CRC042022/CRC042025-FEMP

Farm Environmental Management Plan

Ribbonwood Station – Maree Horo

Prepared by:

Nicole Phillips – Irricon Resource Solutions – November 2009

Updated by:

Nicole Phillips – Irricon Resource Solutions – April 2012

Updated by:

Nicole Phillips – Irricon Resource Solutions – June 2012

1. Updated FEMP

This FEMP has been updated in accordance with the directive from the ECAN Commissioners in their 40th minute of Commissioners – directions to Mare Horo dated 5 June 2012.

This FEMP will focus on the proposed irrigation command area taking water from the Wairepo.

Since the first FEMP was completed there has been a change of Management at Ribbonwood. The new Overseer modelling reflects the change in farming practices that have occurred with the change in management.

Nicole Phillips B.Sc, Advanced Certificate in Sustainable Nutrient Management

Irricon Resource Solutions

Date June 2012

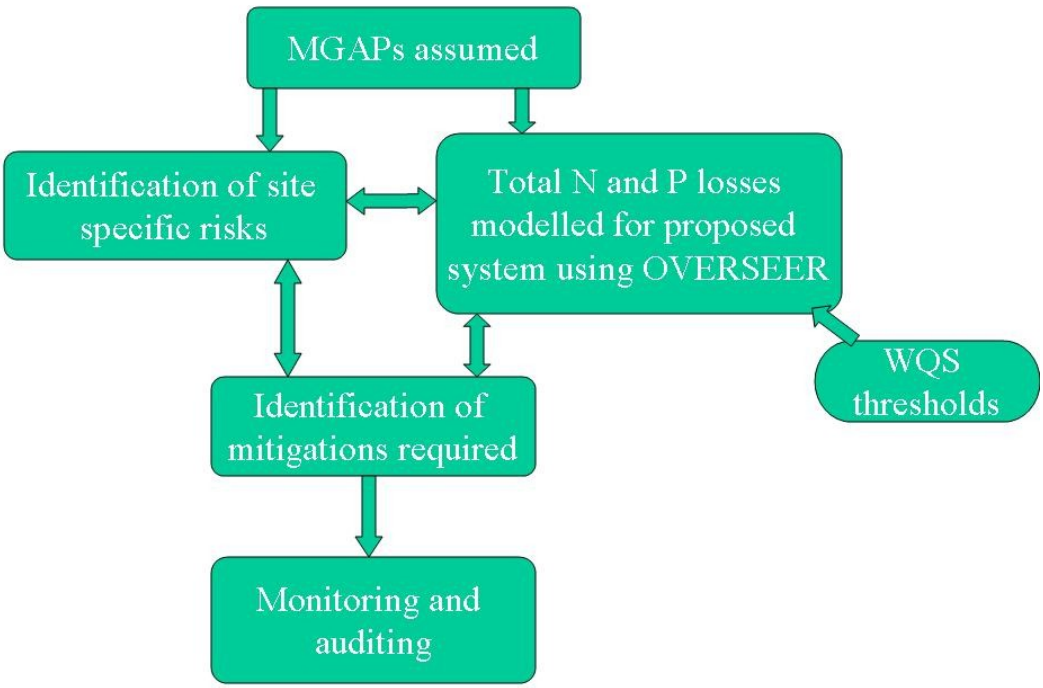
2. Introduction

This Farm Environmental Management Plan (FEMP) has been written to identify the potential nutrient losses from the whole farm; modelled using Overseer and to identify and mitigate other farm specific environmental risks that arise from the inherent or management risks on the farm that are unable to be modelled in Overseer.

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 FEMP lies with the **farmer**.

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



MGAP – Mandatory good agricultural practices

3. Farm Description

3.1 General farm description

Ribbonwood Station is situated between the Ahuriri River and Lake Ohau. The outwash flats on the Ahuriri River valley floor consist of two main terrace levels. The higher terrace bounds the Ahuriri River main stem and extends to a lower terrace associated with the East Branch. The upper terrace, on which irrigation is proposed, has been planted in substantial shelter belts (up to 10 rows deep) and forestry blocks which criss-cross the landscape. Overall the terraces are highly modified with predominantly over sown pasture species.

The property is 7,289 hecatres, and currently carries approximately 9000 stock units (6755 as sheep and 2170 as beef cattle). There is no change proposed to existing stocking numbers once resource consents CRC042022 and CRC042025 are granted.

As the property is fully developed within normal economic parameters, irrigation is now required to take the property to the next production step as follows.

Farming practice now without water involves a fine wool, sheep and cattle breeding and store stock unit in a high country environment. Stock are currently sold on the store market which has distinct limitations in dry seasons and in terms of market options. It is considered that with irrigation all progeny bred on the property will be able to be finished if the irrigation system is installed as planned.

Figure 2: An extensive location plan of Ribbonwood Station

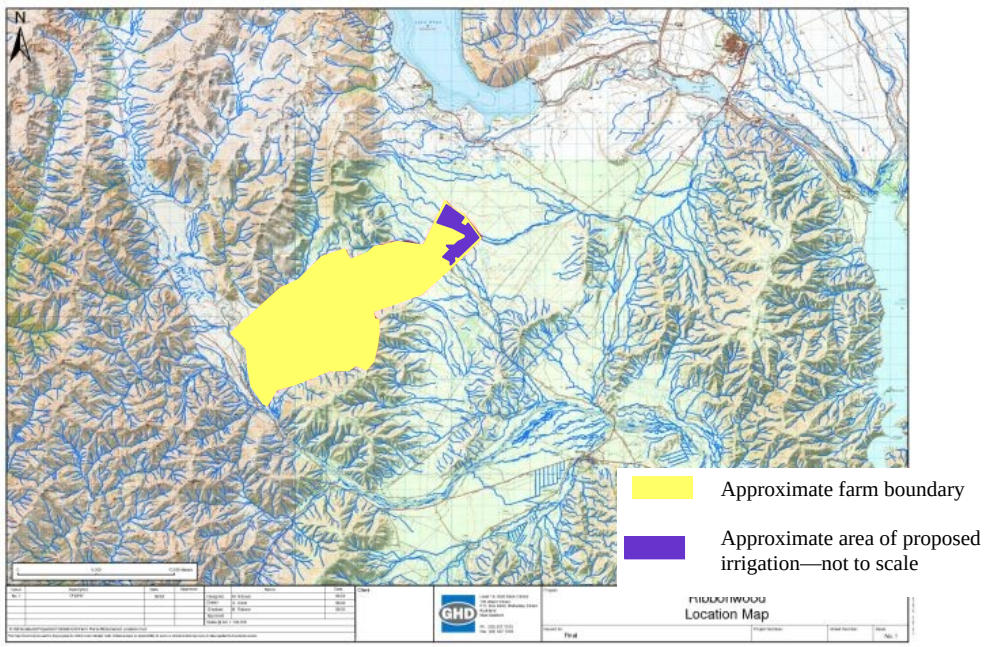


Plate A: North Branch Serpentine Creek within the proposed irrigation command area

3.2 Soils

The property has a mix of soil types, ranging from 40mm PAW to in excess to 110mm.

Soils on the heavy flats are of the Craigieburn silt loam series involving 15-20 cm of silt loam on silt and gravels ex native cover of red and fescue tussock grassland with small patches of lowland scrub of low natural fertility status. The soils are derived from a parent material of greywacke loess over gravels with alluvium in places. They respond well to super phosphate and lime and are prone to severe wind erosion if the soil is left exposed particularly in spring.

Soils throughout this area also include those of the Ohau silt loam series with a thinner subsoil of 10cm of silt loam on 10cm of yellow silt loam on silt and gravels ex native cover of fescue and snow tussock grassland of low to very low natural fertility status. These soils are derived from glacial till with a thin cover of greywacke loess and respond very well to super phosphate. Once again they are very prone to wind erosion during spring cultivation.

The soils at the rear of the property on the Ahuriri Flats are of the Tekapo silt and sandy silt loam series featuring 10cm of fine sandy loam on 5cm of silt loam on silt and gravels with the interspersement of quite sizeable boulders. The soils are derived from glacial till with thin veneer of loess of medium natural fertility status. Once again they are also prone to wind erosion.

Elsewhere on the property are soils of the Omarama steep land and Tengawai and Puketeraki soils on the hill country and steep lands. None of these are attached to the irrigation programme.

3.3 Topography

Ribbonwood is characterised by its varying topography; ranging from river flats through to extensive South Island high country.

Homestead flats	371ha
Main Flats	728
Ahuriri Flats	367ha

River Flats	222ha
Homestead dryland	185ha
Main flat irrigated	52ha
Oversown hill country	822ha
Native hill country	4400 ha
Tree plantations	140ha
TOTAL	7287ha

3.4 Rainfall

The average annual rainfall measured at the Ribbonwood Homestead is 450mm. It is acknowledged that rainfall is subject to quite substantial variation for the property is located on the fringe of the area which can receive rainfall from the northwest during summer months.

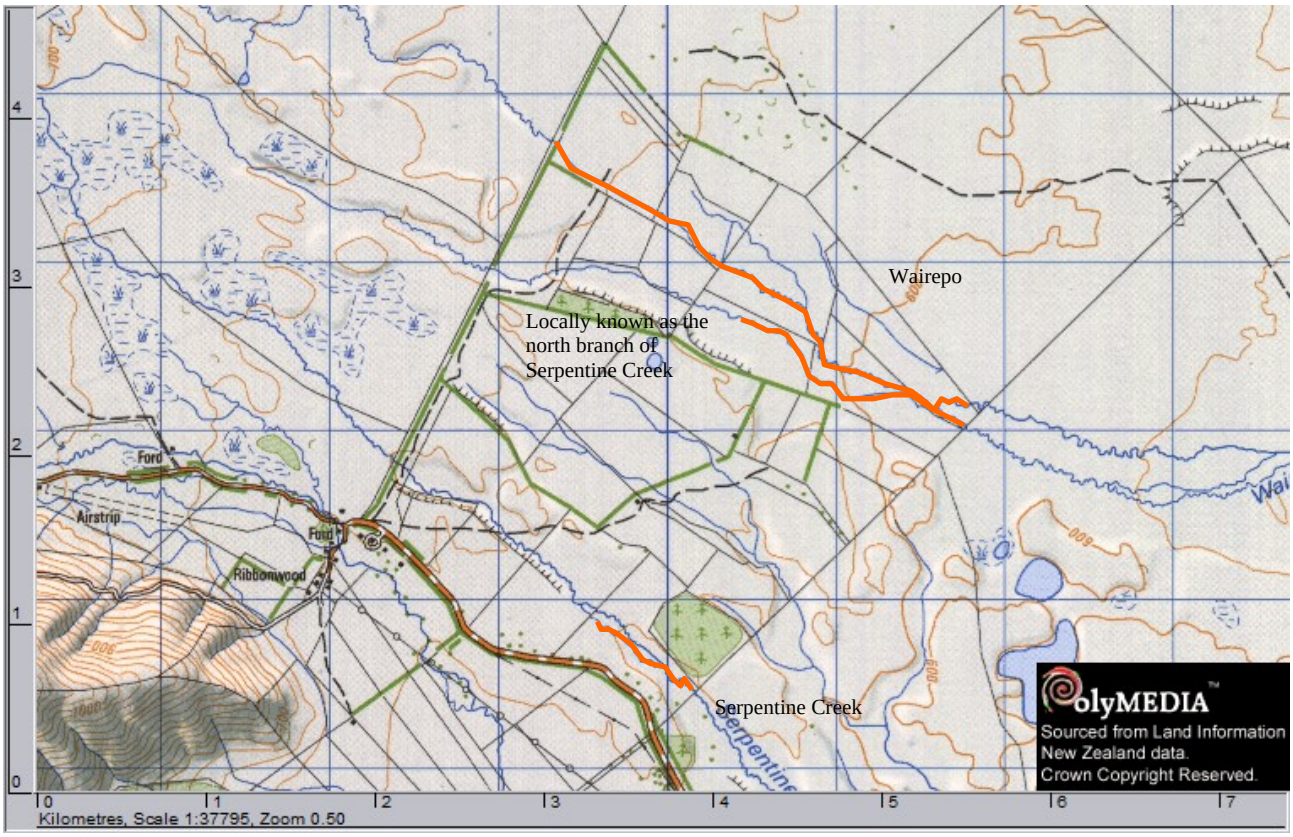
4. Environmental Context

The wider receiving environment for Ribbonwood Station is the Ahuriri River and the Ahuriri arm of Lake Benmore.

4.1 Local receiving environments of the proposed irrigation area

The Wairepo and Serpentine Creeks are small shallow, stony bottomed creeks running through the proposed irrigation command area.

Figure 3: Local receiving environment



5. Farm Environmental Management Plan development

5.1 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 1. 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.

5.2 Stage 2 – OVERSEER

The Overseer modelling based on the proposed farming system at Ribbonwood allows for total N and P leaching as **18,710 kg N and 843 kg P** (this is based on Overseer plus 10%). Table 2 below shows the output from OVERSEER for the modelled proposed farming system at Ribbonwood Station and also the results plus 10% as defined in the interim decision from the ECAN Commissioners.

Table 2: Total N and P losses modelled by OVERSEER for the proposed farming system on Ribbonwood Station

	Nitrogen Threshold (kg/farm)	Phosphorous Threshold (kg/farm)
OVERSEER® outputs April 2012	17009	766
Plus 10%	18,710	843

5.3 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 Ribbonwood and has highlighted potential soil, stock and water 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.

5.3.1 Soil Risk

The risks associated with soil are that although wind erosion wasn't evident there is a potential vulnerability to wind erosion. The 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 and water risks

The risk associated with water is that stock are not restricted from entering any of the many small waterways that flow within the proposed irrigation area.

5.3.4 Site specific management measures and existing mitigation measures in place

1. All of the crossings over creeks within the proposed irrigation area have culverts or bridges for stock and vehicle access.

Photo B: Bridge across the Serpentine Creek within the proposed irrigation area, one of many bridges over creeks

2. Fodder crops are grown as past of the pasture renewal process, ensuring that organic matter levels are not depleted in only a few paddocks. Some paddocks will have two years of crop before being put back into permanent pasture. Regrassing or reestablishment of crop after winter grazed fodder crops will be at the earliest opportunity.
3. A contractor or approved handler if required is used to apply chemicals on the farm
4. Cultivation and Trafficking

Direct drilling is the primary method of establishing 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.

5. 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.

6. Runoff

There is no evidence of track runoff directly 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.

5.3.5 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 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 across a number of sites within the Mackenzie Basin has been reported. While it cannot be assumed from this information that erosion rates will continued 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 three issues has been included in Table 8

6. Farm Environmental Management Plan for Ribbonwood Station

6.1 Mitigation measures and management options adopted on Ribbonwood Station

The table below shows the all the mitigation and management tools that are proposed to be undertaken on Ribbonwood 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 3. Table of mitigation options, monitoring and auditing for Ribbonwood

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 irrigated 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	20 metre layback from any water way when applying fertliser by land based application e.g. bulk spreader	Field records	Annual Audit report
3	Exclude stock access to any natural permanently flowing waterway located in the proposed irrigation areas near Wairepo	Surface water testing of race/waterway as it exits the	Annual auditing report for water quality testing. Photos once mitigation

FEMP stage	Measure	Monitoring	Auditing
	Creek, Serpentine Creek and the creek locally known as the North branch Serpentine Creek (see Map E)	property	completed.
3	Construct a basic settling basin when the Wairepo and North Branch Serpentine creeks converge prior to exiting the property (see map E)	Photos and location plan	Annual audit report once settling basins completed
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 and details	Location plan first annual audit

Figure 4: Approximate locations of mitigation measures to be undertaken at the Wairepo irrigation area

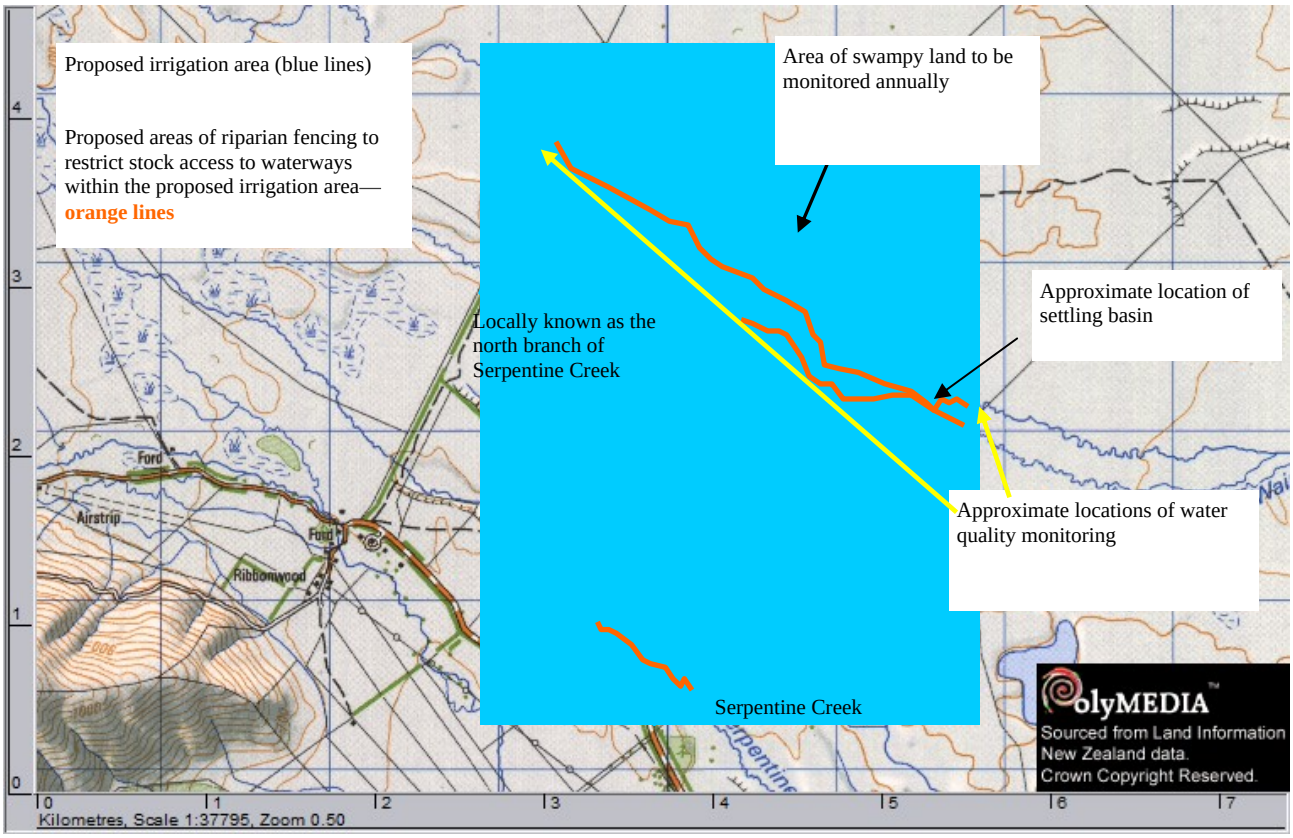


Photo C: Wairepo Creek flowing through some of the proposed irrigation area, this is to be fenced to restrict stock access

6.2 Monitoring and Auditing

6.2.1 Baseline monitoring

Baseline monitoring is already underway on Ribbonwood Station.

Table 4. Baseline monitoring on Ribbonwood Station

		Location	Frequency	Measured parameters to include
Soil	Soil nutrient testing	all intensive areas in rotation	1 in 2 years	Standard suite of soil nutrients
Pasture	Ground cover and species	All blocks	As needed	%Ground cover, species
Livestock	Quality and performance	All blocks	Annual programme as needed	Per head performances, monitoring of livestock bodyweights at critical production periods.

6.2.2 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 on Ribbonwood and Table 8 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 5. Example monitoring plan for Ribbonwood 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	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
Soil	Visually monitor Swamp area (see Figure 4 for approximate location)	Any swamps/heavy ground	Annually	Visual compaction, pugging or stock induced bank erosion	Any visual sign of compaction, pugging or stock induced bank erosion	Remove stock from the area, assess and rectify
Runoff	Wet weather survey	All irrigation blocks	Annually	Runoff	Runoff occurring	Introduce runoff removal infrastructure where appropriate.
Water	Surface water quality	Wairepo Upstream and downstream (see Figure 4)	Monthly from Dec – April	DIN, DRP, EColi, Turbidity, Conductivity, chlorophyll *a*	As per consent conditions	As per consent conditions
Water	Irrigation application	Irrigation area	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	All Farm	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

6.2.3 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. The annual audit should be completed and submitted to ECAN within 1 month of the audit being undertaken and all areas showing non compliance shall be rectified within 3 months of the audit date.

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?	No, bridges or culverts have been installed, see photos. 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?	Bridges or culverts installed, see photos. 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 poor ground cover.
6	Do you have a silage pit located near a permanent watercourse?	No - approximately 50m away. Silage bund
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 - most waterways within proposed irrigation area are not fenced
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...?)	Occasional shower dip, little or no runoff
Some guideline questions for biodiversity		
1	Are there any special areas or species of interest or conservation on the farm?	No
2	Are there any water or wetland features on the farm?	no wetland - water features, swampish area, many creeks
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 - contractor for 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?	Small amount in some, not at the risk level as yet, primarily within the proposed irrigation area - small shallow rocky bottomed streams
Some example questions on cropping		
1	Is inversion tillage used? Describe	Yes if required, primarily direct drilled
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 arable land?	Yes - turnips/grass grown double cropped and then into permanent pasture

4	Are remedial measures in place after winter grazed crops?	Yes - sown into grass at earliest opportunity
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
Some example questions on pest and weed management		
1	Do you undertake any current pest or weed control? E.g rabbits, gorse	Shoot rabbits and potentially poison, most of the boundary within the intensive area is rabbit fenced