is attached as Appendix A.

4.3.1 Soil Risks

The current soil risks identified are vulnerability to and some minor evidence of wind erosion. The commencement of new irrigation and the continuation of existing irrigation will ensure improved ground cover levels which will reduce the risks associated with bare ground and wind erosion. Twin Peaks are continually in a process of improving ground cover on unirrigated areas of the farm to reduce the effect of wind erosion (see photos D, E and F).

4.3.2 Site specific management measures and existing mitigation measures in place

1. Twin Peaks has a small area where the Omarama Stream flows aboveground; close to Broken Hut Road. It is grazed with a small mob of cattle approximately 3-4 months of the year. It was not deemed a risk due to the minimal grazing time and also the low stocking rate. Annual monitoring of this area and identification of soil compaction and bank side erosion and documented remedial actions taken will ensure any soil compaction or bank side erosion due to stock grazing over winter is identified. There is no evidence of stock induced bank side erosion in any of the other waterways that flow within Twin Peaks boundary.
2. At Twin Peaks there are culverts placed where stock or vehicles cross any waterways.

3. There is an existing reticulated trough system to all of the paddocks and a number of the hill blocks.
4. 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.
5. A contractor or approved handler if required is used to apply chemicals at Twin Peaks.
6. Cultivation and Trafficking

Direct drilling is the primary method for renewing and establishing pasture and fodder crops.

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

7. 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.

8. 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.

4.3.3 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 Twin Peaks Station

5.1 Mitigation measures and management options adopted on Twin Peaks

The table below shows the all the mitigation and management tools that are proposed to be undertaken on Twin Peaks 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 6 indicates in brief how the measures are to be monitored and audited.

Table 6. Table of mitigation options, monitoring and auditing for Twin Peaks 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 winter 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	Where Manuka Creek flows regularly within the irrigation area stock access will be prevented.	Photo and location plan	Auditing report
3	An irrigation buffer from the Manuka Creek will be established of approximately 100mm (see Map F)	Photos and Location Map	First annual audit report

FEMP stage	Measure	Monitoring	Auditing
3	Continually improve ground cover on the flats to protect against wind erosion (as is currently being undertaken see photos)	Photos	Audit Report
3	Ensure the filter strip margin on Clifton Drain is sustained (prior to it exiting the property) (see Map F)	Photos	Audit Report
3	20 metre layback from any water way when applying fertiliser by land based application e.g. bulk spreader	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 Plan of waterways and photos	Location plan and photos in first audit report

Map F: Existing and planned mitigation measures for Twin Peaks

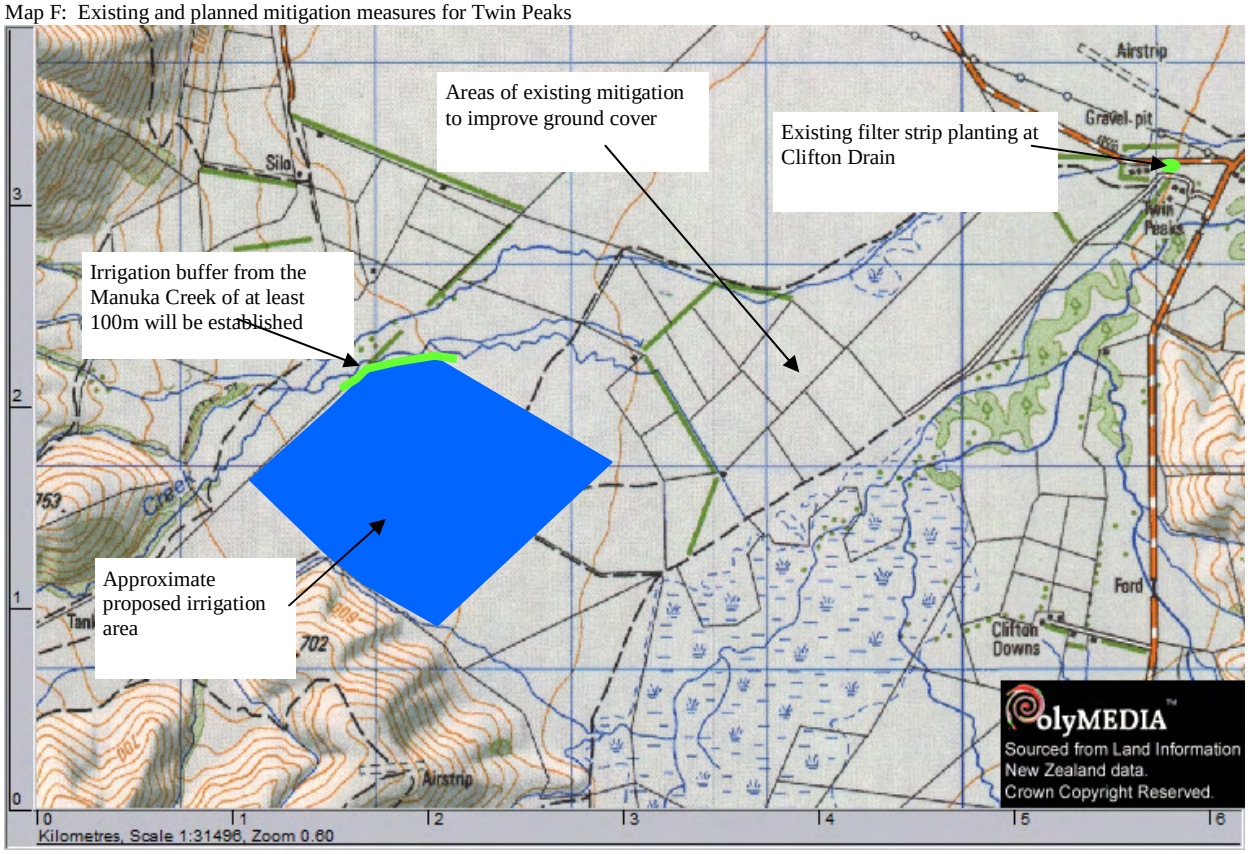


Photo C: Showing the existing filter strip at Clifton Drain prior to it exiting Twin Peaks

Photo D: Existing partially improved ground cover on the flats at Twin Peaks (see map F for approximate location)

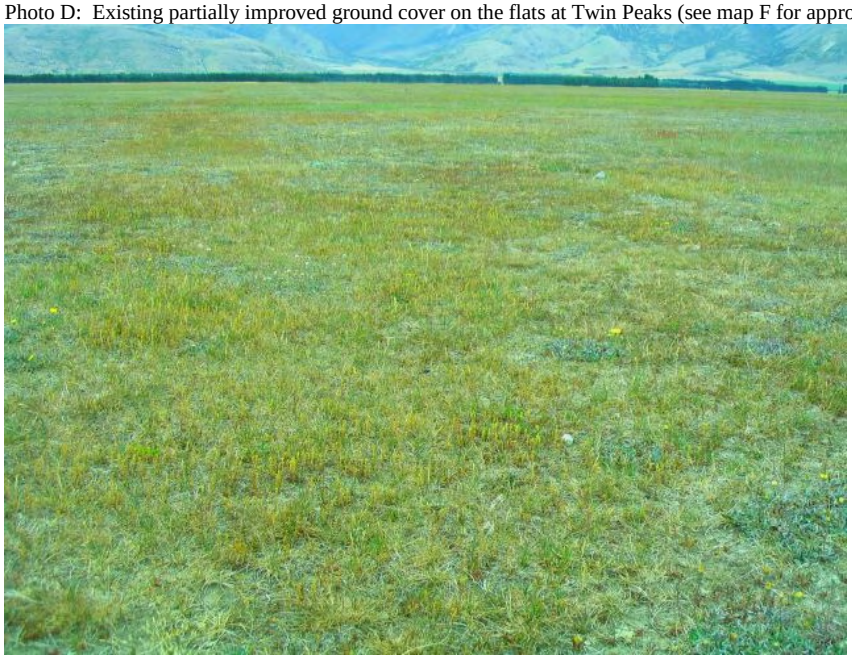


Photo E: Improved ground cover on the flats at Twin Peaks

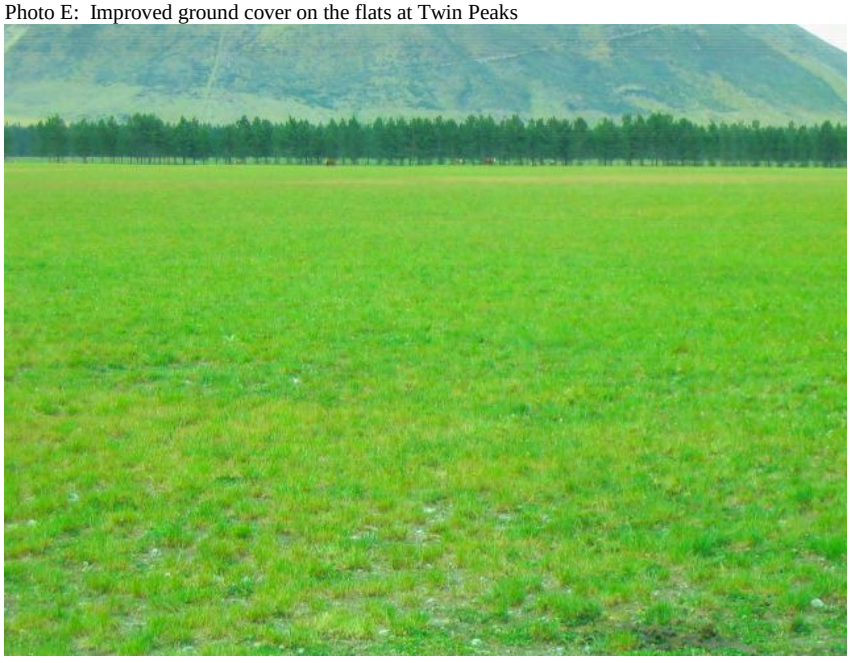


Photo F: Showing shelter that has been planted to try and reduce the impact of wind erosion on the flats

5.2 Monitoring and Auditing

5.2.1 Baseline monitoring

Baseline monitoring is already underway on Twin Peaks Station.

Water Quality monitoring has been undertaken on the Omarama Stream at Twin Peaks by the Upper Waitaki Water Quality Trust in 2007 and 2008.

Table 7. Baseline monitoring on Twin Peaks Station

		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
Pasture	Ground cover and species	All flat land blocks	Annually	% Ground cover, species
Water	Surface water quality	Omarama Stream at Twin Peaks	2007 and 2008	Total Nitrogen, nitrate, ammonia, total Kjeldahl nitrogen, total phosphorus, dissolved reactive phosphorus, suspended solids.
Pest and Weed		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 undertaken for Twin Peaks 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 Twin Peaks 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 paddocks and intensive areas 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	Runoff occurring	Introduce runoff removal infrastructure where appropriate.
Water	Irrigation application	Irrigation area	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
Water	Surface water quality	Monitoring of Clifton Drain as it exits Twin Peaks.	Quarterly for the first 2 years and then reviewed	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 particular contaminant should be identified while a full root cause analysis is undertaken
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	Whole Farm	Annually in house and 1 in 5 years by an independent	Application uniformity		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

See Map B for the proposed irrigation area map, where a number of these monitoring locations refer to. Map A shows the whole farm area.

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 9 below shows an example of an annual audit report for Twin Peaks Station.

Table 9. Table showing proposed contents of an annual audit report for Twin Peaks 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.
Where Manuka Creek flows regularly within the irrigation area stock access will be prevented.	Photos	Areas of fencing damage should be repaired.
An irrigation buffer from the Manuka Creek will be established of approximately 100mm (see Map F)	Check setback area is present. Photos	Areas of fencing damage should be repaired.
Continually improve ground cover on the flats to protect against wind erosion (as is currently being undertaken see photos)	Photos and maps	If maps and photos not provided then should be provided by the next audit
Ensure the filter strip margin on Clifton Drain is sustained (prior to it exiting the property) (see Map F)	Photos and maps	If maps and photos not provided then should be provided by the next audit
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.

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.

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.

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?	Not on any intensively farmed 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 crossing have culverts where necessary. 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 and in some areas reduced ground cover.
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?	Yes
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?	NO
2	Are there any water or wetland features on the farm?	Clifton Drain, a man made drain to drain the Clifton Swamp on the neighbours property. The drain water runs through Twin Peaks
3	Are these features actively protected?	NO
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, a contractor is employed for pasture spraying
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?	NO. Most streams are shallow stony bottomed
Some example questions on cropping		
1	Is inversion tillage used? Describe	Direct drilling is used when planting new pasture
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	Yes

	arable land?	
4	Are remedial measures in place after winter grazed crops?	Yes, ryecorn is grown which is a fast growing crop that comes away well in the spring, thereby utilising those nutrients deposited during winter grazing
5	Is there a possibility of run off from winter grazed areas reaching a water course?	NO
6	Other cropping issues or incidences? Please describe	NO
Some example questions on soil health		
1	Are there compacted, consolidated or capped soils?	None evident, soils very light stony
Some example questions on pest and weed management		
1	Do you undertake any current pest or weed control? E.g rabbits, gorse	Yes if required. No rabbit problem