Farm Environmental Management Plan

Godley Peaks Station

Prepared for Lone Star Farms Ltd

Ryder Consulting

December 2009

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by

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Cover photo: Godley Peaks Station with Lake Tekapo in the background (Photo by Melissa Robson).

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1.0 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 WQS and has been followed here. An overview schematic of the process of building a FEMP is shown in Figure 1 below.

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

1.1 Purpose of a Farm Environmental Management Plan

There are no required nutrient reductions for the receiving environments of this farm, however this FEMP has been written to illustrate that the proposed farm system has identified and mitigated farm specific environmental risks that arise from the inherent characteristics of the farm or from the proposed farm system and its management. These farm specific risks include uncontrolled discharges that are not identified in farm nutrient budget modelling but that may still have an environmental effect.

This FEMP has been expanded to include the irrigation recommendations drawn from McIndoe (2009) pertaining to CRC 12108.1 (existing consent) and CRC10082 (consent for Gallery intake), CRC031175 (consent for water take from Mistake River) and CRC073236 (consent to disturb bed of Mistake River).

1.2 Why use a Farm Environmental Management Plan?

Farm management planning and the use of best management practices and mitigation methods are commonly used to reduce diffuse pollution from farms.

Diffuse pollution, as the name suggests, does not come from a single traceable source. In many cases the impacts are both temporally and spatially distanced from the source. This makes measurement from and traceability to an individual property difficult. For this reason, instead of measuring the losses, the emphasis is placed on the implementation of techniques that are known to reduce the contaminant.

1.3 Scope of a Farm Environmental Management Plan

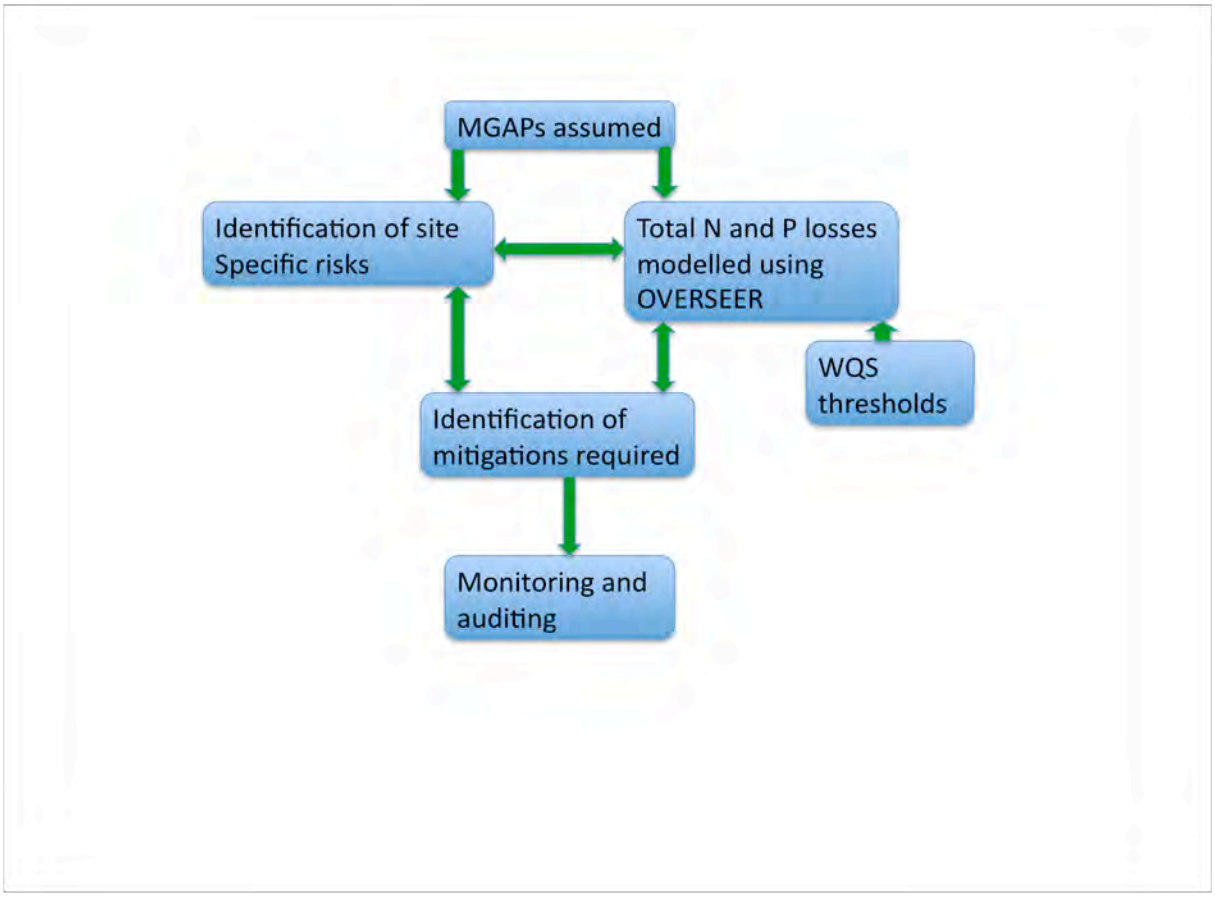
The development of a FEMP is divided into four sections:

- The first section describes Mandatory Good Agricultural Practices (MGAPs) that need to be implemented across the farm, and include the base assumptions of the OVERSEER model[1]. This helps to validate the use of the model on the property;

[1] In the future, should an alternative model be used, the assumptions for that model would need to be specified in this good agricultural practice section.

- The second section involves the construction of a representative farm model in OVERSEER and demonstrating the fulfilment of any nutrient mitigation required by the Water Quality Study; and
- The third section involves the identification and mitigation of site-specific environmental risks.
- The fourth section describes the proposed monitoring and auditing strategy.

Figure 1 An overview schematic of the process of building a Farm Environmental Management Plan



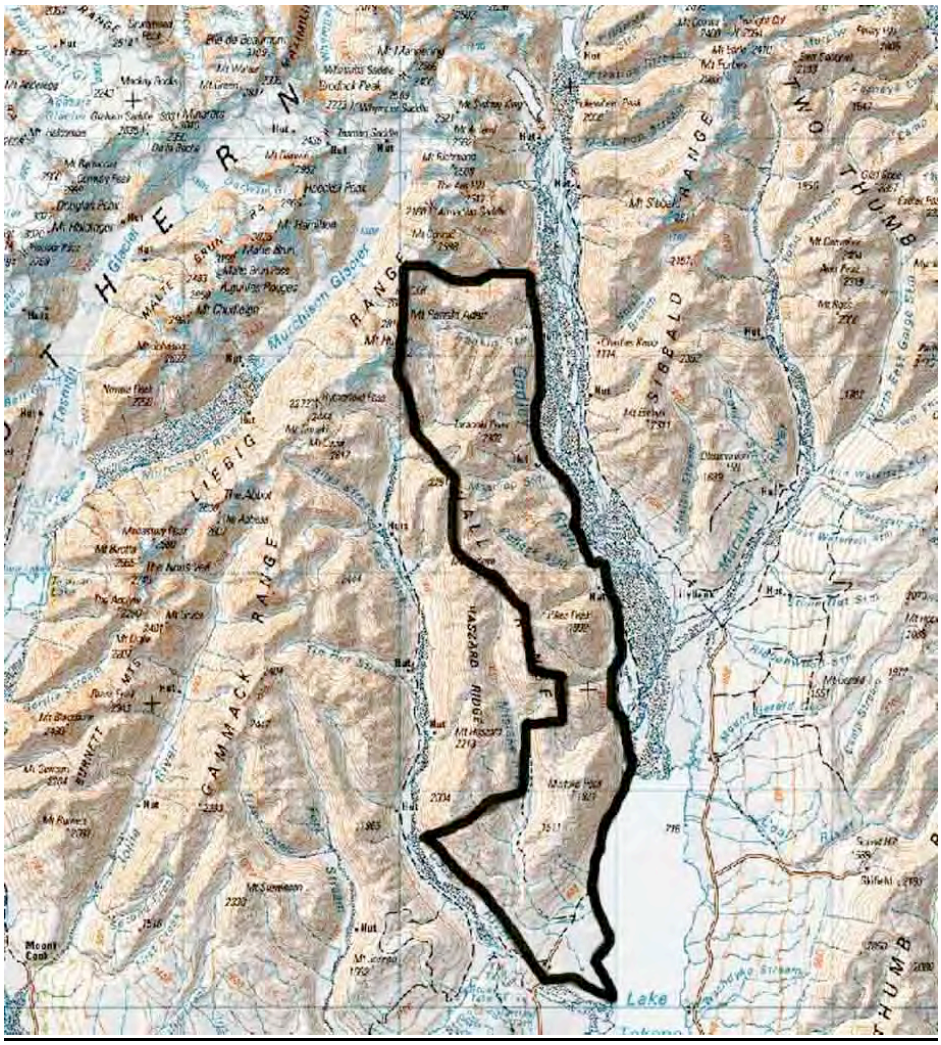
2.0 Farm Description

Godley Peaks Station is situated at the end of Godley Peaks Road, approximately 20 km north of the Lake Tekapo Township. The property lies on the western shores of Lake Tekapo and the Godley River and to the north-east of the Cass River. The property is 14,576 ha, 83 ha freehold and the remaining 14,493 ha is Crown Pastoral Lease (Allen, 2009).

The mountainous glaciated country of the Hall Range makes up the bulk of the property characterised by steep slopes and limited productivity. The area of river flats beside the Godley River and the remainder of the property is an area of lower altitude (700 – 1100 m) moderate to easy hill and rolling country (approx 2,800 ha) between the Hall Range and the Cass River is where the vast majority of the development has occurred. In total, approximately 700 ha has been cultivated and an area of approximately 225 ha partial irrigation or 115 ha full irrigation is possible with the existing 72 l/s consent.

The station is currently wintering 10,160 sheep stock units, 3,230 cattle stock units. Combined this equates to 13,390 SU wintered currently and represents a sustainable stocking rate, this has been retrenched slightly from a stocking high of 14,500 SU two seasons ago (Glover, 2009).

Figure 2 Location map for Godley Peaks Station



2.1 Soils

There are many soils and soil associations on Godley Peaks Station. According to the soil maps produced by the Waitaki Catchment Commission and cited in Bartlett (2009), the irrigation command area has seven soil associations; Pukaki/Simons/Sawdon/Bendrose, Tekapo/Dalgety/Grampians/Streamlands/Holbrook, Cass/Craigieburn/Tasman/Mesopotamia, Cox/Braemar, Mayer/Dalgety/Tekapo/Kurow, Meyer Hill/Kurow Hill/Tirioti Hill/Blackstone Hill/Tekapo Hill, and Mackenzie/Glenbrook/Larbreck.

Flood plain and terrace soil associations, Pukaki/Simons/Sawdon/Bendrose and Mackenzie/Glenbrook/Larbreck are found either side of the course of the Mistake River. Pukaki, Simons, Mackenzie and Larbreck soils are associated with terraces and fans of differing ages. Mackenzie soils are excessively drained, weakly structured, predominantly shallow and stony soils formed from alluvium overlaying sandy fluvio-glacial gravels (Webb, 1992). Simons series are well drained, moderate to deep loessial soils formed in old fan and terraces. Pukaki series are well drained shallow to moderate loessial soils often overlying sandy gravels and found on old terraces (Webb, 1992). Larbreck series are excessively drained weak or single grain structured shallow stony soils formed from alluvium occurring on young terraces (Webb, 1992). Sawdon and Bendrose soils are associated with the floodplains and are characterised by well drained profiles with weak to moderately structured topsoil with variable textures ranging from silt or fine sandy loam to very stony sandy loam top soils (Webb, 1992).

Tekapo/Dalgety/Grampians/Streamlands/Holbrook soils, associated with upland terraces, fans and rolling land are found between the courses of the Mistake and Cass Rivers along with incursions of Cox/Braemar on inland wetlands. Dalgety soils are well drained shallow and stony soils occurring on old fans and are characterised by shallow fine sandy loam to silt loam top soils and structureless stony sand below 50 cm (Webb, 1992). Tekapo soils are well drained shallow to deep loessial soils sometimes over till occurring on moraines and are characterised by weak to moderately structured fine sandy loam upper horizons with structureless C horizon below 50 cm and firm underlying till (Webb, 1992). Grampians soils are moderately well drained loessial soils occurring on piedmont fans (Webb, 1992) and Streamland soils are well drained moderate to deep loessial soils occurring on old fans (Webb, 1992). Holbrook soils are excessively drained, shallow, weakly structured stony sandy loam to very stony loamy sand soils overlying a stony sand C horizon. Cox and Braemar soils are imperfectly or poorly drained loessial soils occurring in depressions. They are characterised by weak to moderately structured silt loam topsoils and massive C horizons that can be very firm (Webb, 1992).

In addition, Mayer/Dalgety/Tekapo/Kurow occur on mid altitude sloping lands and Meyer Hill/Kurow Hill/Tirioti Hill/Blackstone Hill/Tekapo Hill on sunny, mid-altitude hill slopes between the courses of the Mistake and Cass Rivers.

2.2 Climate

The productive areas of Godley Peaks have a climate typical of the Mackenzie basin, with hot dry summers and long cold winters (130 days or more). The historic long-term average rainfall is approximately 700 mm in the irrigation command areas; however over the recent past the rainfall has only averaged around 580 mm (McIndoe, 2009). The rainfall increases in the hill country.

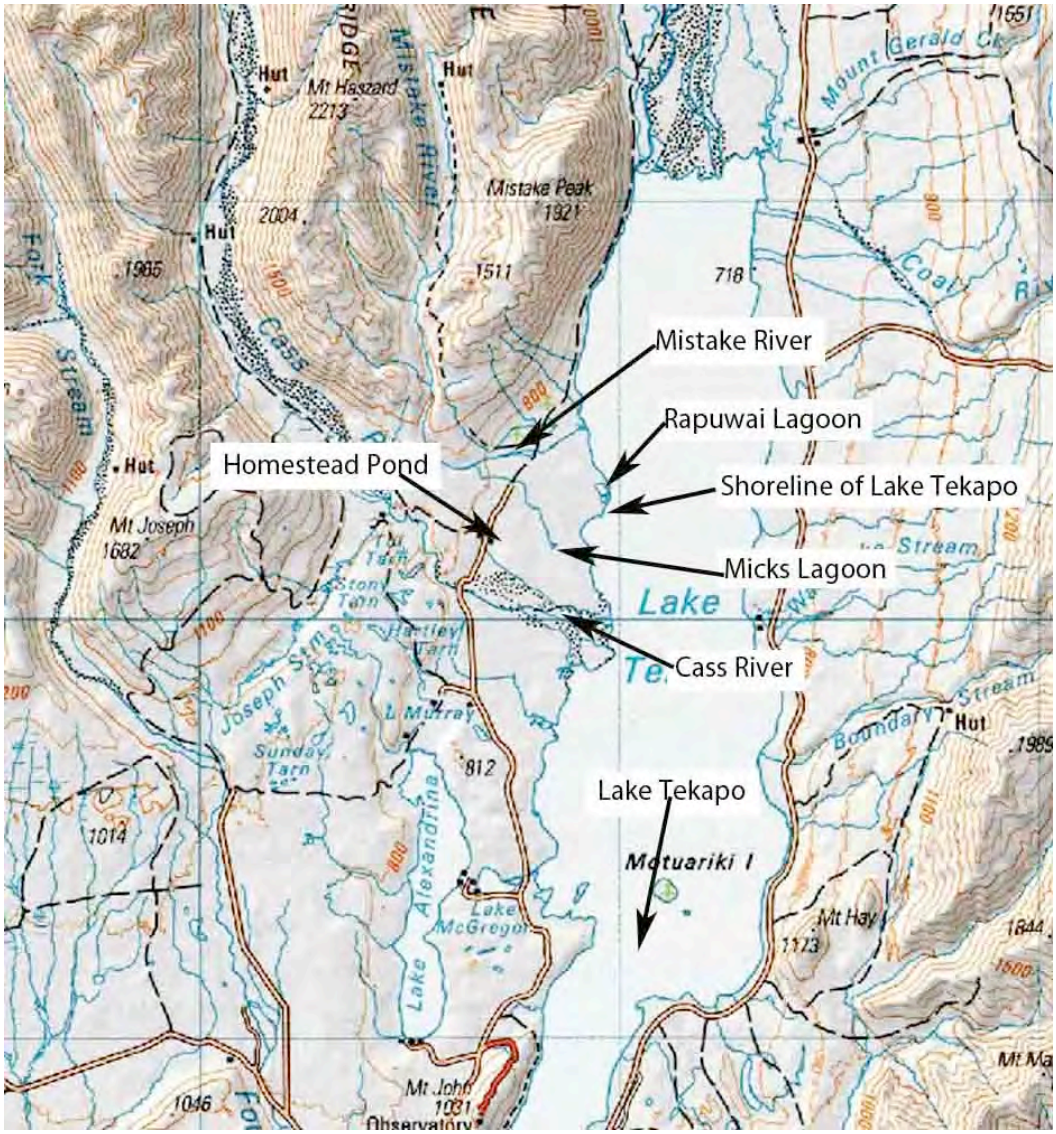
2.3 Topography

The majority of the Station consists of steep, high altitude hill country (approximately 11,750 ha) with rolling mid and lower altitude rolling country (approximately 2,150 ha) and 700 ha of flat and rolling land. The irrigation command area is on flat country sloping slightly to the south east.

3.0 Environmental Context

The environmental context of the farm is a reference to both the local and wider receiving environments. Figure 3 shows the receiving environments of Godley Peaks Station.

Figure 3 Map showing receiving environments of Godley Peaks Station



3.1 Water Quality Study mitigation requirement

The proposed irrigation area of Godley Peaks Station lies in the upper catchments in terms of surface water identified in the WQS (GHD, 2009) and drains directly to Lake Tekapo. There are no groundwater sub-catchments identified in this area (GHD, 2009) (Annexure 1).

Table 1a and Table 1b show the calculated nutrient mitigation requirement for the receiving environments as determined in the WQS and the resulting thresholds for Godley Peaks Station.

For this property there are no nutrient mitigation requirements to cap farm nutrient losses.

Table 1a Water Quality Study mitigation requirements for Godley Peaks Station (GHD, 2009)

Farm	Surface water sub-catchment	Secondary surface water sub-catchment	Ground water sub catchment	Lake Sub-catchment	Proposed whole farm N loss from WQS	Proposed whole farm P loss/ha from WQS	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		Groundwater 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
Godley Peaks	Upper			Northern	41828	1110	0	0	0	0	0	0	0	0	0	0	0	0

Table 1b Water Quality Study mitigation requirements for Godley Peaks continued

Stream mitigation required for periphyton kg/farm		Secondary stream mitigation required for periphyton kg/farm		Stream mitigation required for ANZECC kg/farm		Secondary stream mitigation required ANZECC kg/farm		GWR mitigation required kg/farm		Lake mitigation required kg/farm		Stream mitigation threshold for periphyton kg/year		Secondary stream mitigation threshold for periphyton kg/year		Stream mitigation threshold for ANZECC kg/year		Secondary stream mitigation threshold for ANZECC kg/year		Groundwater mitigation required threshold kg/year		Lake mitigation required threshold kg/year		Overall Farm thresholds for WQS mitigation kg/year	
N	P	N	P	N	P	N	P	N	P	N	P	N	P	N	P	N	P	N	P	N	P	N	P	N	P
	0	0	0	0	0	0	0	0	0	0	0	0	41828	1110	41828	1110	41828	1110	41828	1110	41828	1110	41828	1110	41828	1110

3.2 Local receiving environments

The local receiving environments for Godley Station that are not considered in the WQS are the margins of Lake Tekapo, Mistake River, Cass River, Micks Lagoon, Rapuwai Lagoon and Homestead pond.

Micks Lagoon is currently fed by an existing stockwater race from Mistake River and is a DoC administered Black Stilt sanctuary as well as providing habitat for other bird species. There is a single outlet from the Lagoon that discharges into the Cass River. In previous water quality tests, the outfall has shown significantly higher concentrations of contaminants such as Faecal Indicator Organisms than the inlet. Considering the use of the Lagoon, an increase such as this is not unexpected.

Rapuwai Lagoon is found close to the shore of Lake Tekapo. It forms a significant habitat for raupo. Banded Dotteral, Australsian bittern and white winged back tern have also been identified in the wetland. Typically there are no overland inputs to the Lagoon and it is thought that the lagoon is fed by local groundwater and is also influenced by the Lake's level, Figure 5.

Homestead pond as indicated on the map is located close to the yard and several domestic dwellings. The water level is maintained through several old existing races and springs rising in the slope approaching the pond. According to Bartlett (2009) is a Wetland of Ecological and Representative Importance and is reported to be degraded in quality.

Mistake River, is a highland stream completely contained within the property and discharges to Lake Tekapo. It is a largely unmodified river characterised by low flows in mid to late winter due to seasonal snowpack in the headwaters, that provides trout spawning and juvenile habitat. In the lower reaches water is extracted for irrigation and the course of the river runs adjacent to the current and proposed irrigation areas. A study of the hydrology completed by Boroman Consultants Ltd identified a mean flow of 1,902 l/s, and a mean annual low flow of 517 l/s (McIndoe, 2009).

Cass River, a larger tributary of Lake Tekapo forms the southern boundary to the property. The Cass River supports population of endangered endemic and exotic fish species as well as

habitat for a variety of wading birds, however is largely unaffected by the on-farm practices on Godley Peaks Station with the exception of the discharge from Micks Lagoon.

For Lake Tekapo, although the proposed activities on Godley Peaks Station are highly unlikely to impact on the Trophic status of the lake, their activities may have an impact on the lake margins through both point and diffuse sources.

4.0 FEMP Development

4.1 Mandatory good agricultural practice (MGAPs)

Table 2 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 (NZFMRA, 2002).	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 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 every 5 years by an independent 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.

Mandatory good agricultural practices	What these practices mean on farm
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	Proper storage of supplements and responsible methods of feeding out that do not result in accumulations of excreta on small proportions of the farm. Where large amounts of supplements are fed out, a feed pad should used.
Winter grazing management	Winter management of stock to prevent pugging and high densities of stock in one area for long times.

4.2 OVERSEER and meeting WQS mitigation requirements

Godley Peaks Station at the head of Lake Tekapo, lies in the Upper Catchments according to the WQS (GHD, 2009). Normally the WQS thresholds (or NDA) are derived from the proposed losses from the farming system as calculated by the WQS (not including any mitigations) minus the calculated mitigation requirements for that sub-catchment or area. However, in the case of Godley Peaks Station, there is no receiving environment mitigation requirement. The ultimate destination of nutrient lost from this station will be the Northern Arm of Lake Benmore via the Tekapo, Pukaki and Ohau canal system.

Table 3 below shows the output from OVERSEER for the modelled proposed farming system at Godley Peaks[2] and the WQS thresholds. The OVERSEER N outputs at a Developed setting are relatively close to the threshold, largely as a result of the losses modelled from the steep hill country, representing 65 % of the total N losses. At a Highly Developed setting, the modelled N losses increase as this setting allows for no immobilisation of N and is therefore conservative and represents the upper bound of N losses for the systems as they are described and modelled in OVERSEER 5.3.4. When the current system as is, is modelled at Highly Developed, the losses exceed the thresholds, however with a reduction in fertiliser usage on the irrigated block, these thresholds can be met. Outputs from all scenarios are supplied.

Soil monitoring for N immobilisation is imperative for those stations that do not meet their thresholds at Highly Developed with their currently proposed system.

For phosphorus, the current and proposed modelled losses are above the threshold. As with N, the extensive steep hill country accounts for 70% of the farm P losses. In addition, high non-block losses are anticipated by the model accounting for 20 %, leaving the intensively farmed area of the farm only losing approximately 10 % of the total farm losses. In this case, the allocation of nutrients to this farm in the WQS has underestimated in comparison to modelled losses both current and proposed.

The change in farming activity is only modelled to increase P losses by 3 %. Therefore the actual losses from the station are already being received by the lakes and canals and these are very close to what the proposed losses will be. The farm has no WQS receiving environment thresholds and the addition of an extra 3 % P/year over current would have a very minor effect on water quality of Lake Tekapo and the water discharging into Lake

[2] Original OVERSEER modelling was conducted by Ravensdown

Benmore through the canal system, and therefore the environmental effects of taking the proposed loss for phosphorus as its threshold are minor.

Table 3 Total N and P losses modelled by OVERSEER for the proposed farming system on Godley Peaks Station and WQS thresholds

	OVERSEER modelling outputs kg/year	WQS threshold kg/year
Total N leaching/runoff	40,376	41,828
Total N leaching/runoff using Highly Developed	52,533 (41,728 with fertiliser adjusted)	41,828
Total P leaching/runoff	1,465	1,110 (1,465[3])

[3] P threshold at modelled P loss for proposed farming system

4.3 *Identification and mitigation of site specific environmental risks*

The Farm Environmental Risk Assessment (FERA) has highlighted potential site-specific environmental risks on the current and proposed farm system. These risks are described in Tables 4 and 5 below and are colour coded to indicate severity of risk or sensitivity of environment to risk[4]. All risks identified will need to be addressed in the Farm Environmental Management Plan (FEMP). Risks have been divided into overall farm risks and those risks specific to a receiving environment.

Table 4 General Farm Environmental Risk Assessment for Godley Peaks Station

Farm General		Current	Proposed
Irrigation description	Intake/ conveyance	Current off take from Mistake River into small holding dam with water meter. Small leak from dam. No RE. All conveyed through open irrigation races, therefore leaks and inflows and open channels are vulnerable to contamination	Submerged gallery intake and distribution via network of polyethelene pipes
	Type	Pivot and hard hose	Pivot and hard hose
	If BD – destination of tailgate losses?	NA	NA
	Scheduling	Aquaflex on existing pivot. In general, 48 mm on 10 day return	Extended use of aquaflex
	Application rate	48 mm	
	Application efficiency and calibration	Not calibrated	Not calibrated
	Fertigation	NA	NA
	Visual inspection	Some temporary ponding at the end of the pivot, but no runoff	-
Soil	Evidence of / vulnerability to wind erosion	No, but most exposed soils vulnerable to erosion. Weakly structured soils under proposed northern pivot. Regrassed soils south of Micks Lagoon no consolidation but vulnerable to wind blow	-
	Evidence of / vulnerability to water erosion	Evidence of some runoff on straight up drilled grass sloping to Micks Lagoon	-
	Evidence of / vulnerability to capping and pugging	Soils on Northern pivot location where exposed during pasture renewal have capped and under pasture have pugged, slopes toward Mick's lagoon vulnerable to pugging and capping	-

[4] High risk, medium risk low risk

	Organic matter management	OM levels generally low. Increase under irrigation but will need a longer time to build soil and soil structure	-
	Tillage used	Direct Drilled	-
	Bare soils over winter	After Forage Crop	-
	Rotations used/ renewal?	Forage Crop for pasture renewal	-
	Variability of soil within blocks?	Current pivot has variable soils across pivot	Northern pivot has lighter area nearer the Mistake River.
Point sources - Nutrients	Yard	Runoff from yard escapes with roof drainage across track and flows to Homestead Lagoon	-
	Silage/Baleage	Site of baleage storage is > 50 m from Mistake River	-
	Fallen Stock	No offal pit	-
	Fertiliser store	Covered store > 50 m from any receiving environments	-
	Fertiliser filling area	> 50 m from any receiving environments	-
Effluent/dirty water/ infrastructure	Storage - fully sealed	NA	-
	clean and dirty water	No clean and dirty water separation on yard	-
	Direct discharges from yard	Yes	-
	Application rate and depth and total load	NA	-
	How is depth determined?	NA	-
Point Source - Chemicals	Yard	Runoff from yard where jetting occurs escapes with roof drainage across track and flows into Homestead lagoon	-
	Store	Sealed bunker. Remainder of chemicals bought in on demand by contractor	-
	Fuel	Mobile bowsers	-
Tracks	Evidence of / vulnerability to tracks running off to R.E.s?	No	-

Table 5 Specific receiving environment Farm Environmental Risk Assessment for Godley Peaks Station

Describe Local receiving environments		Mistake River	Homestead Pond	Micks Lagoon	Rapuwai Lagoon	Lake Tekapo	Cass River
Type		Watercourse	Pond	Lagoon	Lagoon	Shoreline of Lake Tekapo	River
Source		Highland, contained on farm	Spring fed pond augmented by 2 water races. Would be smaller without this augmentation	Irrigation water from Mistake River via water races	Spring/GWR level is thought to reflect Lake Tekapo level	NA	Highland
Destination		Lake Tekapo	-	-	No outlet	Water leave UW via canal system and Lake Benmore	Lake Tekapo
Germorphology		-	-	-	-	-	-
Condition		-	Degraded	Lagoon is good	-	Good	ND
Value		Habitat and unmodified status (IO)	Wetland of Represenatative and Ecological importance (WERI)	Biodiversity/ Black stilt	-	amenity/ visual	Habitat
Protection		-	-	DoC sanctuary	-	-	-
Regulation/required quality		-	-	-	NS	-	-
Current threats							
	Stock	No stock access	Stock access to lagoon although normally only sheep in this paddock. Stock on sloping field draining to lagoon	Protected from Stock	Stock have access to part of lagoon	Although stock are not restricted completely from the Lake there was no evidence of damage by stock. There is extensive (although variable) gravel foreshore	Stock are not restricted from Micks Lagoon outfall channel (Figure 7)
	Runoff	In vicinity of irrigation the very shallow gradient to the river would reduce the vulnerability to runoff	Roofwater is piped via downpipe and drain under track to outlet across the paddock and meanders in a runoff channel to Lagoon. Cross drain at lowest point of yard also drains into this drain. Yard is used to treat and jet sheep and therefore runoff is contaminated with excreta and chemicals (Figure 8)	Runoff potential into Micks Lagoon - capped soils with some consolidation sloping down to lagoon (Figure 6)	The surrounding slopes may runoff, but this is a natural phenomenon	Ephemeral channel in proposed hardhose area east of eastern pivot. Runoff to lake.	-
	Effluent	NA	NA	NA	NA	NA	NA
	Fertiliser	-	NA	-	Absence of buffer	Fert applied within 20 m of the shoreline	-
	Chemicals	-	In runoff channel in Killer paddock a white/opalescent sheen was seen on the surface of the runoff water (figure 9).	-	Absence of buffer	Absence of buffer	-

	Vegetation	-	-	-	-	-	-
	W quantity	-	-	-	-	-	-
	Irrigation	End gun of pivot shut off to maintain irrigation buffer on south side	-	-	-	-	-
	Cultivation	-	-	-	Paddock over which the ephemeral passes has recently been cultivated	Cultivation on lower terrace at 43 50 238/ 17029884 immediately adjacent to the shoreline	-
	Other	-	House septic tank soakaway areas will also eventually drain into House lagoon	-	1st time in 9 years a flowing ephemeral stream (spring and possible some surface runoff, Figure 4) starts in bearby paddock and flows into Rapuwai Lagoon, traversing a paddock that was renewed last year and thereby had poor ground cover. This ephemeral also had stock access and traversed a road. The ephemeral was carrying a reasonable load of nutrients and sediments (visual assessment)	-	Heavy vehicles that can't use the bridge pass through a ford. These vehicles include fertiliser and fuel trucks
Potential threats			0	0	0	0	0
	Stock	See current	See current	See current	See current	Heavy stocking over late autumn early winter in irrigated areas close to lake	See current
	Runoff	Little chance of overland runoff	Absence of buffer from proposed irrigation	See current	See current	See current	-
	Effluent	NA	NA	NA	NA	NA	NA
	Fertiliser	Absence of buffer	Absence of buffer from proposed irrigation	Absence of buffer	See current	Higher risk timing for N fertiliser	Absence of buffer
	Chemicals	Absence of buffer	See current	Absence of buffer	See current	See current	Absence of buffer
	Vegetation	-	-	-	-	-	-
	W quantity	-	Water races that are a a by-product of current irrigation system will cease and may decrease volume of water in Lagoon	W quantity will be maintained through a metered take from proposed system	-	-	-
	Irrigation	The shallow and stony nature of the area on northern bank of Mistake River under the proposed pivot appears to have lower PAW and is vulnerable to over irrigation.	The proposed area of irrigation in proximity to Homestead lagoon is variable in terms of soil characteristics and is therefore vunerable to over and under irrigation	-	See current	-	Absence of buffer.
	Cultivation	-	-	Potential consolidation/compaction due to machinery.	Cultivation through the ephemeral channel	See current	-
	Other	-	-	-	-	-	-

Transitional period			0	0	0	-	0
		Sediment from infrastructure installation	Sediment from infrastructure installation and runoff into Homestead lagoon	Sediment from infrastructure installation and runoff into Micks lagoon	-	Sediment from infrastructure installation and runoff into Lake	-
		Compaction from heavy machinery to install infrastructure	Compaction from heavy machinery to install infrastructure and consequent runoff and soil structural damage	Compaction from heavy machinery to install infrastructure and consequent runoff and soil structural damage	-	Compaction from heavy machinery to install infrastructure and consequent runoff and soil structural damage	-
		Cultivation for initial establishment - sediment and P	Cultivation for initial establishment - sediment and P	Cultivation for initial establishment - sediment and P	-	-	-
		Cultivation for initial establishment - N and P	Cultivation for initial establishment - N and P	Cultivation for initial establishment - N and P	-	-	-

Figure 4 Ephemeral surface water runoff to Rapuwai Lagoon

Figure 5 Rapuwai Lagoon and Lake Tekapo in background

Figure 6 Marginal surface runoff on slopes to Micks Lagoon

Figure 7 Outflow from Micks Lagoon including stock encroachment

Figure 8 Yard where sheep jetting occurs with drainage at far end

Figure 9 Contaminate drainage from yard in Killer paddock discharging to Homestead Pond. Note Opalescent film on water.

5.0 Proposed farm system with mitigation

The proposed farm system is an extension of the current system. The proposed irrigation, shown in Figure 10, is largely being sought as a risk management strategy in this dry environment. It would provide increased reliability of feed supply throughout the summer, and provide increased areas where winter feed crops could be grown. The base stock numbers will increase but it is not envisaged that capital numbers would be increased significantly above the levels the property has historically run (up to 14,500 SU) and the stock numbers over the winter period would not alter significantly. The additional feed provided by the irrigation over the summer and autumn would go towards increasing per head performance of capital stock, and the balance would see an increase in summer trading stock (November to April).

Figure 10 Map of proposed irrigaiton areas on Godley Peaks Station

Soils

The FERA highlighted soils risks arising from the vulnerability of some soils to erosion from both wind and water, the presence and vulnerability of some soils to surface compaction and pugging, low organic matter, and unprotected wetland soils around lagoons.

The proposed management or mitigation measures are;

- ***The annual monitoring and identification of soil compaction in hydrologically connected areas and documented remedial actions taken;***
- ***No trafficking (machinery or stock) of soils when wet, and as this is not always possible, the above monitoring will identify any issues arising in hydrologically connected areas;***
- ***Use of contour drilling on slopes east of Micks Lagoon;***
- ***The installation of a buffer strip and subsoiled strip on foot of eastern slopes approaching Micks Lagoon;***
- ***Use forage cropping rotationally during pasture renewal;***
- ***Fencing out of stock from wetland areas around ponds and lagoons; and***
- ***Direct drilling should be used to establish crops and pasture renewal.***

Anticipated fertiliser use

Specific fertiliser recommendations will be produced on an annual basis using a recommended system. Plant nutrient supply will be estimated from inorganic fertilisers and direct deposition as well as N fixation using a nutrient budgeting system.

The FERA highlighted potential fertiliser issues arising from N applications occurring in autumn, Olsen P levels increasing above 25 in irrigated areas, watercourses, wetlands, lake margins and bores not having a fertiliser layback, and highly variable soils in the irrigation command area which may lead to under and over fertilisation if fertilised at a flat rate.

The proposed management or mitigation options are:

- ***In accordance with the MGAPs, fertiliser spreaders must be calibrated annually in-house and every 5 years by an external auditor;***
- ***Fertiliser N will not be applied between 15th April and 10th September except if as an N inhibitor;***
- ***A 20 m buffer will be maintained for all fertiliser applications from all watercourses, wetlands and lake margins and 50 m from all bores.***
- ***Fertiliser applications will be split to < 50 kg N/ha per application;***
- ***Continued use of GPS for application of fertiliser;***
- ***Continued use of a covered fertiliser storage area;***
- ***Continued use of a safe fertiliser filling area, not within 50 m of a watercourse, lake, spring, bore or wetland, with no drains and no risk of discharge straight to ground; and,***
- ***Soil Olsen P levels maintained below 25.***

Stock

The FERA highlighted current stock nutrient loss risks associated with the stock having access to watercourses and wetlands and additional potential risks from heavy stocking in late autumn and early winter in irrigated areas adjacent to the lake or on lighter soils adjacent to the Mistake River.

The proposed management options or mitigations are;

- ***Rapuwai Lagoon will be completely fenced;***
- ***Irrigation areas adjacent to lake and on lighter soils adjacent to Mistake River should not be heavily stocked in later autumn and early winter. If winter grazed fodder crops are grown, in field buffer strips should be left in tact to reduce runoff reaching Mistake River and the margins of Lake Tekapo.***
- ***In accordance with the MGAPs, stock and stock feeding areas should be moved frequently on winter grazed crops and pastures to prevent excessive concentrations of excreta deposited in small areas.***

Water

It is proposed that the current irrigation of 72 l/sec be retained; and an additional consent for 261 l/sec from the Mistake River is sought. This would be sufficient to fully irrigate a further 447 ha, bringing the total to 562 ha irrigated and 333 l/s. The irrigation water will be taken from a submerged gallery in the Mistake River and piped from there to the Pivot and Big Gun Irrigators.

The proposed management and mitigation options are:

- ***A submerged gallery should be used to taken water from the Mistake River;***
- ***A stepped reduction in take should flows in Mistake River fall below 781 l/s detailed in table below;***

Table 6 Stepped flow reductions for Godley Peaks' take from Mistake River with respect to flows in Mistake River

Mistake River flow (l/s)	Godley Peaks abstraction (l/s)
0-350	0
350-520	up to 72
520-585	72 + 0 (or minor managed take)
586-650	72+65
651-715	72+130
716-780	72+195
>780	72+261

- ***Pipelines must be buried <400 mm below ground level to avoid damage from cultivation machinery;***
- ***No irrigator will cross an open waterway;***
- ***The 775 m pivot on the northern side of Mistake River should be installed with boombacks to reduce irrigation onto centre pivot tracks and achieve required efficiency;***

- ***The 775 m pivot on the northern side of Mistake River should be regularly monitored as there is a more than minor risk of runoff occurring; and.***
- ***To comply with required irrigation efficiencies on each irrigation area, the below table should be complied with.***

Table 7 Irrigation parameters for centre pivots and hard hoses on Godley Peaks Station

Irrigator type	Soil type	Return period (days)	Irrigator maximum application rate (mm/hr)	Soil infiltration rate (mm/hr)	Acceptable?	Application efficiency (%)
408 m pivot	Tekapo	5	30	18-33	Yes	82
708 m pivot	Tekapo	2	52	30-53	Yes	88
	Larbreck	5	52	41-58	Yes	85
775 m pivot	Mesopotamia, Cox and Ohau	2	46	18-29	May require further mitigation	78
	Larbreck	4	56	43-60	Yes	84
Gun	Tasman	7	9	9-15	Yes	79
	Tekapo	10	14	<15-28	Yes	80
	Larbreck and Holbrook	10	14	<28-40	Yes	80

Runoff

The FERA highlighted water and runoff risks associated with runoff from sloping paddocks to Micks Lagoon, ephemeral surface water flow to Rapuwai Lagoon, contaminated runoff from the yard draining through Killer paddock to Homestead pond, cultivation of lower terrace North of Mistake River adjacent to the lake margin, and an ephemeral channel in proposed hardhose area adjacent to the lake margin draining to the lake. The existing network of open irrigation and stock water races are being replaced by a reticulated system, thus reducing associated risks.

In addition there will be runoff from unfarmed steep high country, however this is a natural phenomenon and no mitigation is appropriate.

The proposed mitigation or management options are:

- ***The installation of a buffer strip and subsoiled strip on foot of eastern slopes approaching Micks Lagoon;***
- ***Ephemeral channel carrying flows to Rapuwai Lagoon to be grassed and remain under grass;***
- ***Where conditions are such that the there is surface water ponding flowing (ephemeral channels flowing to Rapuwai Lagoon and Lake Tekapo), stock to be restricted from the immediate area by temporary fencing;***
- ***No cultivation of lower terrace North of Mistake River adjacent to the lake margin; and,***

- ***Separation and discharge of clean water from the yard. The roof water that currently mixes with contaminated yard water at the base of the down pipe should be isolated and can continue to be discharged under the track and via Killer paddock.***

Chemical Risks

The current FEMP identified chemical risks associated with runoff from the yard where sheep jetting is carried out and the absence of buffer strips from the lake margin.

The proposed mitigation or management options are:

- ***Contaminated yard runoff to pass through a biobed for treatment prior to being discharged onto Killer Paddock. A biobed is essentially an organic filter system consisting of a lined structure that contains a biomix - a mixture of topsoil, compost and straw. The biomix removes the pesticides from the contaminated water, the retained pesticides are then degraded and the treated water can be reused (Fogg, 2007). Further details on biobed construction and use are given in Annexure 2;***
- ***No spray areas for chemicals to be mapped and clearly displayed in sprayer cabs; and,***
- ***Back siphoning prevention measures to be implemented on the farm when filling sprayers from an un-isolated water supply.***

In addition

- ***A contractor or approved handler should continue to be used to supply, handle, and apply chemicals on the farm; and,***
- ***Chemicals should continue to be stored on the property should be stored in a secure and bunded area.***

Construction risks

There are additional risks that are only associated with the period of construction and are therefore temporary, however additional mitigation will be required to minimise the effects.

- ***Works in Mistake River will be carried out when flows are low and outside fish spawning and bird breeding periods[5] and a fish passage will be maintained at all times***
- ***No storage or refuelling will take place on the creek bed***
- ***Any works on Mistake River that have destabilised the banks should be remediated.***
- ***Compaction caused by construction equipment should be removed***
- ***Groundcover should remain in tact during construction.***
- ***Where construction is taking place on slopes, a set of 3 narrow subsoil strips should be cultivated to reduce runoff to receiving environments namely Micks Lagoon and Homestead Pond.***

[5] Where this in not possible consultation will be undertaken with DoC and Fish and Game

6.0 Farm Environmental Management Plan for Godley Peaks Station

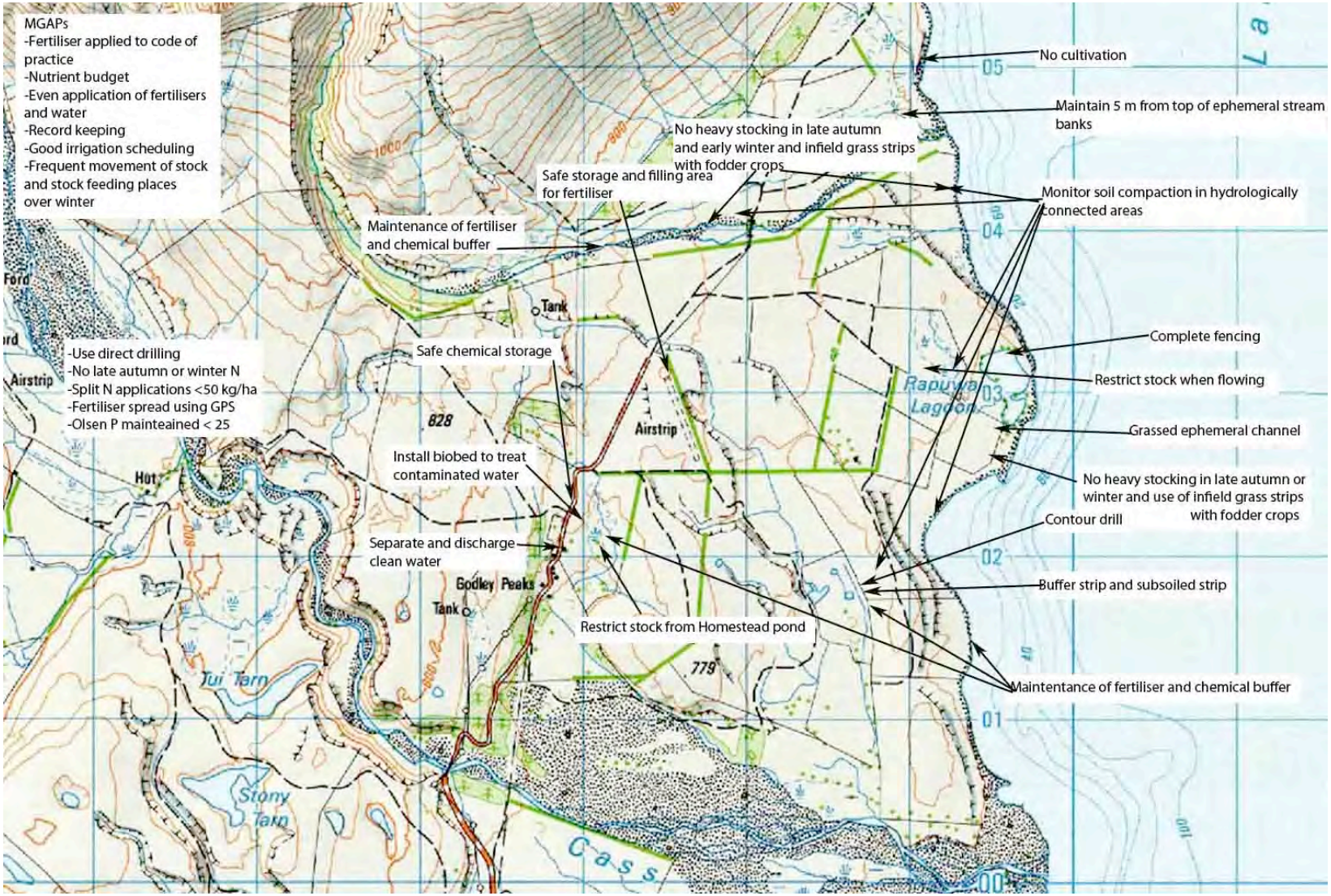
Table 8 below shows the all the mitigation and management tools that are proposed to be undertaken on Godley Peaks Station. Measures indicated as FEMP stage 1 are those identified as Mandatory Good Agricultural Practice, measures identified as FEMP stage 2 are those changes that have been modelled in OVERSEER , and those indicated as FEMP stage 3 are mitigation measures chosen to ameliorate site specific environmental risks on the farm. The table indicates in brief how the measures are to be monitored and audited, and a map showing the locations of the proposed mitigation measures is shown in Figure 11.

Table 8 Table of mitigation options for Godley 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 animal returns and soil reservoirs	Soil testing and use of a nutrient budgeting	Reconciliation of fertiliser and soil records with nutrient budget for example blocks. Submission of example soil 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 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, stock days, nutrient inputs and yields per farm management unit	Upkeep of records - current recording system	Submission of example block records
1	Good design of irrigation systems	Design of irrigation system by a certified professional	Irrigation system audited after installation and then by a certified auditor every 5 years
1	Robust irrigation scheduling	Use of example pivots for aquaflex soil moisture monitoring	Submission of soil moisture monitoring data
1	Good silage storage and good feeding out management through use of silage lines and frequent movement of stock.		Annual audit for baleage storage location Submission of example stock movement records.
1	Frequent movement of stock over winter to prevent pugging and reduce winter stock losses	Upkeep of stock movement records	Verification of example stock movement records
2	Direct drilling used to establish crops and pasture		OVERSEER nutrient Budget. Annual audit
2	Fertiliser N will not be applied between mid April and 10th of September	Field records	Verification of field records and OVERSEER Nutrient Budget
2	Fertiliser N application should be split to < 50 kg N/ha per application	Upkeep of records	OVERSEER nutrient Budget. Annual audit
2	Fertiliser will be applied using GPS spreading technology		Verification of application maps
2	Stock will not have access to watercourses in intensively grazed areas of the property		Annual audit
2	Olsen P of below 25 maintained	Regular soil testing (every 3 years)	Submission of soil tests
2	No fertiliser will be applied within 20 m of a watercourse, wetland or the margin of Lake Tekapo or 50 m of a bore		Verification of application maps
2	Use of forage crops rotationally during pasture renewal		OVERSEER nutrient Budget. Annual audit
3	Ephemeral channels restricted from stock when flowing		Annual audit
3	Identify and remove soil compaction and consolidation in	Annual soil compaction in hydrologically connected area	Submission of assessment and remedials

	hydrologically connected areas		
3	Use on contour drilling on slopes adjacent to Micks Lagoon		Annual audit
3	Installation of a buffer strip and subsoiled strip adjacent to Micks Lagoon		Annual audit
3	Complete fencing of Rapuwai Lagoon		Annual audit (one-off check)
3	Continued use of direct drilling		OVERSEER nutrient Budget. Annual audit
3	Irrigated areas adjacent to the lake and on lighter soils adjacent to the Mistake River should not be heavily stocked over late autumn and early winter		Verification of example stock movement records
3	If winter grazed forage crops are grown in hydrologically connected areas, infield buffer strips should be left in tact		Annual audit
3	Ephemeral channel carrying flows to Rapuwai Lagoon should be grassed and remain under grass		Annual audit
3	Contaminated yard runoff to pass through biobed for treatment prior to discharge	Monitor discharge quality	Verification of discharge analysis. Annual audit
3	Separation and discharge of clean water from yard		Annual audit
3	No spray areas to be mapped and clearly displayed in sprayer cabs		Annual audit
3	No cultivation on lower terrace north of Mistake River adjacent to the lake margin		Annual audit
3	Back siphoning prevention measures when filling chemical sprayers from un-isolated water supplies		Back siphoning prevention measures verified during annual audit
3	Fertiliser will continue to be stored under cover		Photograph of store (one-off). Annual audit
3	Fertiliser filling area will continue where there are no drains and where a direct discharge to ground in not possible		Photograph of filling area (one-off). Annual audit
3	A contractor or approved handler will continue to be used to supply, handle and apply chemicals		Verification of contractor details

Figure 11 Annotated map with key mitigation options an locations on Godley Peaks Station



6.1 *Monitoring and Auditing*

Monitoring and auditing of the FEMP are as important as the plan itself.

Table 9 shows the monitoring suggested for the mitigation and management options chosen for Godley Peaks Station. Table 9 Location, frequency and parameters for environmental monitoring on Godley Peaks Station

shows the frequency and parameters for the environmental monitoring, Figure 6 shows these monitoring points on a map of the property.

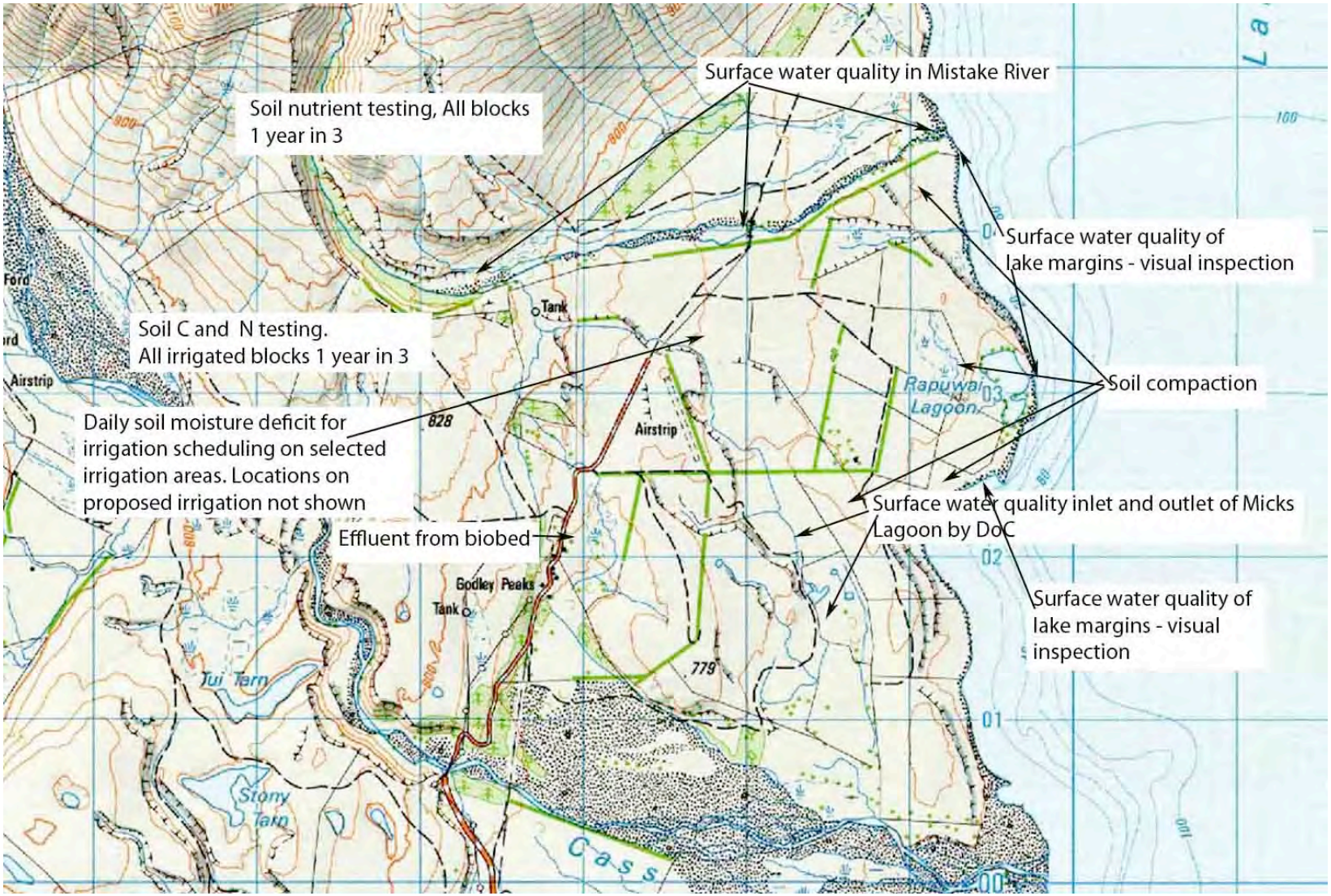
Additional monitoring will be carried out in conjunction with other farmers in the sub-catchments by the Mackenzie Irrigation Company in the Northern Arm of Lake Benmore.

Table 9 Location, frequency and parameters for environmental monitoring on Godley Peaks Station

	Location	Frequency	Measured parameters to include	Triggers	Contingency plan if triggers are exceeded
Soil nutrient testing	All blocks in rotation	1 in 3 years	Standard suite of soil nutrients plus total C and N	Olsen P of 25. No further accumulation of N indicating highly developed soils.	Reduce of stop addition of P to area and monitor. Use Highly developed setting in OVERSEER for compliance assessment
Soil compaction survey	All hydrologically connected blocks Adjacent to Misktake River, Micks Lagoon, Rapuwai Lagoon and lake margins)	Annually	Surface and subsoil compaction	Compaction, surface capping	Remove compaction with appropriate tool
Surface water quality	Mistake River upstream of intake, at Bridge and at outlet to Lake Tekapo	Quarterly	Total Nitrogen, nitrate, ammonia, total phosphorus, dissolved reactive phosphorus.	No significant increase in any measured water quality determinand	If comparative surface water analysis indicates a decrease in surface water quality across the property, the degraded determinands should be identified, as these will indicate the likely cause of the contamination, while a full root cause analysis is undertaken.
Surface water quality	Micks lagoon at outlet and at upstream of confluence with Cass River	Quarterly	Total Nitrogen, nitrate, ammonia, total phosphorus, dissolved reactive phosphorus, Faecal coliforms,	No triggers - as birds and other wetland biodiversity are likely to elevate nutrients concentrations.	
Surface water quality	Lake margins	Monthly between December and April	Visual inspection of lake margins for signs of excessive nutrient loss/runoff	Proliferation of algal or weed growth	If point source, trace source of nutrients on farm and take appropriate action. If diffuse, a root cause

					analysis should be instigated to identify contributing activities and suggest mitigations.
Biobed effluent water quality	Biobed discharge	Quarterly input and output for first year and if working consistently, every six months	Concentrations of Extanosad components	No trigger established	If comparative concentrations indicate no treatment effect, the biomix should be replaced. Biomix should be replaced every 5 years.
Irrigation application		Annually in house and 1 in 5 years by an independent	Application uniformity	>80 %	Optimisation of the irrigator performance will take place at the time of testing
Soil moisture deficit	Example pivots on different soil types	Daily during irrigation system	Soil moisture and deficit	67-88 % SMD for irrigation scheduling purposes	Irrigation
Fertiliser application		Annually in house and 1 in 5 years by an independent	Application uniformity		Optimisation of the irrigator performance will take place at the time of testing

Figure 12 Annotated map showing location of monitoring points on Godley Peaks 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 8, 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[6] at the time of trigger breach?

Yes – continue monitoring to see if trigger breach continues

No – Seek advice of suitably qualified person to further investigate root cause and suggest appropriate further mitigation.

If emergency conditions occur that risk a pollution event, such as a catastrophic failure of the fuel containment, seek immediate guidance from the Canterbury Regional Council: **0800 76 55 88**

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 Environment Canterbury by end of July each year. Table 10 below shows the proposed contents of an annual audit report for Godley Peaks Station.

Table 10 Table showing proposed contents for an annual audit report for Godley Peaks Station

Audit measures	Action in the case of non-compliance if applicable
Additional auditing that must be done externally	
Check the storage of baleage for visible signs of discharge and location	Any discharge must be stopped immediately. Temporary solutions such as sawdust may be used to take up any discharges. Baleage sited in risky locations should be moved for the following audit. Following that - non compliance
Verify the change of use from open stock water races to a reticulated water supply (one off check)	Where verification is not possible, this should be rectified for the following audit. Following that - non compliance.
Review of stock movement records to show winter feeding and stock movement and no heavy stock adjacent to Lake Tekapo or on light soils adjacent to Mistake River in later	Where verification is not possible, this should be rectified for the following audit. Following that - non compliance.

[6] Abnormal conditions include extreme weather conditions and catastrophic failure of irrigation/effluent infrastructure

autumn and early winter.	
Review of field records to verify use of direct drilling	Where verification is not possible, this should be rectified for the following audit. Following that - non compliance.
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.
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.
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. Following that - non compliance
Check Micks lagoon, Rapuwai Lagoon and Mistake River fencing is in tact	Any failure in the integrity of the fencing must be repaired immediately or a temporary barrier placed around gap to prevent stock access.
Check in field and riparian grass strips where fodder crops are winter grazed in hydrologically connected areas	If grass strips are not in place, short term mitigations such as pathway sub soiling, temporary sediment pits or temporary straw bale barriers should be considered to protect watercourses. Strips should be planted/left the following year.
Review measures recommended by irrigation audit have been implemented	Recommendations not already implemented should be done so prior to next audit.
Review field records to verify split applications of N	Where verification is not possible, this should be rectified for the following audit. Following that - non compliance.
Review field records to verify no late autumn and winter applications of N	Where verification is not possible, this should be rectified for the following audit. Following that - non compliance.
Review of chemical management policy - use of contractor, approved handler status, use of a crop adviser	Concerns or absence of policy should be rectified for next audit. Following that - non compliance
Review GPS maps for variable and precision application of fertiliser N and to verify lay backs on water features are observed.	Where verification is not possible, this should be rectified for the following audit. Following that - non compliance.
Review of back siphoning prevention measures	Immediate stop of use of unprotected water supply for filling chemical sprayers while permanent measures are put in place. If measures are not in place for following audit - non compliance.
Verify use of contour drilling on slopes adjacent to Micks Lagoon	Where verification is not possible, this should be rectified for the following audit. Following that - non compliance.
Annual soil compaction survey on hydrologically connected areas, submission broad findings and remedials	Recommendations not already implemented should be done so prior to next audit. Following that - non compliance
Verify rotational use of fodder crops	Where verification is not possible, this should be rectified for the following audit. Following that - non compliance.
Verify that where ephemeral channels are flowing, stock are restricted	Where verification is not possible, this should be rectified for the following audit. Following that - non compliance.
Verify the maintenance under grass of ephemeral channel flowing to Rapuwai Lagoon	If this channel is not grassed, this should be rectified for the following audit. Following that - non compliance.
Verify installation of buffer strip adjacent to Micks Lagoon with a subsoil strip on field side	Where verification is not possible, this should be rectified for the following audit. Following that - non compliance.
Verification of clear and dirty water separation on yard and destination of contaminated water to biobed	If contaminated water is being discharged along with clean water, all should be diverted immediately to the biobed storage facility until proper separation ensures only clean water is discharged.
Verification that no further cultivation on lower terrace north of Mistake River adjacent to the lake margin	If this area has been cultivated, this should be rectified for the following audit. Following that - non compliance.
Verification of biobed functioning and review of effluent quality results	If biobed is not functioning, contaminated water should be stored until it can be treated
Independent fertiliser spreader and irrigation testing and calibration 1 in 5 years	Spreaders and irrigators not performing should be recalibrated
Additional auditing that can be done either externally or internally	
Submission and brief interpretation of soil, water quality, biobed effluent and machinery calibration tests	Where triggers have been exceeded, immediate contingency plans should have been effected and a root cause analysis conducted. The results of which should be presented here. Continual breach - non compliance
Submission of example irrigation schedules and reconciliation with soil moisture monitoring	The restriction of irrigation water to 600 mm/ha is an important driver to efficiency. Other sanctions are unlikely to be necessary to promote water use efficiency.
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

7.0 Summary

This FEMP has been written to illustrate that the proposed farm system has identified and mitigated farm specific environmental risks that arise from the inherent characteristics of the farm or from the proposed farm system and its management. These farm specific risks include uncontrolled discharges that are not identified in farm nutrient budget modelling but that may still have an environmental effect.

As the farm is situated in the upper catchments, there are no nutrient mitigation requirements imposed by the WQS. However the WQS has underestimated the P loss from the farm under the current scenario mainly as a result of the high P losses from the steep highlands and high rainfall. As these are outwith the farmer's control and are not affected by the development it is therefore proposed to assume the proposed P loss as the threshold.

The mitigation and management measures detailed in Table 8, lay out the techniques that have been adopted to fulfil these objectives and Section 5 illustrates how site specific environmental issues, including uncontrolled discharges, have been identified and are mitigated.

The monitoring and auditing of this plan, addressed in Section 6 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.

8.0 References

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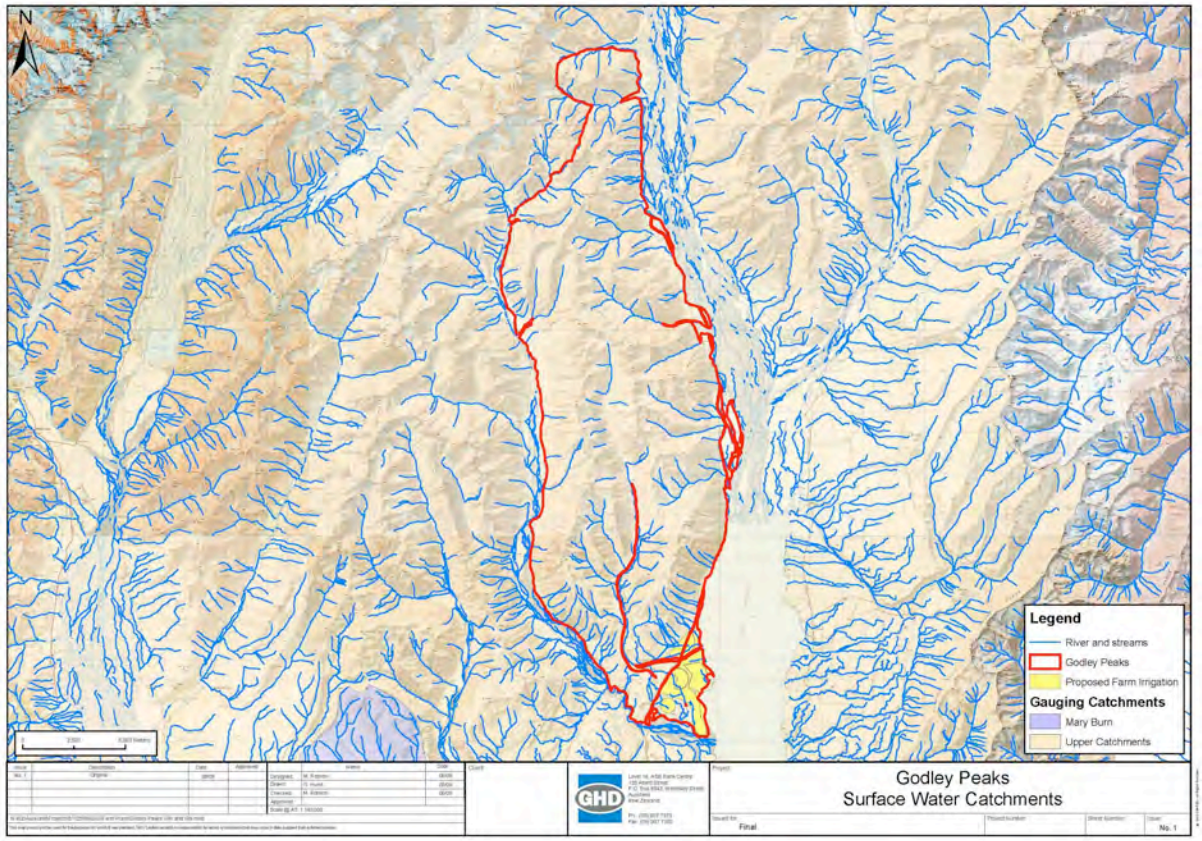
ANNEXURE 1

WQS surface water sub-catchments for Godley Peaks Station
Maps provided by GHD Ltd to illustrate sub-catchment boundaries only



ANNEXURE 2

Further Information on construction and use of Biobeds