

Cropping

- Crop rotations adjusted to maximise use of residual N in soil.
- Cultivation practices and timing adjusted to minimise N loss. Manage periods of exposed soil between crops to reduce the risk of erosion, overland flow and leaching.
- Paddock history, plant and deep soil N tests and soil test results and decision support tools assist with efficient fertiliser planning.
- For all cultivation adjacent to a water body leave a vegetative strip to prevent sediment and P runoff into the water.
- Cultivate along contours (rather than up and down the slope) where slopes greater than 3°.
- Use placement tools e.g. GPS guidance, crop sensing, where possible.
- Test the nutrient levels in soils before planting pasture and crops.
- Soil test results and decision support tools like AmaizeN assist with efficient fertiliser planning.

Hot Spots

- Silage stacks are located at least 50m from surface water and any leachate is directed to pasture or the farms effluent system. http://ecan.govt. nz/advice/your-business/farming/Pages/ silage-effluent-wrap-disposal.aspx
- Plastic waste from the farm is recycled.
- Any offal or rubbish pits are sited to minimise risk of leachates entering ground or surface water.

Infrastructure

- Tracks that go through waterways can be a major source of pollution. Putting in bridges or culverts. May help the operation of the farm and the waterway.
- Maintain stock races and direct water running off them away from waterways and into paddocks through the use of cut-offs.
- Putting in troughs will attract stock away from streams.
- Well-heads are protected from contamination.
- The risk of wind damage to buildings and infrastructure is reduced by trimming or removing large trees.

Good Management Practices

Project website: www.landcare.org.nz/Regional-Focus/Christchurch-Office/Opihi-Catchment-Project

WORKING FOR OPIHI WATER

Sediment and Bad Bugs

- Exclude stock from significant waterways, drains and wetlands to prevent livestock damaging banks and defecating in water, that add sediment, nutrients and bacteria and reduce water quality. www.dairynz.co.nz/environment/land-and-nutrient/waterways/
- Reduce erosion and movement of sediment and runoff into waterways by use of conservation tillage and planting critical source areas.
- Retain sediment on the land before it gets to waterways by filter strips and sediment retention ponds. Excessive sediment causes water quality, drainage and flooding problems. www.landcare.org. nz/files/file/177/in-channel-sediment- traps-2002.pdf
- Direct run-off from bridges and races into paddocks and away from waterways.

Biodiversity

- Manage or retire bogs and swampy areas.
- Fencing to protect bush will stop stock damage and also improve farm management by taking out areas that are generally difficult to muster.
- Protecting native bush can help preserve streams and protect water quality. http:// ecan.govt.nz/advice/your-business/ farming/Pages/native-bush-biodiversity. aspx#native-bush
- When grazing and fire are absent and a seed source is nearby, natural regeneration of native plants will succeed gorse and broom so planting may not be needed. http://ecan.govt.nz/publications/General/UsingNativesCanterburyE0472.pdf

Erosion

- The sloping banks of hill country streams are particularly vulnerable to erosion. Stock damage to stream banks and vegetation along the stream margin will increase the risk of erosion. Set permanent fencing far enough back to prevent bank erosion and to allow for changing stream meanders. http://ecan.govt.nz/publications/General/HillCountryStreams.pdf
- Plant trees on greatest erosion risk slopes. Consider long-term productive tree species for areas with large weed burdens and minimal profitability.
- Cultivation practices and timing is adjusted to minimise soil erosion (wind & water).

NZ LANDCARE TRUST

Ministry for Primary Industries Manatū Ahu Matua

Sustainable Farming Fund

Rabobank

DEER INDUSTRY NEW ZEALAND





Irrigation

- Design, calibrate and operate irrigation systems to minimise the amount of water needed to meet production objectives. http://irrigationnz.co.nz/news-resources/irrigation-resources/
- Tests show that system performs to desired specifications for: Application depth; and Application Uniformity using bucket test or commissioning test).
- Soil moisture is regularly assessed using: buried sensors or tapes or hand held probe or scheduling service.
- Prevent border dyke irrigation outwash getting to waterways by recycling / irrigation management.
- Return period and/or application depth adjusted according to ET, soil moisture, crop requirements and rainfall. http://irrigationnz. co.nz/wp-content/uploads/34448-Smart-Info- Flyer.pdf
- Daily checks for excessive runoff/ponding and irrigator problems and issues fixed. http://irrigationnz.co.nz/wp-content/uploads/ Operation-and-Maintenance-Manual.pdf

Nitrogen

- N application rates and timing set to match growth cycle of crop and soil moisture conditions, taking into account all sources of nutrients are applied.
- Nitrogen is not applied when soils are below 6oC, are at field capacity or are severely compacted.
- Equipment used for N application is suitably calibrated and Spreadmark standards are used.
- GPS is used for precise application and recording (proof of placement).
- Urine N leaching can be reduced through appropriate paddock selection, grazing time and grazing regime.
- Fertiliser N leaching can be reduced through the use of crop calculators to gauge need, precision application to ensure appropriate application and timing.
- Mineral N leaching can be reduced through the use of minimum tillage.
- www.dairynz.co.nz/media/1237817/reducing-nitrogen-loss.pdf

Phosphate

- Keep Olsen P at agronomic optimum, usually 20-30, using soil testing.
- Equipment used for P application is suitably calibrated and well maintained.
- P application separation distances from waterways are maintained. Use riparian planting as a buffer between paddocks, races and the water. The plants act as a filter, slowing down runoff and catching sediment and P.
- Superphosphate is not applied when soils are near field capacity (through soil moisture monitoring or hole digging?) or if rain forecast within next 7 days.
- Use of slow release RPR reduces P runoff.
- Avoid set stocking wet paddocks and use restricted grazing of forage crops in wet conditions. www.landcare. org.nz/files/file/1250/Rich%20McDowell%20 ECan%20P%20 losses%20Feb%202014.pdf
- Store and load fertiliser to minimise risk of spillage, leaching and loss into water. bodies.

Winter Intensive Grazing

- If possible select paddocks with lower risk of pugging and compaction, do not have significant mole and tile drains, drains or waterways to plant winter feed crops. www.dairynz.co.nz/farm/
- For intensive winter grazing leave a vegetative strip not grazed from edge of drain, stream, river, or lake to capture P and sediment runoff.
- Graze from top to bottom of paddock if sloping. Graze lower lying areas and areas closest to waterways last. Avoid leaving stock on during wet periods, for long periods, or concentrated on small sections of the crop. www.dairynz.co.nz/farm/farm-systems/southern-wintering-systems/wintering-system-review/
- As soon as possible replant grazed area in a crop/pasture that will use up the residual N in soil.

Riparian Management

- Riparian margins are of sufficient width to adequately filter sediment from any run-off.
- To avoid losing plants in floods, determine how your waterway behaves in full flow. This will help you decide where to place fences and what to plant. www.dairynz. co.nz/environment/land-and-nutrient/ waterways/
- Identify areas on your farm where runoff or erosion occur most frequently and have the greatest effect on water quality. This includes seeps, springs, swales, gullies, eroding banks, boggy areas and wet soils. These should be prioritized for fencing and planting.
- Environment Canterbury land management advisors can help develop riparian plans tailored to your farm. It is free, call 0800 324 636.

Effluent

- Effluent is spread evenly across the area ensuring it does not exceed 200 kg/ha/yr. Nutrient level of effluent is tested and paddocks are recorded. www.dairynz.co.nz/ environment/effluent/tools/
- The effluent system is tested regularly to ensure it is applying effluent in a uniform manner with a measured depth (bucket test) and there is no ponding or run off.
- Sufficient storage is available to enable effluent and waste water to be stored when soils are saturated.
- The system is well maintained and monitored. Staff are trained and immediate action, (fix, clean-up & future proof) is taken. www.dairynz.co.nz/media/195210/4A-Farmers-Guide-To-Managing-Farm-Dairy-Effluent.pdf
- Effluent spread over a suitable area to maximise the use of effluent nutrients.
- Effluent storage systems are compliant with regional and district plan rules.



Environment

Protecting waterways from wallow and feed pad run-off

Pride and now regulation

In June 2004, deer farming was the first pastoral farming industry to produce a Landcare Manual – an initiative that reflects the great pride most deer farmers take in the management of their farm environment. This Manual was fully updated in 2012.

Today, pride and good intent are not enough. Regional councils are under increasing pressure from the general public to clean-up waterways and are demanding that farmers reduce discharges of phosphorous (P), nitrogen (N), bacteria and sediment. Also in 2016 the government announced it was setting deadlines for farmers to exclude livestock from waterways.

Each council has its own way of dealing with the water quality challenge. It is important for deer farmers to look out for proposed rule changes that might apply to their farms. Deer farmer submissions may be needed to ensure that rules drawn up by officials are affordable and appropriate for deer farms.

Run-off from wallows and feed pads are the biggest threats posed by deer to water quality. Fortunately there are proven strategies to deal with them.

By diverting wallow run-off away from flowing streams, water quality will be protected, while still allowing deer to behave naturally.

Feed pads are highly efficient and practical options for feeding deer, but should be built so that effluent run-off is contained and filtered.

WALLOWS

Wallowing (lying and rolling in a hollow dip filled with water or mud) is a natural behaviour. Deer urine and faeces accumulate in wallows and deer stir up the soil as they wallow.

The run-off from wallows is typically high in bacteria and P-laden sediment. Water quality can be greatly reduced if this flows directly into streams.

For this reason 'connected wallows' are known as 'Critical Source Areas' (CSAs). CSAs are monitored by regional councils when assessing farms to see if they comply with water quality regulations.

Photo: Richard Hilson

Wallowing is natural, but its worst effects can be minimised through good practice.

KEY POINTS

- Good water quality is essential for aquatic life, human and animal health and water-based recreation.
- Aim to maintain or improve the quality of water leaving your farm.
- The main risk to water quality posed by deer is the run-off of sediment carrying phosphorous and bacteria.
- To reduce levels of phosphorous, nitrogen, bacteria and sediment entering waterways, break the connection between wallows and feed pads, and streams.
- Don't build feed pads or silage stacks in main water catchment areas, such as gullies.
- Manage run-off into sediment traps and/or constructed wetlands. Retain silage leachate until it can be spread back on pasture.
- Run-off control systems should be big enough to hold and slowly release the water generated during normal rainfall.

It's seasonal

Wallows are used by both sexes at all times of the year, but stags wallow more intensively in the rut. Hinds and stags also wallow during the spring coat moult.

Breed

English and European red deer will readily wallow. Wapiti/elk and their crossbred progeny and eastern reds wallow less frequently. Fallow deer do not wallow at all.

Best practice wallows

The best practice options are to:

- Fence off or fill in wallows that are connected to waterways
- Divert wallow run-off into a fenced run-off treatment area, made up of sediment ponds and constructed wetlands, so the run-off is filtered before it enters a waterway
- Create wallows in safe locations.

Preventing deer wallowing can be difficult as deer may create a new wallow nearby when an existing one is filled in. For this reason the ideal is to create a wallow in each paddock. The drainage from the wallow should be self-contained or flow to a fenced sediment pond/wetland to filter out sediment and nutrients.

Poorly located wallows can then be filled-in with gravel, broken concrete or rocks and overfilled with soil. Place branches over the top to deter deer. Be aware that rough concrete edges may split deer feet.

Reduce the risk

- Identify natural springs and wallows before cultivating paddocks and pipe or drain them into treatment areas
- Avoid grazing high-risk areas when deer wallow the most (spring for hinds and autumn for stags)
- Provide shade and shelter in summer to keep deer cool.

Prevent wallows developing around troughs

Deer like to play in water, so leaks and splashes at troughs can quickly become major wallow holes. To reduce the chance of this happening, cover trough mechanics, leaving just a small area for drinking. Fix water leaks promptly.

Use several smaller troughs to discourage deer wading. Locate troughs under fence lines to prevent immersion and/or on a rocky raised area, to improve drainage.

Prevent deer from turning waterways into wallows

On intensive farms, deer should be fenced out of streams, ponds and lakes to prevent them from breaking down banks, stirring up sediment and directly contaminating the water with faeces. The long grass and planted vegetation that grows in fenced-off vegetation strips ('riparian strips') along waterways also help create a better environment for aquatic life.

Riparian strips help reduce the run-off of phosphate-rich sediment from pastures and crops, but on free-draining soils they do little to reduce N-loss because most N is lost to ground water.

The optimum width of these strips will vary with the slope and the soil type, and it is hoped that monitoring of environmental protection measures at Invermay and elsewhere will help provide farmers with some more specific guidelines.

In 2016 the government drew up regulations excluding cattle, deer and pigs from waterways. Deadlines for excluding deer from waterways had not been confirmed when this *Deer Fact* went to press. Check the Deer Hub, www.deernz.org, for details.

Photo: Tony Pearse

This riparian run-off management strip on Grant and Andrea Cochrane's Otago deer farm was established in a Sustainable Farming Fund supported Focussed Farm project in 2008. It is now mature and working effectively

CASE STUDIES

Practical measures are underway to improve water quality at AgResearch Invermay deer research farm as part of a 5-year plan to mitigate the farm's damaged waterways. The outcomes of the improvements are being monitored as part of a Deer Industry Focus Farm initiative and will be used as a case study for other deer farmers.

Research at Invermay in 2009 showed that fencing off and planting an old wallow – and creating a new wallow that did not flow into a stream – reduced stream P levels by 90% and significantly reduced bacteria and sediment levels. However it did not significantly reduce N levels as deer were still passing N via urine across the whole paddock.

Andrew & Rachel Mitchell's commitment to preventing run-off from their Ngakuru, Rotorua, deer farm from entering sensitive waterways won much praise. This 2005 initiative involved fencing off and constructing a series of ponds to capture sediment and nutrients in a gully running through the farm where deer formerly wallowed.

The 1.7 kilometre gully carries water from two springs. The 3.5 hectares of retired grazing land now includes 1.25 hectares of water in a cascade of 10 dams. The wet areas are a mix of open water and wetland with native and exotic plantings. The dams are connected by 315 mm pipes with fluming to minimise the impact on the sensitive pumice soils.

Above: Rodway Park in 2005, before the Mitchells put in a run-off management system

Right: Andrew Mitchell shows visitors around the new run-off management system in 2007

RUN-OFF TREATMENT SYSTEMS

Every farm and every situation is different, so each run-off treatment system will be different. It will be influenced by the area of the catchment, the soil type, the slope, the area available and the size of major rainfall events.

Consult your regional council about consent requirements and learn from local farmers about what has worked for them.

Build two or more run-off treatment ponds if the situation is suitable. The first one or two should be sediment-catchers that can be easily cleaned, while the final 'pond' should be more of a wetland. All should be fenced to prevent entry by stock.

Where possible, the run-in to the first pond should have a gentle gradient and be planted in pasture grasses and/or sedges to slow the water flow and prevent gully erosion. This will also help with filtering runoff.

In the first pond, plant mainly grasses in areas where you will be bringing in heavy equipment to remove sediment. Plant grasses or sedges to stabilise the banks. In the wetland area, plant flax, toe toe and sedges to help remove nutrients and to further filter sediment. Wetlands also enhance biodiversity on your farm.

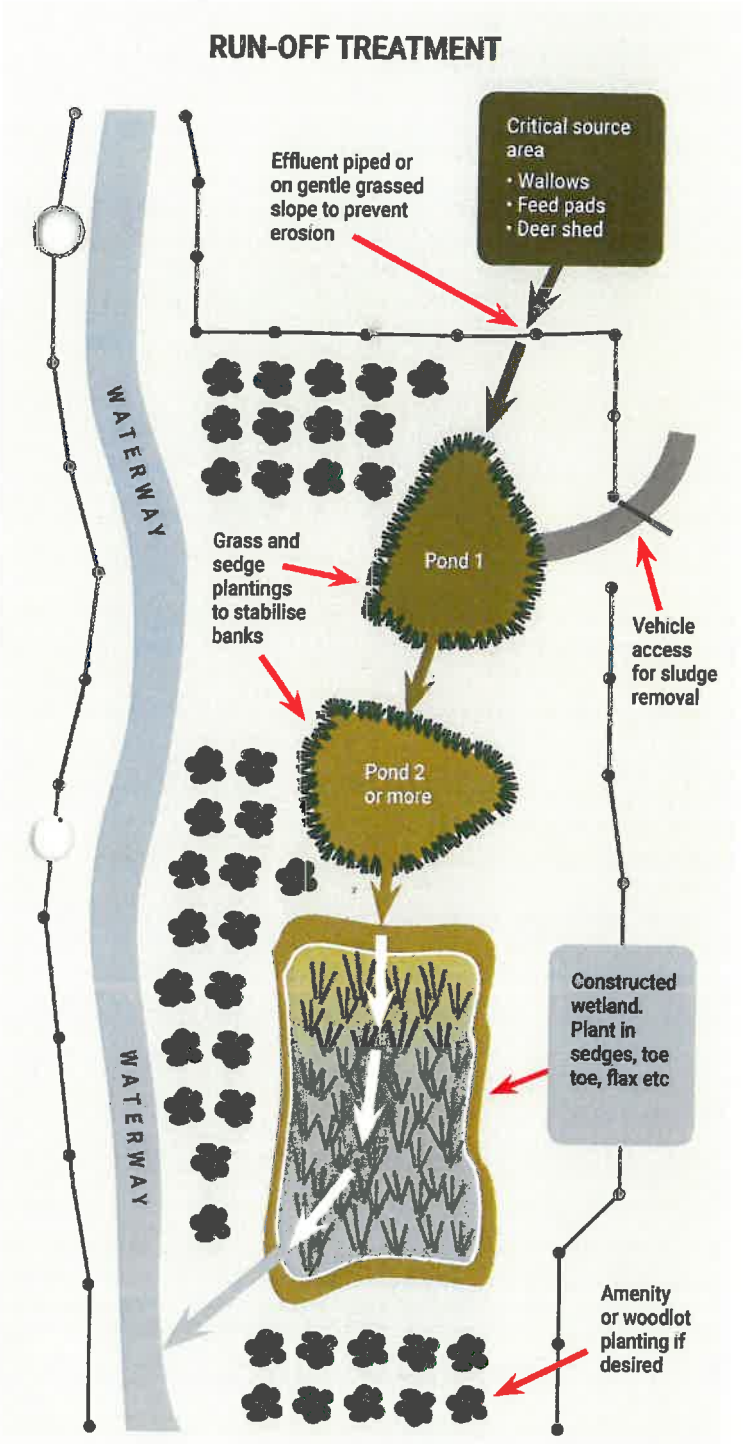
To allow muddy water to settle, sediment ponds need to have a storage to catchment ratio of not less than 100:1, i.e. 100 cubic metres of temporary pond storage for each hectare of contributing catchment.

Clean your sediment ponds out regularly and check them after every storm. If they are allowed to become too shallow, the sediment gets stirred up by ducks and storm flows, ending up back in the waterway.

Spread the sediment from the pond on drier, non-draining paddocks. The high P content of the sediment will help boost soil fertility.

Constructed wetlands – especially if they are vegetated – help remove N. The bigger the wetland the higher the removal of nutrients and bacteria. Wetlands process N more slowly in high rainfall and the cold.

For more information see NIWA's *Constructed Wetland Treatment of Tile Drainage* and the NZ Landcare Trust's *Sediment Traps Fact Sheet* (links below).



Many farms will need run-off treatment systems (sometimes called sediment traps) to meet regional council water quality standards

FEED PAD EFFLUENT

Feed pads allow deer easy access to feed either via a self-feeding silage pit or storage feeders. They reduce the need to move feed, reduce feed wastage and enable deer to be kept off sensitive soils over winter.

Giving deer a firm base of compacted soil or concrete to stand on while feeding helps prevent the hoof health issues associated with standing on muddy wet ground.

But when deer gather to feed they generate effluent that is high in N and bacteria. In addition, leachate from silage stacks is high in N and ammonia – about 200 times stronger than raw sewage. These effluents must be captured before they acidify and de-oxygenate waterways.

Best practice feed pads and self-feed silage stacks

- Site feed pads and silage stacks away from active waterways, farm boundaries, deep wells, tile drainage systems and areas with a high water table
- Produce silage to a good quality (30% dry matter or more) where possible and keep it protected from the weather and rainwater run-off. This will minimise moisture content, spoilage and leaching
- Regardless of the quality of your silage, make sure you have facilities for storing or containing the likely volume of leachate. This may be a tank or sump, or – where the subsoil is compacted clay – a blind ditch or a containment bund. Storage of at least 3 m^3/100 tonnes of grass ensiled is suggested
- To minimise the volume of leachate that needs to be stored and managed, design self-feed silage areas to minimise the mixing of leachate with effluent and rain run-off from the feeding pad
- Check your regional council rules relating to the location, design and management of silage stacks

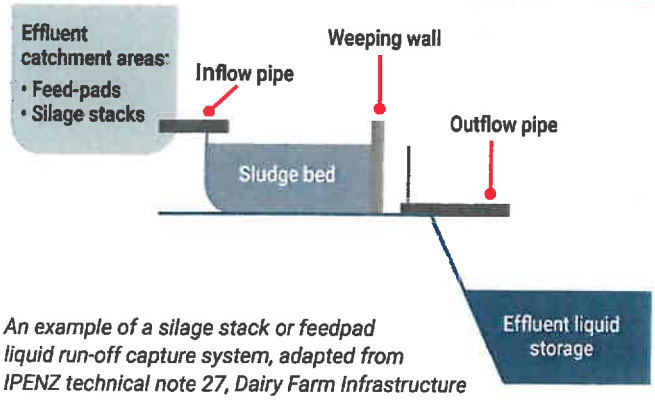
- On the Dairy NZ website there is excellent information about silage stack and feed pad construction and effluent management, much of which applies to deer farms.

Disposing of silage leachate

Silage leachate is highly toxic and corrosive. Do not allow it to enter normal drainage systems, oxidation ponds, wetlands, waterways or ground water. However, with dilution, it can be a useful fertiliser

Spray irrigate or spread leachate onto pasture after diluting it 1:10 with water at a rate of 25 m^3/ha. This mixture can provide 25-75 kg/ha of N, 25 kg/ha of P and 100 kg/ha of potassium.

Irrigation of undiluted effluent is possible at 10 m^3/ha, but may cause scorching of pasture, especially during hot weather



An example of a silage stack or feedpad liquid run-off capture system, adapted from IPENZ technical note 27, Dairy Farm Infrastructure

THE WORK CONTINUES

DINZ and the NZDFA developed pastoral farming's first Landcare Manual. More recently they have been involved in a MPI Sustainable Farming Fund project in the Opihi catchment in South Canterbury that produced a *Sediment Traps Fact Sheet*.

They were also represented on the committee that devised ECAN's *Industry-agreed Good Management Practices Relating to Water Quality*. (See links below.) They have also been part of the Sustainable Farming Fund project from 2013-16 on *Increasing Adoption of Environmental Best Practice on Deer Farms*, managed by the NZ Landcare Trust.

Since 2016, the South Canterbury North Otago NZDFA has been running a focus farm with a strong environmental management focus at Raincliff Station. DEEResearch is also involved in the environmental focus farm project at AgResearch Invermay.

The objective of these initiatives is to find effective and affordable ways for deer farmers to reduce their environmental footprint. In addition an environmental policy manager has been appointed by DINZ to assist deer farmers with their submissions to reviews of regional council water quality plans.

CASE STUDY

Brian and Jacqui Wellington, Te Awamutu Station

The hinds on Brian and Jacqui Wellington's Te Awamutu Station are wintered in a gully planted in radiata pine. Self-fed silage stacks at the top of the gully provide efficient winter feeding for 1000 hinds.

At the foot of the gully and in the creek exiting the pines are a series of ponds that effectively capture sediment. The set-up helped the Wellingtons win the Elworthy Environmental Award in 2012.

Photo: Tony Pearse

Two of the settling ponds on Te Awamutu Station. There are more ponds upstream in a pine plantation where 1000 hinds are over-wintered on self-fed silage

More >>

NZ Deer Farmers' Landcare Manual, www.deernz.org/Landcare

Best Environmental Practice on Canterbury Deer Farms – 5 videos, NZ Landcare Trust, bit.ly/DEER_ENV_VIDEOS

Constructed Wetland Treatment of Tile Drainage, bit.ly/NIWA_wetland

Environmentally Friendly Silage Management, Environment Southland, bit.ly/LEACHATE

Industry-agreed Good Management Practices relating to water quality, ECAN, bit.ly/GMP_water

Land and Environment Planning Toolkit, www.beeflambnz.com/lep

Sediment Traps Fact Sheet, NZ Landcare Trust, bit.ly/SedimentTrap

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