Appendix II. Menu of practices for dry stock farms to improve water quality in Southland

This menu of practices to improve water quality is designed to guide farmers on options for reducing farm impacts on water quality. It is based on the MENU of practices (http://www.waikatoregion.govt.nz/menus) developed by Waikato Regional Council and the Upper Waikato Primary Sector Partnership, a group of representatives from agricultural industry organisations working in the Upper Waikato catchment, but has been re-freshed to reflect cost and effectiveness metrics for Southland farms. Similar to the Menu prepared for Dairy farms (Appendix I), it includes a general rating of effectiveness for each practice based on recent research and best guess; these assessments consider the flow pathway targeted by each mitigation and have been scaled to a whole-farm system equivalent. The rating indicates the likely effectiveness (low, medium or high) of each practice in reducing the amount of N, P, sediment and harmful micro-organisms likely to enter waterways on farm. Because every farm has unique topography and management regimes, the need for and effectiveness of different practices will differ. This rating is an indicative best estimate and assumes generally accepted industry good practice is followed when putting any of the practices into place. As stated on the above website, the menu should be used together with current industry initiatives, such as the Beef + Lamb New Zealand Land and Environment Planning Toolkit.

	Estimated reduction in loss:					**Potential impact on farm business:**	
	Nitrogen	**Phosphorus**	**Sediment**	**Microorganisms**		**Cost**	**Benefit**
Low (L)	<5%	---------- Less than 20% ----------			$	Limited input of time and cost	Little change to farm profit or infrastructure required
Medium (M)	5 to 15%	---------- From 20 to 40% ----------			$$	Moderate input of time and expenditure. Some practice change required.	Practice likely to result in a moderate increase in profitability or improved management
High (H)	>15%	---------- More than 40% ----------			$$$	Significant input of farmer time and significant expenditure. Significant practice change required.	Very profitable practice or results in improved management e.g. reduced farm operational costs.

Mitigation	GMP examples	Likely Water Quality Benefit				Potential Impact on Farm Business		Factors to Consider
		N	P	Sediment	Micro-organisms	Cost	Benefit	
Whole Farm Planning	Undertake a Land and Environment Plan (LEP) to understand farm resources and risks	Preparation of the farm plan will identify water quality risks. Likely water quality benefits of different practices depend on land classes, management challenges and practices used to manage risks on farm.				$-$$	$$$	Involves assessment of farm resources, stocking policies and farm business risks – see www.beeflambnz.com/farm/tools-resources/landand-environment-planning-toolkit/ for more information. Should include industry good practices and a risk assessment of current practices.
Nutrient Management	Do a whole farm nutrient budget	Likely water quality benefits will depend on the range of practices used to manage nutrients as a result of nutrient budget recommendations.				$	$$	Farm consultant/advisor should use the latest version of the OVERSEER® Nutrient Budgeting model to create a nutrient budget for the whole farm.
	Keep Olsen P at biological optimum using soil testing	-	L but depends on soil P test			$	$	Avoiding unnecessary applications of P will reduce costs. To minimise runoff, apply P fertiliser when soil moisture is good and no large rainfall events are forecast. Consider use of lower solubility P fertiliser if soil conditions allow.
	Use placement tools e.g. GPS guidance and crop sensing	L	M	-	-	$$$	$$	Delivers more precise nutrient inputs for expected crop yield. Likely to become more widely used as equipment is upgraded over time.
Riparian Management	Fence cattle, cows and deer out of waterways	L	M	H	H	$ - $$$	$$	Lower stock losses in waterways are a key farm benefit. Fencing can sometimes be used to improve subdivision and pasture utilisation.
	Put in culverts or bridges at regular stock crossings	L	M	H	H	$ - $$$	$$$	Cost will depend on whether culvert or bridge is required. Bridges also require resource consent. Improved crossings reduce lameness and reduce stock and vehicle travel time.
	Improve on farm infrastructure to keep stock out of	L	M	M	H	$$ - $$$	$$	These improvements all add capital value to the farm and provide animal health and welfare benefits alongside water quality benefits.

Mitigation	GMP examples	Likely Water Quality Benefit				Potential Impact on Farm Business		Factors to Consider
		N	P	Sediment	Micro-organisms	Cost	Benefit	
	waterways (reticulate stock water, improve stock crossings, plant shade trees away from water)							Important to locate new troughs away from areas of high water flow and high stock traffic e.g. gateways.
	Riparian planting	L M if swampy	L	L	L	$ - $$	$	Effectiveness improves with a grass margin to help filter runoff, especially on steeper slopes. Effectiveness of planting depends on species. Ongoing weed and pest management is an added cost but reduces with time. Can improve bank stability, provide habitat for wildlife and in-stream shade for fish and insects.
	Manage or retire bogs and swampy areas	M	M	M	M	$$	$$	Controlled summer grazing of swampy areas can be useful for keeping weeds down. Keeping stock out of swampy areas and wetlands will reduce stock losses and mustering time. If they are areas with high stock traffic and high water flows, excluding stock will be highly effective in reducing P losses to waterways.
	Where landscapes allow, consider running tile drainage outflows into wetlands prior to entering ditches	M	M	M	M	$	$	Dependent on contour and landscape
	Sediment trap (an engineered structure to slow water flows, reduce energy, filter sediment	L	M	M	L	$ - $$	$ - $$$	Most useful where steady flow of runoff to waterways during wet periods and sediment/P is an issue. Detainment bunds designed to allow ponding for no more than three days to maintain pasture.

Mitigation	GMP examples	Likely Water Quality Benefit				Potential Impact on Farm Business		Factors to Consider
		N	P	Sediment	Micro-organisms	Cost	Benefit	
	and allow grass growth e.g. decanting dam, detainment bunds)							Require water storage of around 120 m^3/ha of draining catchment. Can be costly where not using existing structures. Requires sound engineering design and on-going maintenance.
	Reduce runoff from tracks and races (using cut-offs and shaping)	L	L	L	M	$	$	Cost and effectiveness depends on contour of farm (higher risk of soil loss on steeper land but will also require more work). Requires regular maintenance but can reduce lameness, water damage and long term maintenance costs.
Managing Critical Source Areas (CSAs)	Graze from the top of the slope toward the CSA (such as a stream or gully), or leave a buffer zone to be grazed last	L	M	H	M	$	$	These areas have reduced vegetative cover so are at greater risk of runoff. Graze from top to bottom of paddock contour. Cost and effectiveness depends on contour of farm (higher risk of soil loss on steeper or poorly drained land, but greater benefit).
	Move troughs and gateways away from water flow paths	L	M	M	H	$	$	These areas of concentrated stock use have high nutrient loads and reduced vegetative cover; runoff risk is accordingly greater. Cost and effectiveness depends on contour of farm; benefit greatest on farms with high risk soils (poorly-drained soils and/or sloping topography).
	Avoid working CSAs and their margins	L	M	M	M	$	$	The areal extent of CSAs is often minimal; thus there can be little loss of productive area whilst still achieving good benefits for water quality.
	Leave grassed areas (or native vegetation)	L M if swampy	L	L	L	$ - $$	$	Effectiveness improves with a grass margin to help filter runoff, especially on steeper slopes. Effectiveness of planting depends on species.

Mitigation	GMP examples	Likely Water Quality Benefit				Potential Impact on Farm Business		Factors to Consider
		N	P	Sediment	Micro-organisms	Cost	Benefit	
	around CSA and margins							Ongoing weed and pest management is an added cost but reduces with time.
	Provide deer wallows away from waterways	L	M	H	H	$$	$	May involve use of sediment traps or buffers to filter runoff from wallows before it reaches waterways.
	Use low solubility P fertilizer if applying to CSA	-	L to M (depends on soil type)	-	-	$	$$$	To minimise runoff, apply P fertiliser when soil moisture is good and no large rainfall events are forecasted.
	Reduce soil cultivation by adopting strip tillage or direct drilling.	L	M	M	-	$	$$	Effective for reducing runoff and soil loss, and improving soil quality and infiltration. Soils that have been grazed over the winter may be compacted or pugged, requiring more cultivation or resulting in rough paddocks. Requires modified planter machinery to deliver good seed placement for even plant establishment. Additional expenditure might be required for insect pest control.
Protect soil structure, particularly in gullies and near stream areas	Include grass buffer strips (3 m or more) for cultivated land adjacent to waterways	L	M	M	L	$$	$	Effective for filtering runoff and reducing the risk of fertiliser loss during spreading. More benefit on greater slope but wider buffer required. Grazing of buffers only appropriate for ephemeral waterways during summer dry. May require weed management but can provide habitat for beneficial predatory insects, reducing need for pest control.
	Cultivate along contours (rather than up and down the slope) where slopes greater than 3 degrees	-	H	H	-	$	$$	Slows down runoff and reduces erosion. Row orientation should follow contour. Avoid cropping on steep land.

Mitigation	GMP examples	Likely Water Quality Benefit				Potential Impact on Farm Business		Factors to Consider
		N	P	Sediment	Micro-organisms	Cost	Benefit	
	Increase sheep to cattle ratios to reduce large urine spots (and soil damage)	L - M	M	M	-	$$	$	Effectiveness depends on farm contour. Profitability of change depends on sheep vs beef schedules and capital stock sales required. Altering ratios may increase management challenge for pasture quality, with fewer cattle to manage long rank pasture.
	Plant spaced poplars or other poles on steep country	-	L	M	-	$$	$$	Fast growing poplar or willow poles effective on southern faces or erodible/wet slopes while still allowing grazing. Mixed agroforestry is drought tolerant and provides an alternate feed source.
	Minimise fence line pacing by deer by creating a visual barrier or separating mobs	L	M	H	M	$$ - $$$	$$	Can lower impacts but will not fully prevent damage. Refer to the NZ Deer Farmers' Landcare Manual for more information, available in hard copy from Deer Industry New Zealand.
	Re-sow areas of bare or damaged soil as soon as possible	L	L - H	L - H	-	$	$	Aim to re-establish ground cover as quickly as possible to minimise the window of loss risk
	Match stock management to land use capability, e.g. avoid grazing heavy stock on steeper, more vulnerable soils, especially when wet.	L	M	M	M	$$	$$	Preventative approach where heavy animal classes are run on flatter contour off the hills where possible. Requires information on land use capability (may be a cost). Requires contour fencing for greatest benefit.
Reduce the accumulation of surplus N in the soil, particularly	Reduce number of old cattle (R3s) to reduce large urine spots	M	M	M	-	$	$$	Male stock also distribute urine more widely, so urine patches are less concentrated. Would also lower live weight on farm for wet winter periods, with benefits for soil health and water quality.

Mitigation	GMP examples	Likely Water Quality Benefit				Potential Impact on Farm Business		Factors to Consider
		N	P	Sediment	Micro-organisms	Cost	Benefit	
during autumn and winter	Control the duration of grazing of pasture and forage crops (on-off grazing)	M	L on well-drained soils; M on poorly-drained soils or sloping land	L on well-drained soils; M on poorly-drained soils or sloping land	L on well-drained soils; M on poorly-drained soils or sloping land	$-$$$	$$$	On-off grazing requires a stand-off pad and effluent storage but feed wastage and soil compaction are reduced.
	Plant catch crops to capture N from grazed winter forages (e g oats)	L - M	-	-	-	$	$$	Sequence cropping will only be successful on free-draining soils where machinery can operate soon after winter crop grazing is completed, where there is irrigation or good rainfall from early December onwards, and where kale is well-utilised during winter grazing so the residues do not interfere with sowing of the catch crop
	Time N application to meet crop demand using split applications	L	-	-	-	$	$$	By targeting crop demand better uptake of nutrients by crops and lower losses occur. Split applications are more costly and management intensive
	Reduce N inputs and stocking rate	L - M	-	-	-	$ - $$	$	Can have major impacts on farm profitability, although this depends on level of N input
Reduce P use	Use low solubility P fertilizer forms if runoff risk is high; or fertilize outside risk months (May to September inclusive)	-	L			$	$	To minimise runoff, apply P fertiliser when soil moisture is good and no large rainfall events are forecast.

Mitigation	GMP examples	Likely Water Quality Benefit				Potential Impact on Farm Business		Factors to Consider
		N	P	Sediment	Micro-organisms	Cost	Benefit	
	Plant split grass/clover swards in near-stream areas	-	H	-		$	$$	
	Reduce use of P fertilizer where Olsen P values are above agronomic optimum	-	L but depends on soil P test			$	$	Avoiding unnecessary applications of P will reduce costs. Where practical, avoid fertilising stock camp areas that are located in CSAs – these areas likely have more than adequate fertility due to stock transfers of excretal nutrients.
Stock management to reduce erosion and soil damage	Separate deer mobs to reduce pacing on fencelines	L	M	H	M	$$ - $$$	$$	Can lower impacts but will not fully prevent damage. Refer to the NZ Deer Farmers' Landcare Manual for more information, available in hard copy from Deer Industry New Zealand.
	Rotational grazing	-	M	M	M	$	$	Keeping animals moving onto fresh pasture reduces stress and pacing when wet weather hits. Could also use break fencing to reduce soil damage during wet periods.
	Plant deer fencelines to reduce pacing behaviour	L	M	H	M	$$ - $$$	$$	Can lower impacts but will not fully prevent damage. Refer to the NZ Deer Farmers' Landcare Manual for more information, available in hard copy from Deer Industry New Zealand.
Planting to reduce erosion	Afforestation of steep southern faces (above Land Use Capability 6e)	L	M	M	M	$$ - $$$	$ - $$	Protects areas of greatest erosion risk and replaces low growing slopes with long term productive investment. Best suited to areas with large weed burdens and minimal profitability. Profitability depends on forestry regime and market. Any afforestation plan should include a harvest plan to ensure all land is harvestable.
Capture nutrients sediment and	Protect and enhance natural wetlands by	M on flat land	L	H	M	$ - $$	$$	N removal effectiveness depends on wetland type, paddock slope, how long water stays in the

Mitigation	GMP examples	Likely Water Quality Benefit				Potential Impact on Farm Business		Factors to Consider
		N	P	Sediment	Micro-organisms	Cost	Benefit	
microbes in wetlands and sediment traps	fencing (temporary or permanent) to exclude cattle and deer, and leaving buffers when over-sowing, topdressing and burning - Alpine PZ	L on steeper land						wetland (the longer the better), and stock management (no pugging or erosion). Fenced wetlands reduce stock losses and improve habitat for wildlife and fish. Appropriate planting and weed/pest management can further increase benefits.
	Install sediment traps where relevant (an engineered structure to slow water flows, reduce energy, filter sediment and allow grass growth, e g decanting dam, detainment bunds)	L	M	M	L	$ - $$	$ - $$$	Most useful where there is a steady flow of runoff to waterways during wet periods and sediment/P is an issue. Detainment bunds designed to allow ponding for no more than three days to maintain pasture. Require water storage of around 120 m^3/ha of draining catchment. Can be costly where not using existing structures. Requires sound engineering design and on-going maintenance.
	If constructing a wetland, incorporate appropriate plants (such as red tussock, New Zealand flax, purei (carex secta), raupo, and							

Mitigation	GMP examples	Likely Water Quality Benefit				Potential Impact on Farm Business		Factors to Consider
		N	P	Sediment	Micro-organisms	Cost	Benefit	
	South Island toetoe) and sediment traps; consider locating near seepage zones where relevant							
	Where landscapes allow, run tile drainage outflows into wetlands prior to entering ditches	M	L	M	M	$	$	Dependent on contour and landscape