Consents Hearing
4 September 2018

White Waters Limited – App 20181247

Appendices Part II

WATER AND LAND 2020 & BEYOND

General Good Management Practices

The following good management practices are applicable on all physiographic zones.

Depending on the physiographic zones and variants (if applicable) which your farm is in, there may be key transport pathways and contaminants that you need to include good management practices for in your farm management plan.

The table below shows which key transport pathways are applicable in each physiographic zone to help you work out which of the other GMP factsheets are relevant to your property.

Please note

You can search for your property and view the physiographic zones map on http://gis.es.govt.nz

Physiographic zone	Key transport pathways (✓)		
	Overland flow[1]	Deep drainage (leaching to groundwater)[2]	Artificial Drainage[1]
Alpine	✓		
Bedrock/Hill Country	✓(o)		✓(a)
Central Plains		✓	✓
Gleyed	✓(o)		✓
Lignite-Marine Terraces	✓(o)		✓(a)
Old Mataura		✓	
Oxidising	✓(o)	✓	✓(a)
Peat Wetlands		✓*	✓
Riverine	✓(o)	✓	

NOTE:

[1] *Overland flow and artificial drainage transport nitrogen, phosphorus, microbes and sediment*

[2] *Deep drainage transports nitrogen, except in Peat Wetlands, see * below*

* *Deep drainage transports phosphorus rather than nitrogen, and lateral drainage of phosphorus and microbes through the soil is also a key pathway in the Peat Wetlands (mitigations are the same as for deep drainage)*

✓**(o)** *denotes that overland flow is only a key transport pathway in the parts of the steeper parts of the physiographic zone, referred to as the (o), or overland flow variant (refer to physiographic zones map)*

✓**(a)** *denotes that artificial drainage is only a key transport pathway in parts of the physiographic zone where there is artificial drainage, referred to as the (a), or artificial drainage variant (refer to physiographic zones map)*

Some example good management practices which could be included in your Farm Environmental Management Plan include[1]:

Mitigation	Example	✓
Capture nutrients sediment and microbes in wetlands and sediment traps	Protect and enhance natural wetlands by fencing (temporary or permanent) to exclude cattle and deer, and leaving buffers when over sowing, topdressing and burning - Alpine physiographic zone	
	Seek advice from Environment Southland land sustainability team to identify wetlands	
	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)	
	If constructing a wetland, incorporate appropriate plants (such as red tussock, New Zealand flax, purei (carex secta), raupo, and South Island toetoe) and sediment traps, consider locating near seepage zones where relevant	
Nutrient management	Prepare a nutrient budget (required by Appendix N)	
	Keep soil Olsen P levels at biological optimum; soil test regularly to check	
	Use proof of placement for fertiliser and/or farm dairy effluent application	
Riparian management	Fence stock out of waterways	
	Put in culverts or bridges at regular stock crossings	
	Improve on-farm infrastructure to keep stock out of waterways (reticulate stock water, improve stock crossings, plant shade trees away from water)	
	Undertake riparian planting	
Effluent management	Increase land application area to ensure N and K returns are not excessive	
	Increase storage volume, where needed	
	Minimise effluent volumes at source (by reducing wash water volumes and rainwater in the system)	
	Use low rate effluent application methods where required - this is soil and landscape dependent	

[1]Regardless of the good management practices chosen, the entire farm environmental management plan must be prepared in accordance with Appendix N. On-farm actions must comply with all relevant rules in the Southland Water and Land Plan 2016, and any relevant resource consent conditions.

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May 2016

WATER AND LAND 2020 & BEYOND

Overland flow

Overland flow is a key transport pathway for contaminants in the Alpine physiographic zone.

In some physiographic zones, overland flow is a key transport pathway, but only in part of the physiographic zone. The part of the physiographic zone where overland flow is a key transport pathway is referred to as the overland flow variant, or (o). The physiographic zones with an (o) variant are:

- Bedrock/Hill Country
- Gleyed
- Lignite/Marine Terraces
- Oxidising
- Peat Wetlands
- Riverine

Please note

The factsheet on General Good Management Practices is applicable everywhere, and should be referred to in conjunction with this factsheet. There may also be other key transport pathways and associated good management practices which are relevant to your property, depending on which physiographic zones and variants are present.

You can search for your property and view the physiographic zones map on http://gis.es.govt.nz

Some example good management practices for overland flow which could be included in your Farm Environmental Management Plan include[1]:

Mitigation	Example GMPs	✓
Protect soil structure, particularly in gullies and near stream areas	Minimise fence line pacing by deer by creating a visual barrier or separating mobs	
	Use minimum or no-till cultivation practices such as direct drilling	
	Re-sow areas of bare or damaged soil as soon as possible	
	Match stock management to land use capability, e.g. avoid grazing heavy stock on steeper, more vulnerable soils, especially when wet	
	Plant spaced poplars or other poles on steep country	
	Cultivate along contours on sloping ground	
Manage critical source areas (CSA)	Restrict grazing of crop and pasture CSAs when soils are near saturation	
	Avoid working critical source areas and their margins	
	Leave grassed areas (or native vegetation) around critical source areas and margins	
	Plant riparian margins	
	Provide deer wallows away from waterways	
	Move troughs and gateways away from water flow paths	
	Reduce runoff from tracks and races (using cut offs and shaping)	
	Graze from the top of the slope toward the critical source area (such as a stream or gully), or leave a buffer zone to be grazed last	
	Use low solubility P fertiliser if applying to critical source areas	
	Seek advice from Environment Southland Land Sustainability Team to identify critical source areas	
Reduce P use or loss	Reduce use of P fertiliser where Olsen P values are above agronomic optimum	
	Use low solubility P fertiliser forms if runoff risk is high; or fertilise outside risk months (May to September inclusive)	
	Plant split grass/clover swards in near-stream areas	

[1]Regardless of the good management practices chosen, the entire farm environmental management plan must be prepared in accordance with Appendix N. On-farm actions must comply with all relevant rules in the Southland Water and Land Plan 2016, and any relevant resource consent conditions.

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Artificial subsurface drainage

Artificial subsurface drainage (e.g. mole pipe or tile drains) is a key transport pathway for contaminants in the following physiographic zones:

- Central Plains
- Gleyed
- Peat Wetlands

Artificial subsurface drainage is also a key transport pathway in other physiographic zones but only in parts of those zones. These parts are referred to as the artificial drainage variant, or (a). The physiographic zones with an (a) variant are:

- Bedrock/Hill Country
- Lignite/Marine Terraces
- Oxidising

Please note

The factsheet on General Good Management Practices is applicable everywhere, and should be referred to in conjunction with this factsheet. There may also be other key transport pathways and associated good management practices which are relevant to your property, depending on which physiographic zones and variants are present.

You can search for your property and view the physiographic zones map on http://gis.es.govt.nz

Some example good management practices for artificial subsurface drainage which could be included in your Farm Environmental Management Plan include[1]:

Mitigation	Examples	✓
Protect soil structure, particularly in gullies and near stream areas	Minimise fence line pacing by deer by creating a visual barrier	
	Use minimum or no-till cultivation practices such as direct drilling	
	Re-sow areas of bare or damaged soil as soon as possible	
	Match stock management to land use capability, e.g. avoid grazing heavy stock on steeper, more vulnerable soils, especially when wet	
Reduce P use or loss	Reduce use of P fertiliser where Olsen P values are above agronomic optimum	
	Use low solubility P fertiliser forms if runoff risk is high; or fertilise outside risk months (May to September inclusive)	
	Plant split grass/clover swards in near-stream areas	
Reduce the accumulation of surplus N in the soil, particularly during autumn and winter	Reduce inputs of N, such as fertiliser or nitrogen contained in imported feed	
	Control the duration of grazing of pasture and forage crops (on-off grazing)	
	Winter stock off-paddock	
	Plant catch crops to capture N from grazed winter forages (e g barley and triticale)	
	Optimise timing and amounts of irrigation input	
	Substitute autumn diets with low-N feed (such as whole crop silage)	
	Time N application to meet crop demand using split applications	
	Re-sow areas of bare or damaged soil as soon as possible	
	Reduce stocking rate	
Avoid preferential flow of effluent through drains	Defer effluent application when soil conditions unsuitable	
	Avoid placing effluent applicators directly over tile drains	
	Apply effluent at low rates and depths	
Capture contaminants at drainage outflows	Where landscapes allow, run tile drainage outflows into wetlands or sediment traps prior to entering ditches	

[1]Regardless of the good management practices chosen, the entire farm environmental management plan must be prepared in accordance with Appendix N. On-farm actions must comply with all relevant rules in the Southland Water and Land Plan 2016, and any relevant resource consent conditions.

WATER AND LAND 2020 & BEYOND

Lateral and deep drainage of phosphorus and microbes

Lateral drainage and deep drainage through the soil are key transport pathways for phosphorus and microbes in the Peat Wetlands physiographic zone.

Please note

The factsheet on General Good Management Practices is applicable everywhere, and should be referred to in conjunction with this factsheet. There may also be other key transport pathways and associated good management practices which are relevant to your property, depending on which physiographic zones and variants are present.

You can search for your property and view the physiographic zones map on http://gis.es.govt.nz

Some example good management practices for lateral and deep drainage of phosphorus and microbes which could be included in your Farm Environmental Management Plan include[1]:

Mitigation	Example GMPs	✓
Reduce P use or loss	Reduce use of P fertiliser where Olsen P values are above agronomic optimum	
	Use low solubility P fertiliser forms if runoff risk is high; or fertilise outside risk months (May to September inclusive)	
	Plant split grass/clover swards in near-stream areas	
Reduce transport of microbes	Defer effluent application when soil conditions unsuitable	
	Apply effluent at low rates and depths	

[1]Regardless of the good management practices chosen, the entire farm environmental management plan must be prepared in accordance with Appendix N. On-farm actions must comply with all relevant rules in the Southland Water and Land Plan 2016, and any relevant resource consent conditions.

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Nutrient Management

Environment Southland is promoting the use of a nutrient budget as good management practice to ensure farmers gain a greater awareness and understanding of nutrient management for their farm.

While having a nutrient management plan or nutrient budget alone won't improve water quality, the information in the budget will help you make practical decisions that could minimise nutrient losses from your farming system.

Knowing about nutrient budgets will put farmers in a good position to be involved in community discussions around setting and meeting catchment limits. Environment Southland is required to go through this process to fulfil the objectives in the National Policy Statement for Freshwater.

Under the proposed Southland Water and Land Plan most farmers are now required to have a nutrient budget as part of your overall farm environment management plan. Check the proposed plan for key dates by which you must have a farm plan.

Nutrient budget

Nutrient budgets provide an estimate of all the nutrient inputs and outputs sourced from fertiliser, dairy effluent and feed supplements for a block of land. The calculated outputs of Nitrogen (P) & Phosphorus (P) can be used to predict the amount of N leaching below the root zone and the P runoff risk, which can be used to assess the potential for impacts on nearby rivers and streams. Nutrient budgets are a management tool for ensuring that nutrients leaving the farm are replaced and that excessive amounts of N & P are not being lost to potentially contaminate ground and surface water.

OVERSEER® Nutrient Budget

OVERSEER® is a software programme that estimates nutrient flows through tall parts of a farm. It provides estimates for off-farm losses of nutrients including nutrient leaching and run-off, phosphorus run-off, risk index, and greenhouse gas emissions.

The programme requires a wide range of information, including soil type and slope, soil tests, fertiliser history, paddock use and supplementary feed. Don't be put off as you and your fertiliser representative or farm consultant probably have most of this information.

The outputs provided will be based on your current farming system, and should be considered on an annual basis (or longer if there are no changes to your farming system). While the information will be useful to you for farm planning, the quality of outputs is reliant on spending some time entering the correct data.

For more information contact your nutrient management advisor.

Understanding phosphorus (P)

Phosphorus is a nutrient that can encourage the growth of nuisance aquatic plants. These plants can choke up waterways and out-compete native species. Ideally, total phosphorus levels in water should be less than 0.04 grams per cubic metre to prevent excessive growth of nuisance plants.

Phosphorus holds strongly to soil particles. The major source of phosphorus loss from farms is with sediment as it moves with water in overland flow and tile drains.

Understanding nitrogen (N)

Nitrogen is a nutrient that can encourage the growth of nuisance aquatic plants. These plants can choke up waterways and out-compete native species. Nitrogen is not held long in the soil. Nitrogen not utilised by plants leaches below the root zone and is lost to the environment. Excessive nitrogen in water can cause sudden growth in algal blooms followed by large die offs where dead plant material blocks water channels or creates an anaerobic smothering layer.

What is a Nutrient Management Plan?

Nutrient management plans are like financial budgets. They're useful tools to plan ahead and keep track of what's coming in and going out on an individual farm. Taking time to understand nutrient cycling for your farming system will make it easier to achieve sustainability over the long term, both in terms of economic and environmental goals.

Nutrient management plans combine all the tools that science has produced to allow the trained nutrient management farm advisors to develop fertiliser recommendations, which maximise the productivity of individual farms while minimising or mitigating the environmental impacts of nitrogen and phosphorus loss to surface and groundwater.

Benefits of a Nutrient Management Plan

- Cost savings when fertiliser type and application method is optimised for uptake
- Reduction of nutrient losses and environmental effects with the uptake of suggested mitigation strategies
- Monitoring of changes for continual improvement such as fertiliser performance and benefits of mitigation practices

Where to go for assistance

It is recommended an experienced and accredited nutrient management adviser, or accredited consultant with a good understanding of nutrient management tools and farming systems, is engaged to help formulate a nutrient management plan for your farm.

For further information on nutrient management:

- Your fertiliser company (i.e., Ballance®, Ravensdown)
- Fertiliser Association of New Zealand (www.fertiliser.org.nz)
- New Zealand Fertiliser Quality Council (www.fertqual.co.nz)
- The Fertiliser and Lime Research Centre (www.massey.ac.nz)
- DairyNZ or Beef+LambNZ
- Farm consultants
- Foundation for Arable Research
- Horticulture NZ (HortNZ)
- OVERSEER® (www.overseer.org.nz)

Credits: Fertiliser Use on New Zealand Dairy Farms – www.fertiliser.org.nz

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Factsheet

Existing effluent storage

There are new rules in the proposed Southland Water and Land Plan that cover the ongoing use and maintenance of existing effluent storage or treatment facilities (such as a weeping wall/sludge bed).

In most cases, you may be able to continue to use your existing effluent storage without consent. This is if the effects are the same or similar in character, intensity and scale, and you were carrying out this activity before the notification of the plan (4 April 2018)[1]. If you do not meet the permitted activity criteria then you will need to lodge a consent application with us within six months of the plan being made operative (all appeals resolved).

In general, to be permitted and to carry on using your existing effluent storage without needing consent you will need to provide Council (on request):

- For above ground structures, or those that are synthetically lined, or concrete that have a leak detection system that is checked monthly and is not leaking:
  - certification from a suitably qualified person within the last ten years, that the pond meets the drop test criteria in Appendix P; or
- For all clay lined ponds or all other structures without a leak detection system:
  - certification from a suitably qualified person from the last three years that the structure has no cracks, holes or defects that would allow effluent to leak and that it meets the drop test criteria in Appendix P.

Take a look at the flow chart to see if you require a resource consent for the use and maintenance of your effluent storage facility. If you're still not sure, give our consents team a call.

[1] *Section 20A of the RMA may apply, giving you a limited time for existing use rights. Please see our advice on s20A or contact our consents team.*

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Consent applications

The information that you'll need to supply in an application will depend on the type of agricultural effluent storage facility (or facilities) you have on your farm.

Ponds

If your pond is not a permitted activity as shown on the flowchart, you will need to apply for consent. Your application needs to include:

- Photos of the pond
- A description of the pond including its age, dimensions, plans, lining material and comments on its condition
- A description of why the pond requires consent
- An assessment of effects that includes: a discussion of risks to water quality (including groundwater quality); the potential for collapse or leaking, and distance to nearest waterways/ abstraction points
- An assessment against policies in the proposed Southland Water and Land Plan, including Policy 17(2) which is specific to effluent systems.

Tanks and bladders

Existing tanks and bladders generally do not have leak detection systems installed and are not able to be drop tested. This means that you will probably need to apply for a consent to carry on using these types of facilities. Your application will need to include:

- Photos of the tank or bladder
- A description of the tank or bladder tank including its age, dimensions, relevant documentation (which may include warranty, original plans, building consent, or producer statement) lining, and comments on its condition.
- The assessment of effects will need to discuss risks to water quality, including the potential for collapse or leaking, and distance to nearest waterways/ abstraction points.

Weeping walls

Existing weeping walls or sludge beds generally do not have leak detection systems installed and are not able to be drop tested. This means that you will probably need to apply for consent to carry on using these types of effluent treatment systems. Your application will need to include:

- Photos of the weeping wall
- A description of the weeping wall including its age, dimensions, plans, lining material, and comments on its condition.
- An assessment of effects that addresses risks to water quality, the potential for collapse or leaking and distance to nearest waterways/ abstraction points.

Common questions and answers

Q: What are the requirements for a leak detection system?

A: A leak detection system is used to see if your pond is leaking with the use of a viewing port or an outlet pipe. IPENZ Practice Note 21 has more information about types of leak detection systems (will have link). Normal operating parameters require that no leakage is allowed.

Q: Why are we concerned about the ongoing use and maintenance of effluent storage facilities?

A: The integrity of effluent storage can degrade over time and with improper management. As these facilitates hold large volumes of effluent and their failure is a risk to water quality it is important that their use and maintenance is managed.

Q: What methodology should be used to test my effluent pond?

A: The Council requires that the pond drop test is completed according to Appendix P of the proposed Southland Water and Land Plan. Requirements for the test include:

- The pond must be at least 75% full;
- The pond must have been de-sludged within the 12 months prior to the test; and
- There must be no sludge or crust on the surface of the pond.

Q: What is counted as an agricultural effluent storage facility?

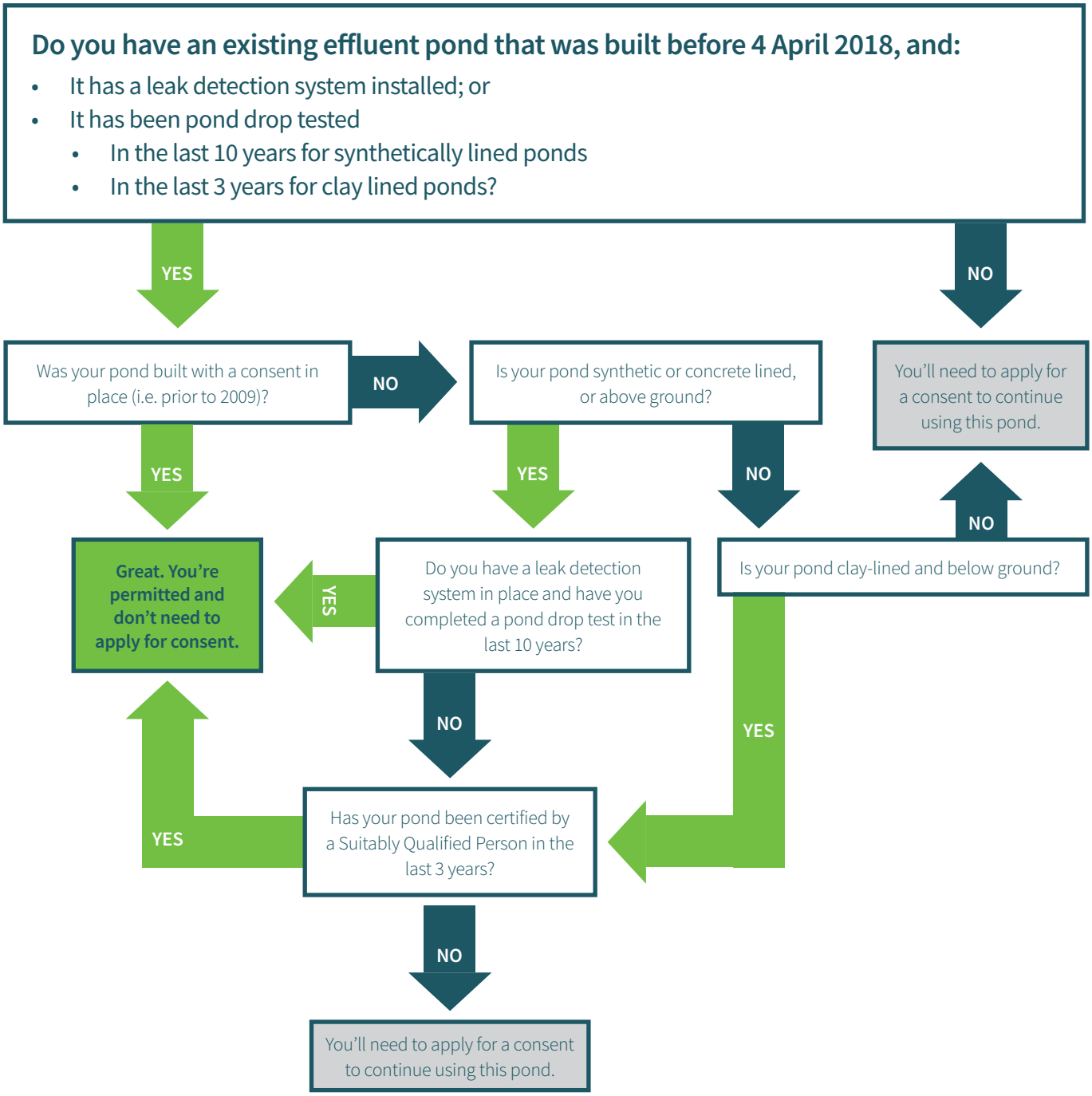
A: A pond, tank, or structure used for the containment, storage, or treatment of agricultural effluent. This includes effluent storage ponds, tanks, bladders, and weeping walls/sludge beds.

Q: How do I know if my pond was constructed lawfully?

A: Either the pond was constructed with consent from 2009 onwards, or was constructed without a consent up until 2009.

Definitions

Agricultural effluent – effluent that is derived from livestock farming.



The information provided is based on on Rule 32A, B and D in the decisions version of the proposed *Southland Water and Land Plan*, April 2018.

If you're thinking about making a change to your farming activity, it's important to remember what the proposed Southland Water and Land Plan is striving towards. Don't forget to address the objectives and policies alongside the relevant rules when you are making an application for resource consent. The objectives and policies are the key drivers of the rules and need to be considered carefully.

Published by:
Environment Southland, April 2018

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WATER AND LAND 2020 & BEYOND

Physiographic zone: Bedrock/Hill Country

Southland's physiographic zones allow us to better understand why we have variations in water quality in different areas. We've divided Southland into nine different zones according to factors such as soil type, geology and topography. Through them we can target solutions to higher risk areas as opposed to a region-wide, generalised approach.

Understanding your zone

Each zone is different in the way contaminants build up and move through the soil, areas of groundwater, and into our streams and rivers. Physiographic zones allow us to target advice and management strategies to keep farm nutrients on the farm and out of waterways.

The Physiographics of Southland project was developed as part of *Water and Land 2020 & Beyond* so we can better understand:

- where our water comes from
- how water moves through the landscape
- why we have differences in water quality across the region

What does 'Bedrock/Hill Country' mean?

Land with bedrock or glacial till* found near the surface, located below 800m above sea level.
There are no significant areas of groundwater.

***Glacial till is a mixture of rock debris and sediment that has been deposited by a glacier. It is relatively impermeable, allowing little water to get through.**

Key features of the Bedrock/Hill Country zone

- Mostly rolling to steep land, up to 800 metres above sea level (below the tree line).
- Prominent landforms.
- Soil overlies bedrock or glacial till.
- Either previously or currently densely covered with native forest, tussock or plantation forestry.
- Found throughout Southland.

Water source and movement

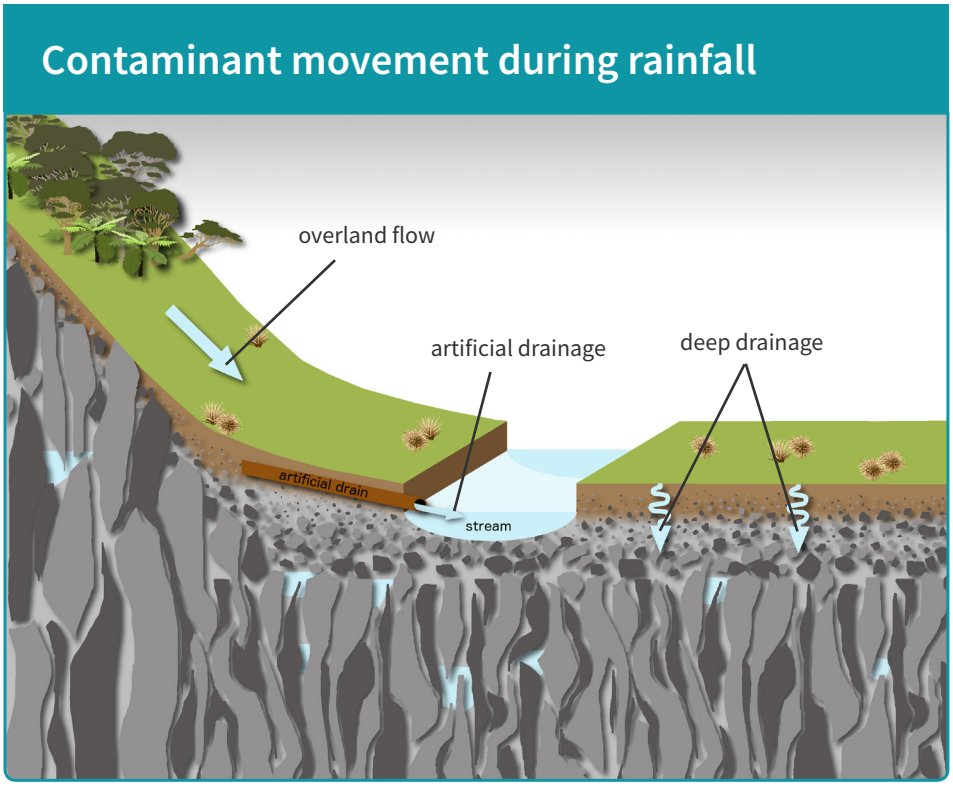
- High rainfall zone due to its elevation.
- Dense network of branching streams throughout the zone that flow to neighbouring lowland areas.
- No significant areas of groundwater.

Contaminant movement

Contaminant loss to streams is the main concern in this zone. Water quickly flows down-slope through wet soils and as overland flow to nearby streams following high or prolonged rainfall. Nitrogen, phosphorus, sediment and microbes are all carried with water, particularly during late autumn and winter.

In undeveloped areas Bedrock/Hill country streams can be a major source of recharge (top-up) water and dilution for lowland waterways and aquifers. However, in developed areas contaminants lost from Bedrock/Hill country streams contribute to the contamination loads in lowland streams in neighbouring zones.

Groundwater within the Bedrock/Hill Country zone is minimal and mainly found within rock fractures. Groundwater contaminants are typically not a concern for this zone.



Contaminant flow pathways for the Bedrock/Hill Country zone include overland flow (runoff) in the steeper areas, and artificial drainage where soils are poorly drained and deep drainage in flatter areas.

What does this mean for water quality?

√ Water from less developed areas of this zones provide a source of high quality water and dilution for downstream zones.

√ Little nitrogen build-up in groundwater due to denitrification in the soil zone.

X Water flowing over highly developed hills carries potentially large amounts of contaminants (nitrogen, phosphorus, sediment and microbes) to nearby streams, particularly following heavy rainfall.

X Water flowing through artificial drainage carries potentially large amounts of contaminants (nitrogen, phosphorus, sediment and microbes) to nearby streams, particularly following heavy rainfall.

Improving Southland's water quality

The following good management practices are applicable to all physiographic zones in Southland:

- Capture nutrients, sediment and microbes in wetlands and sediment traps
- Nutrient management
- Riparian management
- Effluent management

Good management in the Bedrock/Hill Country zone

In addition to the above, good management in the Bedrock/Hill Country zone includes measures for reducing the effects of overland flow and artificial drainage.

Reduce the effects of overflow by:

- Protecting soil structure, particularly in gullies and near stream areas
- Managing critical source areas (CSA)
- Reducing Phosphorus use and loss

Reduce the effects of artificial drainage by:

- Protecting soil structure, particularly in gullies and near stream areas
- Reducing phosphorus use and loss
- Reducing the accumulation of surplus nitrogen in the soil, particularly during autumn and winter
- Avoiding preferential flow of effluent through drains
- Capturing contaminants at drainage outflows

Physiographic zones and the Southland Water and Land Plan

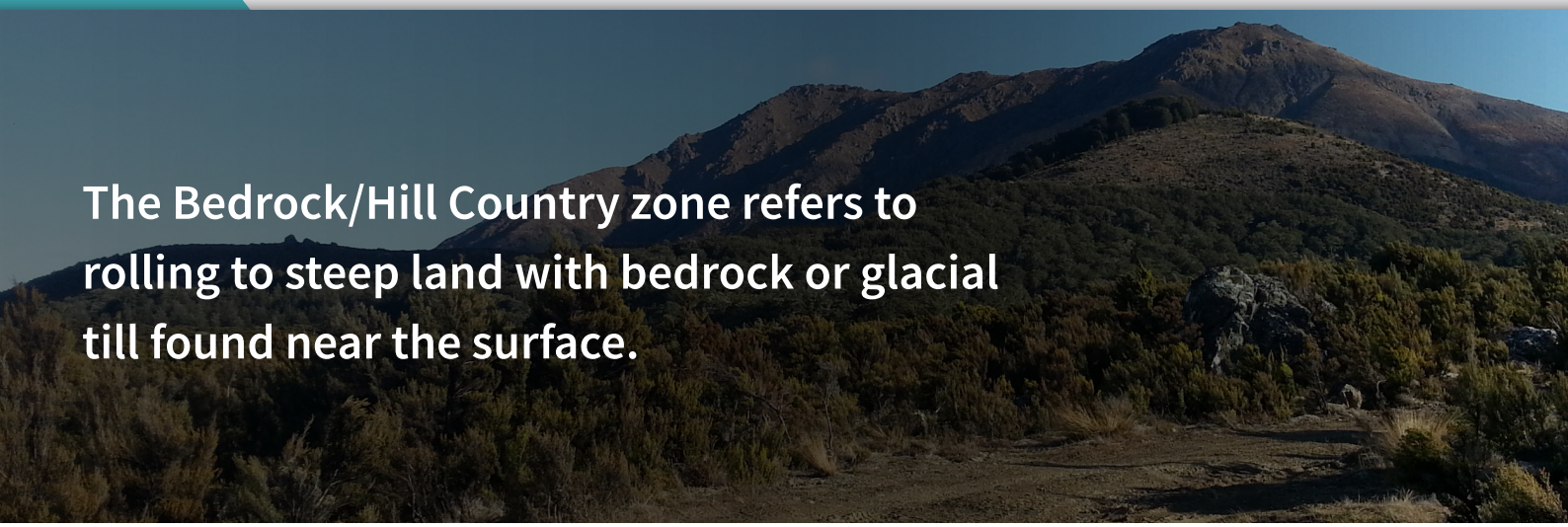
Environment Southland has developed a proposed Southland Water and Land Plan, using the science behind the physiographic zones to inform the plan and provide a tailored approach to particular issues that have been identified for each zone.

The main aim of the plan is to introduce new methods that help to halt any further decline in water quality by managing activities that we know adversely affect the quality of Southland's freshwater – such as land use intensification, wintering and stock in waterways. A key focus of the changes is to shift all land owners towards good management practices in ways that will give the best gains for maintaining water quality.

Further information

For more information about physiographic zones and good management practices contact Environment Southland. Phone 0800 76 88 45 or email service@es.govt.nz. You can also find out more about the Physiographics of Southland and your zone on our website, www.es.govt.nz.

What zone is your property in? View our map online: http://bit.ly/waterandlandmaps



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A farmer's guide to managing farm dairy effluent

A good practice guide for land application systems

DairyNZ

About this booklet

Farm dairy effluent is a valuable resource, and when managed well, can increase pasture production and reduce fertiliser costs. Poorly managed effluent poses an environmental and business risk.

Raw effluent entering waterways can have detrimental effects on human health and water quality, and could result in regional council enforcement action for breaches of the Resource Management Act. The dairy industry is committed to achieving effluent compliance 365 days of the year.

This guide is for farm owners and senior farm staff to provide an overview of effluent management, with links to other DairyNZ resources for more detailed information on specific topics.

This is a good practice guide for the management of land application systems; it doesn't cover the compliance requirements specific to each region. For more details about the rules and requirements for your region, check your council consent, and a copy of your region's *Compliance Checklist* which can be found on **dairynz.co.nz/effluent-compliance**.

There are other resources available and these are listed in the back pages, and available to order or download on the **dairynz.co.nz/effluent** website.

We recommend you get professional advice specific to your farm, from a reputable source, before making any significant changes or investments in your system.

For more information visit
dairynz.co.nz

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Version 2 – September 2015

DNZ40-100

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11. Tools and resources available to help with effluent management **51**

1. The benefits of good effluent management

Good effluent management is a combination of having a well-designed effluent system and processes for people that make sure the effluent the system collects is applied to pasture in the right amount at the right time.

To achieve this, the system must reliably:

- Store effluent until conditions are suitable to apply it to land, and
- Apply effluent to land in a controlled way – at a depth and intensity which match the soil moisture and infiltration conditions and topography.

On-farm benefits of good effluent management include:

- Fertiliser savings by using the nutrients in effluent, and reducing nutrient losses off the farm. See section 4.4 for more about the value of effluent
- Preventing animal-health issues such as milk fever which can be caused by a build-up of potassium (K) levels in the soil
- Improved soil condition from the addition of organic matter, including microbial and worm activity, as well as aeration, drainage and water holding capacity
- Complying with council rules or resource consent, this may lead to less frequent compliance visits and reduced monitoring fees.

2. Planning the right system for your farm

The design and construction of an effective dairy effluent system is a complex process. It requires the assistance of experts who are qualified and experienced in the field. Communication with the system designers, installers and contractors will be crucial to ensure the end result is fit-for-purpose in your farming situation.

A good effluent service provider will offer:

- certainty that their product will perform
- guarantees and producer statements
- after-sales care, service and support, and
- farm team training on the operation and maintenance of the system.

Designers and installers should be involved in the project from start to finish supervising the quality and standard of workmanship during the installation and commissioning of the system. They should be willing to stand by their work.

DairyNZ recommends farmers use suitably qualified and accredited effluent system designers. A list of accredited designers can be found on effluentaccreditation.co.nz. For more information about designing and upgrading an effluent system, see the dairynz.co.nz/effluent or call 0800 4 DairyNZ (0800 4 324 796).

2.1 Make sure the system will be up to the job

A poorly designed system will be expensive and frustrating in the long term, particularly for the farm team. Like milking too many cows through a dairy, it can be done, but it takes longer and the likelihood of fatigue, breakdown and general frustration is extremely high.

A system which is poorly designed may result in problems such as:

- high risk of non-compliance with regional council requirements
- no contingency for adverse weather events, staff absence or system breakdown
- high demand on labour and time
- expensive to operate and maintain
- the need to irrigate on days when ponding, runoff, and leaching risk is high
- additional pressure on the farm team during calving or wet weather
- unrealised investment in the system if it is not user-friendly or doesn't achieve compliance, and
- little room for future expansion.

It is important to think about potential changes to the farm system, especially intensification, including an increase in cow numbers, greater use of stand-off and feed pads or the addition of wintering facilities. If these are desired but finances don't allow you to accommodate these now, plan for a staged expansion to the system as you require it. Get the system designed with the changes in mind – it can save a big expenditure in the future.

The system must be capable of storing all effluent when conditions aren't suitable to irrigate, and then allow the option of getting effluent onto land and emptying the pond when conditions permit.

FIND OUT MORE

Farmer guide to planning the right system for your farm

Farm Dairy Effluent (FDE) Design Standards and Code of Practice

Farm Dairy Effluent (FDE) A farmer's guide to building a new effluent storage pond

IPENZ Practice Note 21: Farm Dairy Effluent Pond Design and Construction

Order or download from dairynz.co.nz

2.2 What needs to be captured?

All areas where effluent is generated should be incorporated into the effluent system design. Effluent includes liquids, sludge, slurries and solids from cow dung and urine. Other contaminants such as milk and silage leachate must also be collected, contained and not allowed to reach waterways. A good way to do this is to use the effluent system to capture and distribute these sources. Regional council requirements for each may vary, but if you are building or upgrading any of the areas listed below, it is good practice to use sealed surfaces to capture all effluent and contaminants.

Examples of areas where effluent should be captured include the following areas:

Underpasses

Sand traps and sumps

Feed bunkers

Silage stacks

Feed and stand off pads

Wintering pads, barns and calf facilities

Yard entry and exit points

Ponds and storage facilities

Bridges and culverts

De-watering pads and solids storage bunkers

What type of system may suit you?

Do you have...	Tick if yes	Consider...
Poorly drained or pugged soils or soils with artificial drainage?		A low rate application system is best. A sprinkler type system is lower risk, however if you operate a travelling irrigator in these conditions it has to be run at high speed to deliver low depths. You will also need extra storage as you can't apply when soils are too wet. A low rate system is one which can achieve very low application depths compared to traditional systems – for example between 1-10mm.
To irrigate on land with a slope greater than 7°?		
A high rainfall area?		
A high water table?		
A nutrient sensitive catchment?		
A large herd (e.g. over 500 cows)?		Include a solid separation component to your system to deal with the extra nutrients and solids before they get to storage. Also check you have a large enough area for applying effluent. Separators can be mechanical or passive (see page 8).
An intensive feeding system?		
A standoff or feed pad in regular use?		
None of the above risk factors?		You can use a range of applicators. Make sure you have adequate storage to manage through wet times and check your application rate.

Understanding the different components of an effluent system

The following information describes the individual components of common effluent systems in New Zealand.

Stormwater diversion

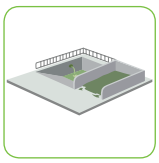
Storm water diversion is when rainfall that has landed on an effluent free yard (including any pad etc.) can be safely diverted away from the effluent storage pond. It is an effective way to reduce the volume of water that can be added to the pond in rainfall events, especially if you are not milking. This has savings via decreased pumping costs, less time staff are irrigating diluted effluent, and less risk of having to irrigate when soils are wet.

There are a huge number of stormwater diversion designs available, including manual and mechanical. Regardless of design, care needs to be taken to manage the stormwater diversion correctly. Installing an automatic facility or warning devices is advised.

Farms located in high rainfall areas would benefit from a stormwater diversion. Farmers may choose to only use stormwater diversion at times of the year when not milking. If using regularly during the milking season it is essential that robust systems are in place to ensure mistakes are not made.

Example: 100mm of rain on a 400m^2 roof or yard = 40m^3 of water. If pumping from the effluent pond at 15m^3/hr = 2.6 additional hours of pumping costs, plus labour and wear and tear on equipment.

Stone trap



Stone traps are designed to slow down and redirect the flow of effluent so sand, stones and debris can drop out. This will prevent blockages in the effluent pipe work, pumps, storage facilities and applicators.

Stone traps are generally made of concrete and have a wide base which slopes down toward the pumping or draining end. The inlet is normally well above and on the opposite side/end of the stone trap to the outlet.

The solids that accumulate in the stone trap need to be regularly removed onto a sealed surface located directly beside the stone trap which drains any liquid back to the stone trap. The solids should be applied evenly to land.

Not all systems need a stone trap, but it is highly recommended. Systems which use weeping walls or two-pond systems which use the first pond as a separation system may be exceptions.

Pump station

The pump station's purpose is to transfer effluent from one location to another. Where possible it is better and more cost effective to use gravity to move effluent. Pump stations may be required to get effluent to storage and are definitely required to transfer effluent from storage to the applicator. There are a wide range of options available for transfer pumps including different types, sizes and capabilities. It is important that your pump specifications match the system specifications and the outcomes required, to ensure your effluent system works effectively.

Solids separator

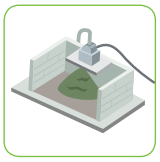
Solid separation involves the removal of coarse solids from the effluent resulting in a liquid effluent which is stored until use.

Using solid separation in the system will mean there is less liquid to be stored and storage facilities may require de-sludging less frequently. The removal of solids also allows the liquid effluent to be applied through any type of applicator. Low rate and mainline centre pivot systems ***must*** have a solids separator or some sort of inline filtration to prevent blockage on smaller applicator orifices.

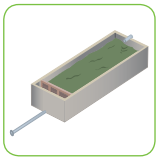
Solid separation should be considered when operating a feed pad or high feed input system as the amount of solids in the effluent is greatly increased in these systems.

If solids are separated effectively, water recirculation for use as yard or pad wash-down can also be considered (See *DairyNZ Farmfact 6-65* for more about the use of recycled effluent for yard washing). This would also lower the storage volume required.

There are two main methods of solids separation:



1. Mechanical separators: Mechanical separators achieve a high rate of separation and produce a dry solids component which is held on a pad or bunker for use at a later date. Once the solids are removed the liquid component is transferred to a storage facility. Mechanical separators are normally either slope screen, rotary screen or screw presses.



2. Passive separation: These are usually weeping walls. Weeping walls are lined storage areas which have a narrow slotted wall along the length of the store. There should be two storage areas which can be alternated. The liquid drains through the wall into a drainage channel and is transferred to a liquid storage facility. The solids remain in the storage area. Once the solids build up to a certain level they can be left to dry out and then applied to land. The sizing and design of the weeping wall is critical to its success.

All solids need to applied to land in a way that meets regional council rules and consent conditions.

	Pros	Cons
Passive separator (Weeping wall or settling pond)	• Low risk of breakdown • Very low ongoing labour input • Low energy usage	• Farm specific – design different on every farm • Solid product has higher water content • Solids can become anaerobic causing odour • Takes up a large physical area • Emptying bunkers is a bigger job. May require a contractor (take care with liners).
Mechanical	• Liquid effluent is better filtered • Requires smaller physical area • Produces a drier solids product, to store and spread	• Ongoing mechanical maintenance • Increased risk of breakdown • High capital cost • Higher energy costs • Requires stone and grit removal prior to separation • Works best when effluent properties are consistent • Feed waste such as palm kernel grit or pumice and other fibre or waste can cause issues for mechanical separators.

Storage

The storage component of an effluent system is critical for all farms. Having sufficient storage for your effluent provides flexibility in terms of application. This means you can apply effluent when soil conditions are right and nutrient uptake can be maximised and allows you to irrigate at a time that suits you.

Storage facilities can be either in-ground or above-ground ponds and tanks. These need to contain the effluent without leaking, so are commonly lined with synthetic products or clay (where soil types permit).

The amount of storage you need depends on your farm system and local environment. It is best calculated by using the *Dairy Effluent Storage Calculator*. This is best used by your effluent system designer or your pond/tank company.

Include an agitator or stirrer in the storage facility. Continuously agitating and homogeonising the effluent will keep solids in suspension consequently reducing odour and the need to desludge. It will also ensure useful nutrients are applied to the farm instead of settling to the bottom of the pond. Match the stirrer to the type of pond liner.

For more detailed information on the design and construction of storage facilities refer to the *IPENZ Practice Note 21: Farm Dairy Effluent Pond Design and Construction*, this can be downloaded from **dairynz.co.nz/effluent-systems.**

Applicator

The applicator distributes the effluent to the paddock. There are a large number of applicators including:

Travelling irrigators

Low rate application systems (sprinklers)

Pivots

Slurry tanker

* The user is the final component in the system. The correct use and management of all of these hardware components has the greatest impact on effective effluent management.

	Pros	Cons
Traveller – application depth 8mm+	• Low capital outlay • Can distribute large quantities of effluent in one application cycle • Don't require fine solids removal • In case of breakdown, easy to interchange with alternate traveller • Easy to service and maintain.	• Unsuited to topography steeper than 7˚ and high rainfall or high drainage areas • High application rates and depths • Risk of poor performance due to poor daily set up • Risk of poor performance due to poor design and lack of maintenance • Not well suited to small or irregular paddocks • High application depth when travelling at slow speeds.
Low rate sprinkler systems – application depth 1-10mm+	• Low application rates • Many irrigation days available throughout the year, and less storage required • Suited small or irregular shaped paddocks • Less moving parts – easy to maintain • Less chance of spray drift over boundaries etc • Can distribute large quantities of effluent in one application cycle at low depths if multiple sprinkler units are used over a large area • Easier to shift and run in rolling topography • Suits high rainfall/high risk soils/rolling or artificially drained land.	• More difficult to get even application throughout the paddock particularly if different people shifting each time • More shifts involved to get same volume of effluent as traveller (depending on soil moisture deficit) • Easily blocked (need solids separation or filtration) • Specific planning and design needed to get correct pressures and volumes to all sprinklers.
Pivot – application depth 1mm+	• Excellent low application depths • Many irrigation days available throughout the year • Can get rid of extremely large volumes of effluent quickly • Requires much less storage • Uses existing infrastructure • Little time spent setting up and moving • Covers large area easily with valuable nutrients.	• May have to wash effluent out of lines afterwards. Must have back-flow preventer (valve) • Pivots have been known to get stuck when operating during the winter • Requires computer operated valves if irrigating effluent over paddocks with water courses and drains • Some 'add on' effluent sprinklers to pivots i.e. guns have very poor distribution uniformity • Need excellent solids removal or nozzles will block • Can have different application at each bay.

	Pros	Cons
Contract spreader	• Very low capital invested in system • Very low labour requirement • Empties pond fast • Proof of placement.	• Reliant on contractors timeframes • Less benefit from regular water and nutrient application • Must make sure contractor applies with rules • Cost of contractors.
Slurry tankers	• Can access any part of farm that is drivable • Excellent low application depths • Can move large volumes of effluent relatively quickly • No solids removal required • Easy to allow for wind drift • Excellent placement control • Has the ability to suck out sumps and other sources that don't have pumps • A relatively cheap option compared to pumps, pipes, irrigators etc • Return of more organic matter to the soil.	• Heavy gear causing damage to pastures and races • Not ideal on wet soils due to wheels causing pugging and compaction • Need good vehicle access to ponds • Health and safety risks for driver on steep land.

Technology

'Fail safe' technologies suitable to various application methods can be built into your system

These can include:

- pond or sump level alarms
- traveller motion alarms
- variable rate irrigation on pivots
- software for planning, monitoring and recording effluent management
- integrated telemetry and data logging systems for soil moisture deficit monitoring
- cut-out switches on pumps
- pump pressure and flow rate meters
- anti-siphon valve at pond
- anit-drain valve at paddock.

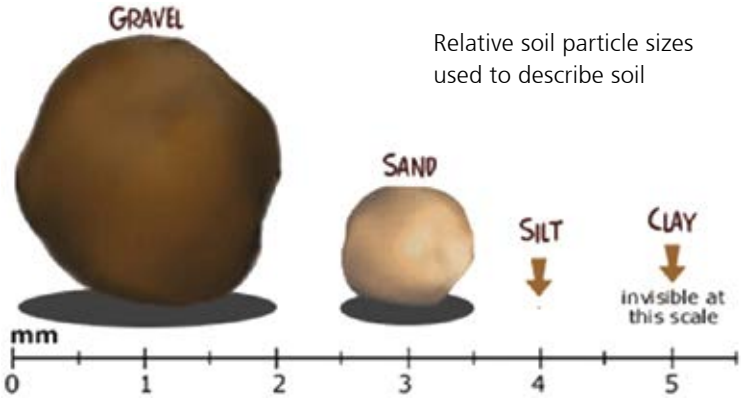
3. How landscape and climate affect effluent system design and management

There are three main landscape and climate factors which play a role in the success of effluent application:

- the soil drainage characteristics
- landscape contour and topography
- climate.

3.1 Soil texture

Soil is like a sponge, the amount of water soil can hold is determined by the soil texture.

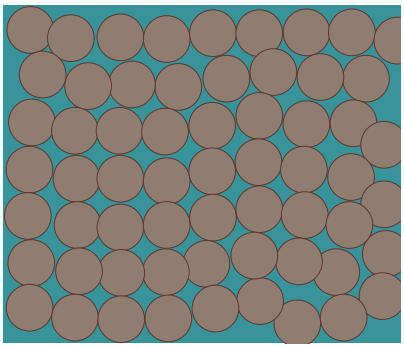


Relative soil particle sizes used to describe soil

Soil texture is defined by the size of the particle that it is comprised of. Texture affects the infiltration rate (speed) of water moving down through the soil, and also the way soil particles hold onto water in the soil (water holding capacity), thus affects how applied effluent moves in the soil.

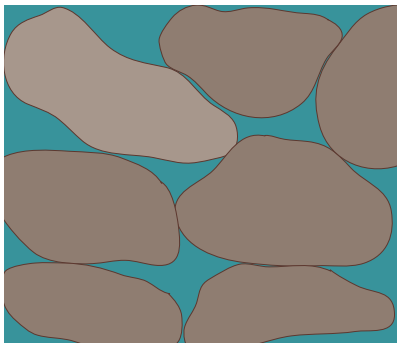
The water holding capacity and the current water content of the soil determine the depth of effluent which can be applied before it goes past the root zone to groundwater.

Clay soils



Clay soils have smaller particle sizes, and smaller pores. They can hold more water than coarser soils, and also hold onto the water more tightly. When effluent is applied to these soils it cannot drain quickly and may pond on the surface.

Sandy soils

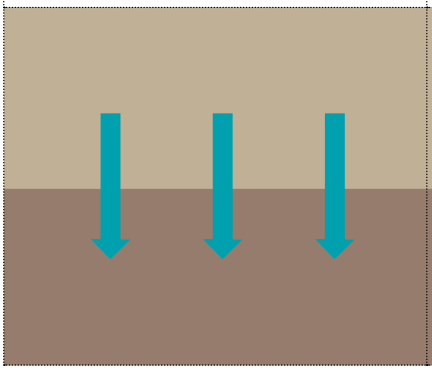
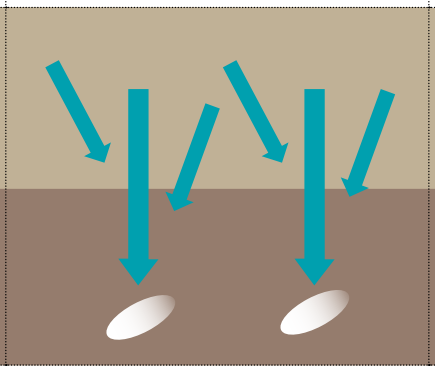
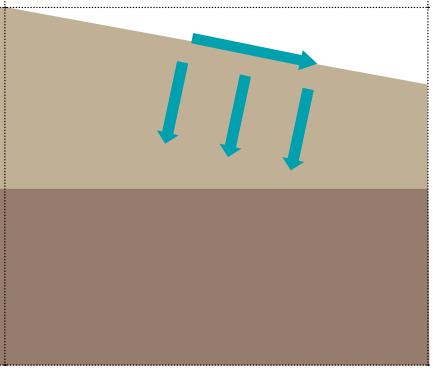


Sandy soils have larger pores and hold less water, but make it easier for the plant roots to extract the water. Effluent drains freely through the large pores and care must be taken so that it does not go straight to groundwater.

The water holding capacity is expressed as a depth, in mm/m. It varies from 45-55 mm/m for sand to 175-190 mm/m for clay.

3.1.1 Soil drainage

Soil drainage can be characterised by three methods of water movement through or over the soil:

Matrix flow	Preferential flow	Surface runoff
• Uniform movement down through the soil.	• Water fast tracks through soil through cracks and channels.	• Very little infiltration, water moves across the surface or ponds.
• High infiltration rates • Well drained soil profile • High porosity • Fine soil structure	• Poor natural drainage • Mole and pipe drainage • Heavy or course soils	Influenced by: • Length of slope and steepness • Soil moisture content • Soil infiltration • Ground cover and land-use • Soil compaction
		

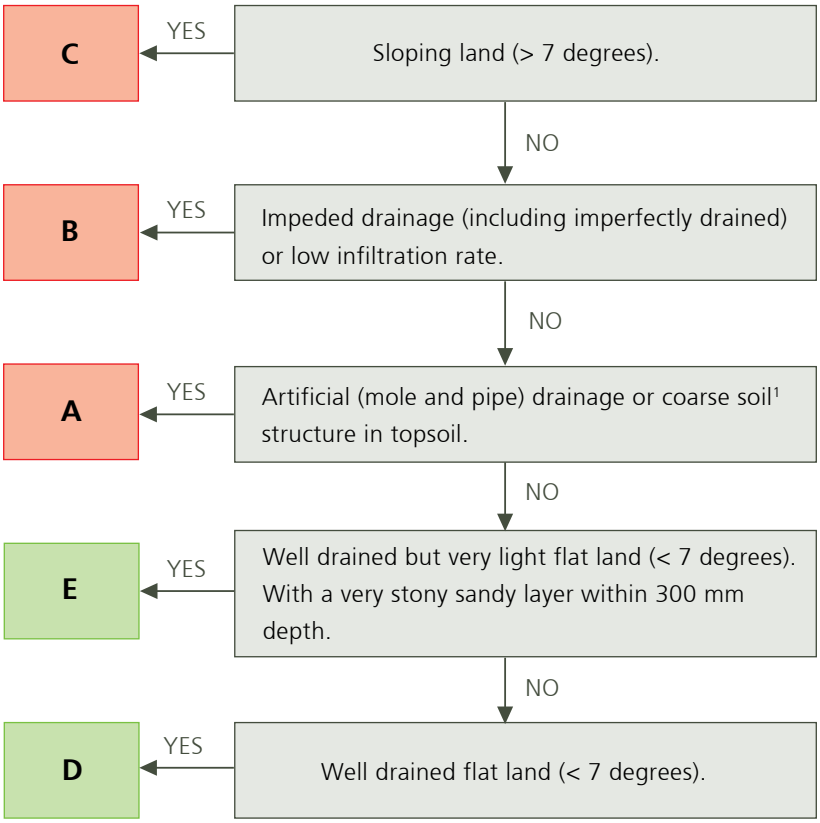
FIND OUT MORE

Pocket guide to determine soil risk for farm dairy effluent application.

Order or download from dairynz.co.nz

3.2 Soil and landscape classifications and risk profiles

This classification system is used to determine an appropriate effluent application depth and effluent storage requirements (using the *Dairy Effluent Storage Calculator)*. Soil and landscape features may be categorised into one of the five classifications noted below. An explanation of these soil classifications appears on the page opposite.



Many of the soils in New Zealand have been mapped in detail and may help you determine the soil characteristics on your farm. Visit **smap.landcareresearch.co.nz**. The soils in your effluent block may have been classified if you have had the *Dairy Effluent Storage Calculato*r used on your farm. A field guide for classifying soils into the different risk profiles has also been produced by DairyNZ as listed below.

- Effluent can be applied to 'Low Risk' soils 24 hours after rainfall or irrigation has stopped, and any water puddles have disappeared
- 'High Risk' soils require a soil water deficit equal or greater than the depth of the effluent to be applied
- The Dairy Effluent Storage Calculator assumes you will use 'Low Risk' soils if irrigation must occur 24 hours after a rainfall.

FIND OUT MORE

Dairy Effluent Storage Calculator – download from www.massey.ac.nz/~flrc/FDE.html
Pocket guide to determine soil risk for farm dairy effluent application – order or download from dairynz.co.nz

[1] Soils with 80% or more soil aggregates captured on a 10 mm sieve within the top 300 mm soil layer are considered to have coarse soil structure.

	1. High risk soils for effluent management			2. Low risk soils for effluent management	
Category	**A**	**B**	**C**	**D**	**E**
Soil and landscape feature	Artificial drainage or coarse soil structure	Impeded drainage or low infiltration rate	Sloping land (>7°) or land with hump & hollow drainage	Well drained flat land (<7°)	Other well drained but very light flat land (<7°)
Risk	High	High	High	Low	Low
Application depth (mm)	< SWD[1]	< SWD	< SWD	< 50% of PAW[2]	≤ 10 mm & < 50% of PAW[2]
Storage requirement	Apply only when SWD exists	Apply only when SWD exists	Apply only when SWD exists	24 hours drainage post saturation	24 hours drainage post saturation
Max depth: High rate tool	10 mm	10 mm	10 mm[3]	25 mm[4] (10 mm at field capacity)	10 mm
Max depth: Low rate tool	25 mm	25 mm	10 mm	25 mm	10 mm

[1] SWD is the soil water deficit
[2] PAW is the plant available water in the top 300 mm of soil
[3] Only applicable when instantaneous application rate from the irrigator is less than the infiltration rate
[4] Suggested maximum application depth when a suitable SWD exists (≥ 15 mm).

Soil and landscape categories A and B:

Artificial drainage or coarse soil structure refers to soils which drain very rapidly such as soils with mole and tile or artificial drainage. It also includes very free-draining coarsely textured soils such as stony soils with a thin topsoil, The main risk on these soils is preferential flow (effluent bypassing the soil and making its way into ground and surface water quickly).

Impeded drainage or low infiltration rate soils are very slow to drain, these may be heavy such as the high clay content ones which pug easily. The main risk on these soils is ponding and runoff as effluent irrigation will not soak into the soil quickly.

Management tips: application depth must be less than soil water deficit. These soils suit low rate application systems because of improved control over application rate and depth.

Soil and landscape category C:

Sloping land (>7°) or land with hump and hollow drainage refers to soils which are gently rolling to steep. It also includes soils which have been humped and hollowed. The main risk is runoff on these soils.

Management tips: application depth must be less than soil water deficit and application rate must be less than soil infiltration rate. A low rate application system is the only practical way of applying effluent without ponding and runoff.

Soil and landscape category D:

Well drained flat land (<7°) refers to soils which are generally wet-weather-safe, with deep free draining subsoil. The main risk on these soils is over application of nutrients.

Management tip: ideal for applying effluent because soil behaviour under drainage is less of an issue. Both high rate and low rate application systems can give good control.

Soil and landscape category E:

Other well drained but very 'light' flat land (<7°) refers to soils which drain well but may have a very thin topsoil. They don't typically have effluent or wet weather risks. These may be the soils which dry out first on the farm. The main risk on these soils is leaching of effluent past the root zone.

Management tip: Do not apply more than 10 mm of effluent at a time.

3.2.1 Soil mapping

Soil types and risk profiles vary across a farm depending on the soil forming features. The best way to fully manage the variation and implications of the varying soil types is to have a farm scale soil map produced.

This information will be useful for fertiliser decisions, effluent and water irrigation planning, cropping and grazing rotation decisions, and other farm management decisions.

Electromagnetic (EM) mapping is an emerging technology that is also starting to be used by farmers for mapping of soils at paddock scale for more precise application of nutrients and water.

Many of the soils in New Zealand have been mapped in detail and may help you determine the soil characteristics on your farm. Visit smap.landcareresearch.co.nz.

3.3 Effluent application plans

All farms contain high-risk and low-risk areas for effluent application. An effluent application plan can help to identify suitable areas of the farm for effluent application, and areas to avoid. All staff need to be aware of the effluent application plan. Check your consent conditions for any restrictions (minimum distances, application area, irrigating after rainfall or minimum irrigation intervals for example). It is usually recommended paddocks are rested for 10-14 days between application and grazing or further applications.

Making a plan:

- From a map of the farm, identify waterways, natural drainage patterns, soil types and sub-surface drainage, slope, prevailing wind direction and neighbours' dwellings
- **Low risk areas** are ideal for effluent application (shown in green on the map below); note irrigator runs for each paddock and high risk or no-application zones
- **High risk zones** include mole or tile drainage areas, > 7° slope, very wet soils or very free-draining areas with porous subsoil and accessible groundwater (shown in orange on the map below).
- **No-application zones** include all land within 20 m* of a drain, waterway or bore, or the boundary of a neighbouring property (shown in red in the map below).

If you have to irrigate over mole and tile drains, try to have runs which go across the drains, rather than down the length of them. When soils are wet or very dry, decrease application depth or defer application until conditions are more suitable for irrigation.

Key

- Effluent pond
- Dairy shed
- Tile lines
- Waterways
- Example showing effluent runs

Risk zones

- No application zones
- High risk zones
- Low risk zones

Apply effluent to higher risk soils when conditions permit. Save the low risk soils for poor weather conditions.

* Some councils, such as Otago may require a greater buffer zone. Be familiar with your councils requirements.

4. Applying effluent to land

There are four key principles to capturing the value of effluent:

1. know the depth of effluent application
2. keep it in the root zone – don't exceed the soil water deficit when you irrigate
3. be aware of spray patterns – test your irrigator's output to see how even it is
4. know the nutrient loading from effluent application.

4.1 How to test application depth and rate

Test location

Test the application depth at the location which puts the pump under the greatest work load, e.g. at the greatest distance from the pump, or at the highest elevation above the pump station.

Collection containers

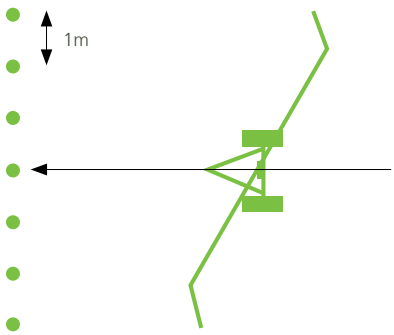
When testing, you can use either rectangle trays with straight sides, rectangle trays with sloped sides or standard round buckets. You will need about 20 of these. You must use a different calculation depending on the type of collection container.

Step 1:

Containers

Before applying effluent, put containers in a line across the path of the applicator:

1. 1-2 metres apart
2. use enough containers across the spray width of the irrigator
3. put a stone in each container to stop it blowing over.



Step 2:

Run irrigator

Run the irrigator as normal:

1. record the actual amount of time that effluent is falling in the containers.

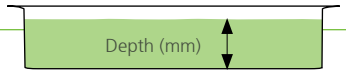
Step 3:

Measure the depth of effluent in every 'wet' container.

For RECTANGLE TRAYS WITH STRAIGHT SIDES:

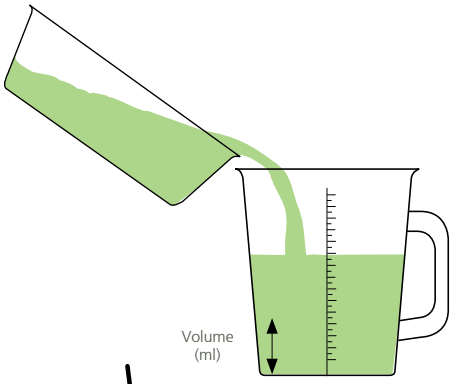
1. use a tape measure
2. remove the stone
3. measure how deep the effluent is in each container (mm)
4. write down depth for each container.

Tip: Make sure container is level (not on a slope) before you measure.



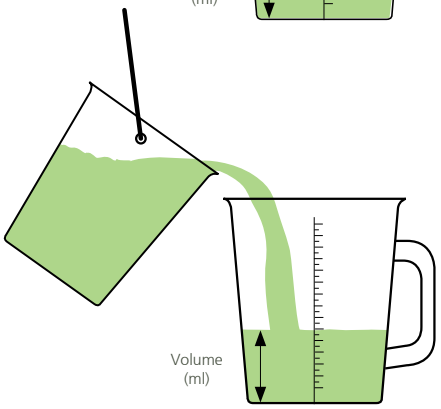
For RECTANGLE TRAYS WITH SLOPING SIDES:

1. remove stone
2. tip effluent into measuring jug record the volume (ml)
3. write down volume for each container.



For ROUND BUCKETS WITH SLOPING SIDES:

1. remove stone
2. tip effluent into measuring jug record the volume (ml)
3. write down volume for each container.

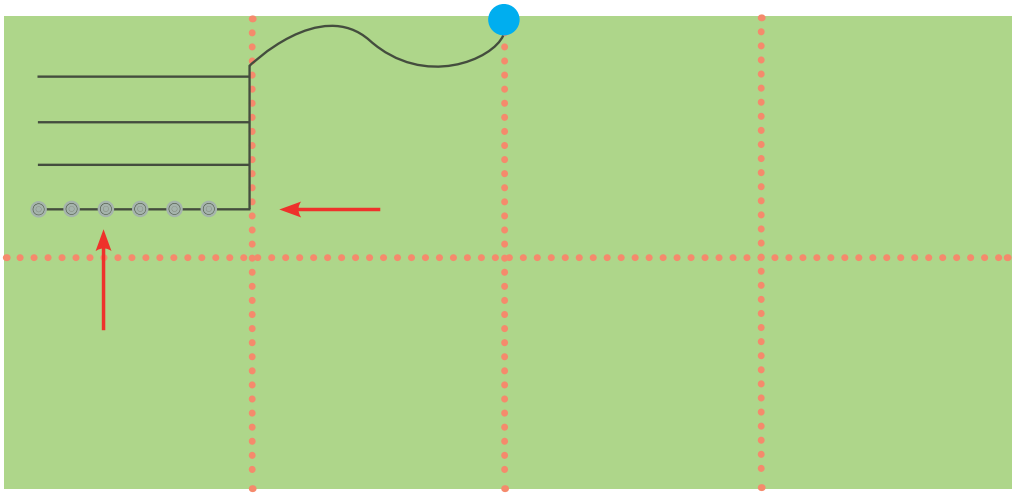


Go to pages 20-22 for calculation steps.

Low rate application systems

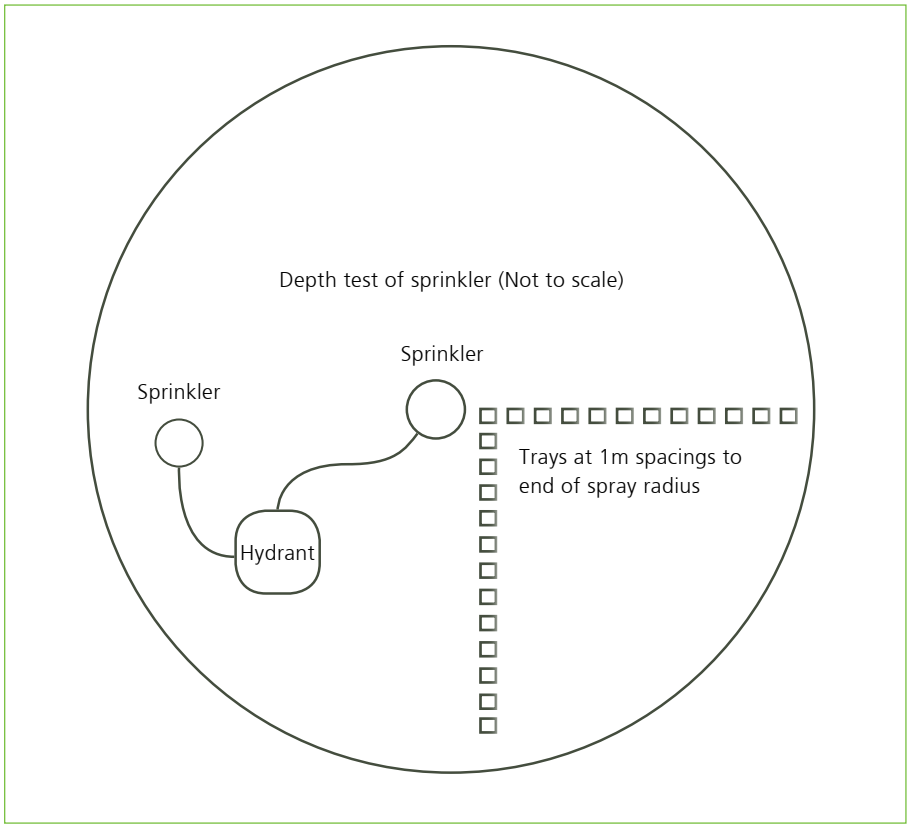
Step 1: Location

Go to the middle pod on the last pod line in the series (furthest away from the hydrant)



Step 2: Layup containers

Lay out collection containers out in an "L" shape from the middle pod. Containers should be spaced at 1 m intervals and cover right to the edge of the spray area of the pod. Put a stone in each container to stop it blowing over if needed.



Step 3: Turn on

Turn the system on. Run the pods for one hour. Record the start and finish time.

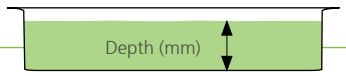
Step 4: Measure how much

Measure the depth of effluent in every 'wet' container.

For RECTANGLE TRAYS WITH STRAIGHT SIDES:

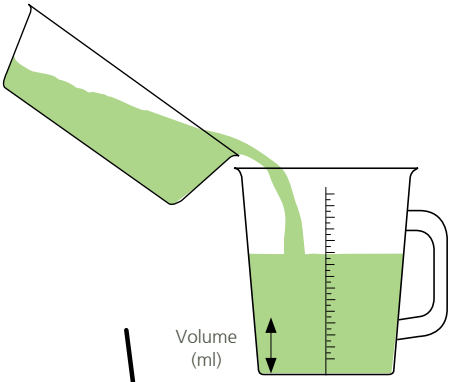
1. use a tape measure
2. remove the stone
3. measure how deep the effluent is in each container (mm)
4. write down depth for each container.

Tip: Make sure container is level (not on a slope) before you measure.



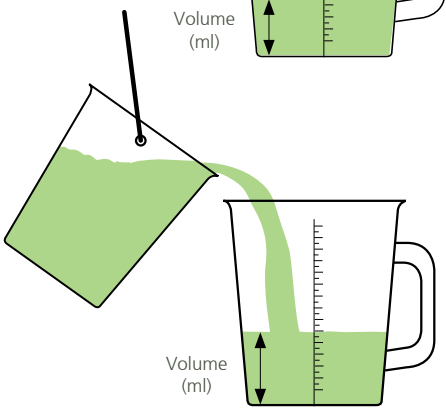
For RECTANGLE TRAYS WITH SLOPING SIDES:

1. remove stone
2. tip effluent into measuring jug record the volume (ml)
3. write down volume for each container.



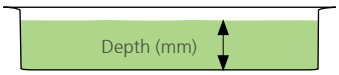
For ROUND BUCKETS WITH SLOPING SIDES:

1. remove stone
2. tip effluent into measuring jug record the volume (ml)
3. write down volume for each container.



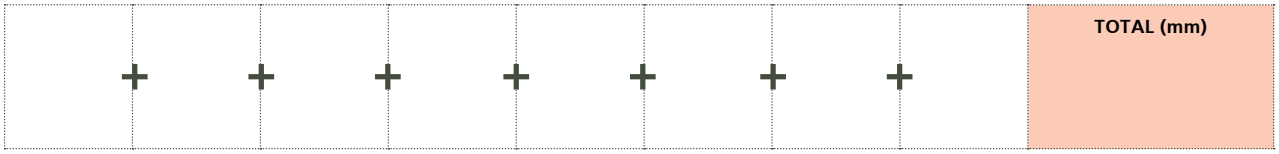
How to calculate application and depth rates

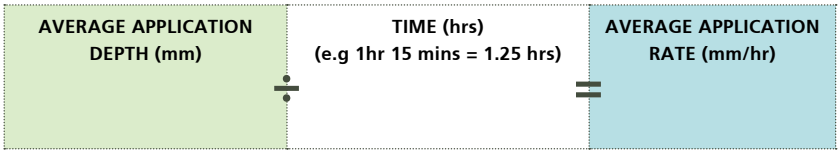
Rectangle trays with STRAIGHT sides



Record the depth from each container, e.g. on a sprinkler with a 40 m diameter wetted area, there may be 20-40 containers.

Container 1 Container 2 etc ...



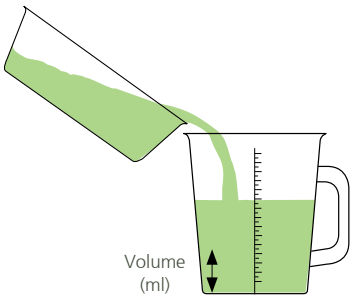


Note: Maximum application depth = The CONTAINER with the deepest measurement.

Tip: To convert seconds or minutes to decimal, divide by 60 e.g. 21 mins = 21 ÷ 60 = 0.35 hrs.

How to calculate application and depth rates

Rectangle trays with SLOPED sides



Record the depth from each container, e.g. on a sprinkler with a 40 m diameter wetted area, there may be 20-40 containers.

Container 1 Container 2 etc ...

TOTAL (ml)

TOTAL (ml) ÷ NUMBER OF CONTAINERS = AVERAGE VOLUME (ml)

CONTAINER WIDTH (mm) X CONTAINER LENGTH (mm) = CONTAINER AREA (mm²)

1000 X AVERAGE VOLUME (ml) ÷ CONTAINER AREA (mm²) = AVERAGE APPLICATION DEPTH (mm)

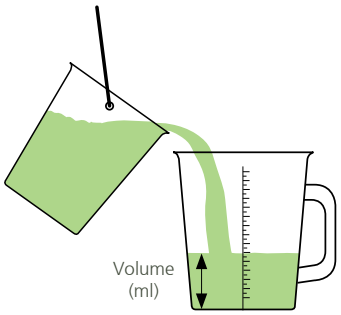
AVERAGE APPLICATION DEPTH (mm) ÷ TIME (hrs) (e.g 1hr 15 mins = 1.25 hrs) = AVERAGE APPLICATION RATE (mm/hr)

Note: Maximum application depth = The CONTAINER with the deepest measurement.

Tip: To convert seconds or minutes to decimal, divide by 60 e.g. 21 mins = 21 ÷ 60 = 0.35 hrs.

How to calculate application and depth rates

Round buckets with SLOPED sides



Record the depth from each container, e.g. on a sprinkler with a 40 m diameter wetted area, there may be 20-40 containers.

Container 1 Container 2 etc ...

+ + + + + + +

TOTAL (ml)

TOTAL (ml) ÷ **NUMBER OF CONTAINERS** = **AVERAGE VOLUME (ml)**

CONTAINER WIDTH (mm) ÷ **2** = **CONTAINER RADIUS (mm)**

3.14 X **CONTAINER RADIUS (mm)** X **CONTAINER RADIUS (mm)** = **CONTAINER AREA (mm²)**

1000 X **AVERAGE VOLUME (ml)** ÷ **CONTAINER AREA (mm²)** = **AVERAGE APPLICATION DEPTH (mm)**

AVERAGE APPLICATION DEPTH (mm) ÷ **TIME (hrs) (e.g 1hr 15 mins = 1.25 hrs)** = **AVERAGE APPLICATION RATE (mm/hr)**

Note: Maximum application depth = The CONTAINER with the deepest measurement.

Tip: To convert seconds or minutes to decimal, divide by 60 e.g. 21 mins = 21 ÷ 60 = 0.35 hrs.
For assistance and advice on testing application depths and rates on pivot systems, please contact DairyNZ.

4.2 Matching effluent application to the soil water deficit

Soil water deficit (SWD), measured in mm (sometimes %), is the amount of available water removed from the soil within the plants active rooting depth. It is also the amount of water required to refill the root zone to bring the soil moisture conditions to field capacity.

- **Field capacity** refers to the amount of water held in the soil after excess water has drained away. This is typically a day after soil saturation (e.g. from rain or irrigation). Adding water/effluent at this point will result in ponding, runoff or leaching. A SWD increases with drainage and evapotranspiration, and decreases with rainfall or irrigation.
- **Deferred irrigation** means irrigation is delayed (or deferred) until there is a big enough SWD to allow for ***more*** water to be added to the soil without causing runoff, ponding or leaching.
- The greater the application depth and intensity of the irrigator (i.e. travellers vs. sprinklers), the greater the SWD required for irrigation. It may be inappropriate to proceed with effluent irrigation if:
  - the soil is too wet following rainfall or irrigation – effluent may pond, run off to waterways, or leach through to groundwater
  - the soil is very dry and cracked, especially over tile or mole drains – effluent may travel through soil cracks to underground drains and then flow into waterways
  - the soil is compacted or frozen.

Take care when applying effluent at the same time as fresh water irrigation. The SWD principles still apply, and total water application should be considered otherwise there is a risk of leaching or ponding if soil is over-irrigated.

Irrigating at times of low soil moisture and at a rate the soil can absorb.

Do not apply more effluent than the soil can absorb. Ponding causes pasture damage and leaching to groundwater.

It is important to make sure that application depth and intensity do not exceed the soil water deficit or the application limit on your consent at any time to prevent ponding or runoff to waterways.

4.2.1 Measuring soil water deficit

The most accurate way to measure the SWD is with soil moisture technology. Getting good advice before investing in measuring devices is vital. Get a qualified technician to calibrate the system for your farm and provide a soil moisture deficit range for safe irrigation. Make this system simple for the farm team to use.

Here are some different methods for measuring soil moisture:

- handheld instantaneous probes are the cheapest option. They need to be calibrated to your soil type and situation by a qualified technician
- permanent in-ground sensors can be read either by hand-held devices or via telemetry and software systems. Telemetry systems allow for remote monitoring
- a fully integrated system which monitors climatic data, effluent pond level, soil moisture levels, soil mapping, irrigator positioning and run recording and can be used for full irrigation scheduling, with remote monitoring. You can be sent text alerts and recommendations based on your farm's irrigation system. These systems are more costly but allow for precise monitoring and are particularly good for large operations or absentee owners. Staff training in these systems is essential.

4.3 Evaluate your applicator spray patterns

Spray pattern uniformity varies depending on the type and condition of the applicator. Sprinkler systems and oscillating applicators have a more even spray pattern than standard travelling irrigators. A fast traveller speed will have a more even pattern than a slower one.

Ensuring the applicator is in good condition through on-going maintenance (e.g. cleaning, greasing, correct gearing, check rubberware and tyre pressure) will get the best performance out of the system.

A regular servicing and maintenance programme with your local service provider can save you money and hassle in the long run.

> Replace irrigator rubberware when you replace the rubberware in the dairy.

4.3.1 The effect of uneven spray patterns

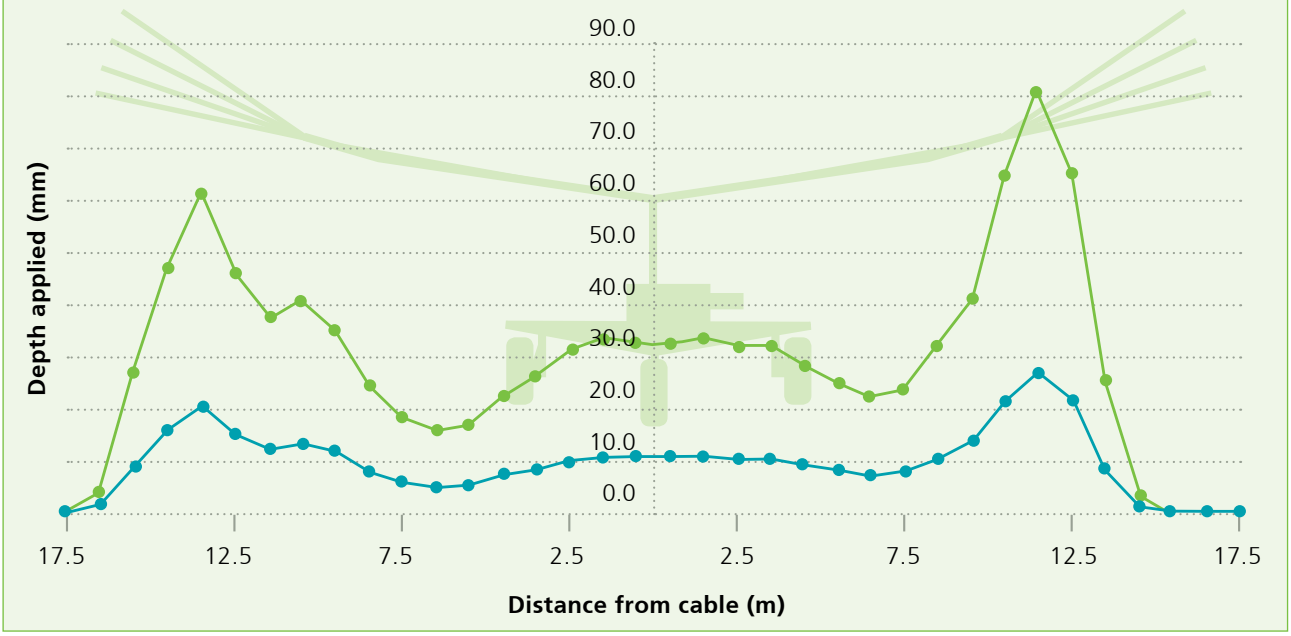
Travelling irrigators have a 'donut' shaped spray pattern, increasing the load applied to certain parts of the paddock. Areas at the outer edge of a travelling irrigator's spray pattern receive effluent for longer periods, so there is a band of heavier effluent loading on each side of the irrigator's run, with a lighter loading in the middle.

Uneven spray patterns can result in ponding or runoff, if the instantaneous application at certain parts of the spray pattern is higher than the soil can absorb.

Travelling irrigator runs must be wide enough apart so there is no overlap on the outer edges.

> The spray pattern can be improved by making sure the irrigator is well maintained and has been set up correctly. See pg 42 and 43 for more tips for travellers.

Depth of effluent applied from a travelling irrigator



- Irrigator maintaned and well set up
- Irrigator in need of maintenance and poorly set up

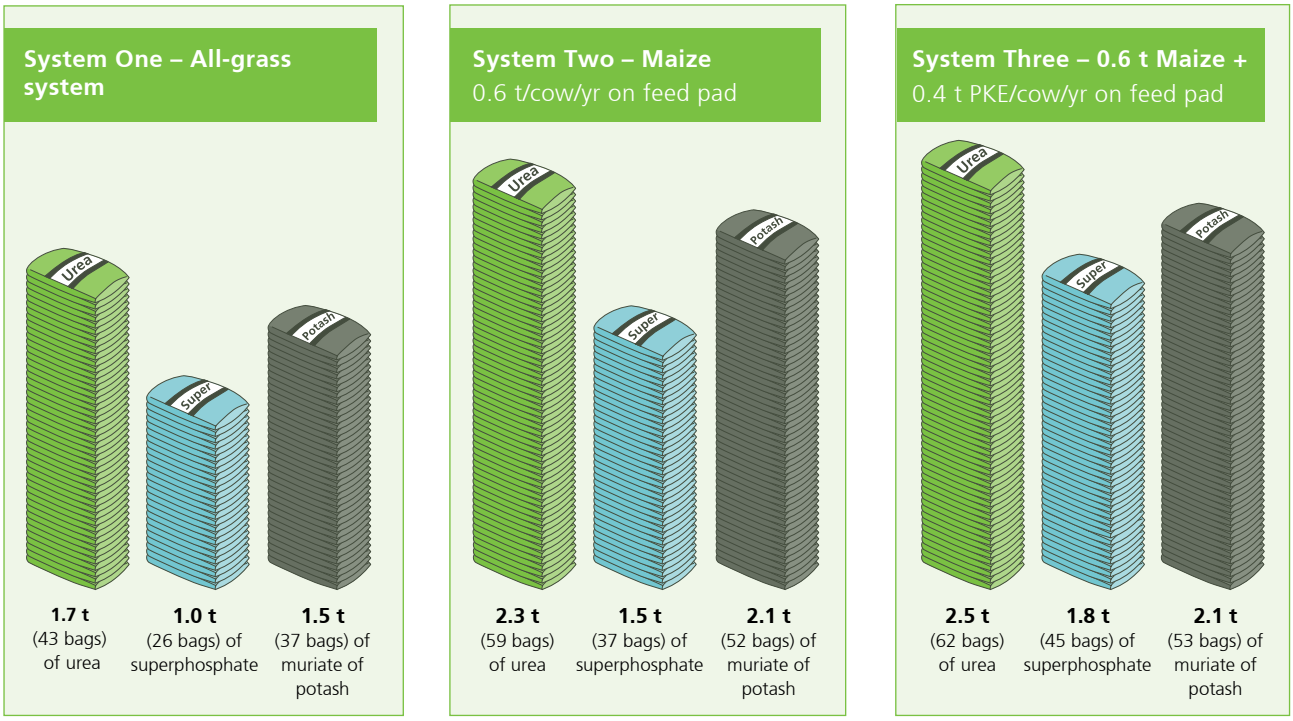
4.4 Nutrient management – know the nutrient loading from effluent application

4.4.1 Nutrient value of effluent

Farm dairy effluent offers a source of nitrogen (N), phosphorus (P), potassium (K), magnesium (Mg) and sulphur (S), as well as trace elements to increase pasture or crop production.

Your nutrient budget will calculate the nutrient inputs and outputs from all sources on your farm. The nutrient value of effluent for your farm is based on stock, feed and management practices. The amount of nutrient coming in can be determined in the budget and this can also be translated to the equivalent fertiliser value.

Solid fertiliser equivalent of effluent from 100 cows under different scenarios



The nutrient content of effluent depends on the effluent solids content, the length of time cows spend on any area that collects effluent, the cows' diet, and the length of time effluent is stored in a pond before it is applied to land.

	Nutrients in effluent from 100 cows (kg/yr)			Effluent area needed to apply 150 kgN/ha (recommended annual loading)	
Effect of time spent on a feed pad (farm dairy effluent plus feed pad effluent – feeding 2tDM/ha of maize silage)					
Time on the pad	**N**	**P**	**K**	**% of farm***	**ha /100 cows***
½ hour per day on pad	838	100	868	14	5.6
1 hour per day on pad	1008	120	1044	17	6.8
2 hours per day on pad	1348	160	1396	22	8.8

* Effective effluent application area excludes waterways/drains/buffer zones and other exclusion areas.

As your farm system changes, for example adding a feed pad; update nutrient budgets to see if you still have enough area in your effluent block to avoid applying too much N and K (see pg 29). Ensure supplement and fertiliser-use are accurately recorded in your nutrient budget.

4.4.2 Taking nutrient samples

To work out the value of nutrient in effluent, collect a sample to send to a lab for analysis. The nutrient content of effluent will vary due to variations in the cows' diet during the season and between seasons, the solids content of effluent (how well agitated the effluent is prior to application), and the length of time the effluent has been stored.

Take the sample from the effluent collected during the depth test (see pg 17). Be sure to take the sample from the irrigator not the pond.

Step 1. Fill a sampling bottle about two-thirds full with the effluent from the jug, squeeze till effluent reaches the top to remove air, and then cap. Name and sample ID the bottle.

Step 2. Keep sample chilled! This is very important.

Step 3. Record your details and the tests requested on the lab's form, attach to the sample, and send to the lab as soon as possible. Useful tests include % DM, total nitrogen (N), phosphorus (P), potassium (K), sulphur (S), calcium (Ca), magnesium (Mg) and sodium (Na).

The DairyNZ *Farm Dairy Effluent Spreading Calculator* can help you find the nutrient application rate for your farm.

4.4.3 Calculating nutrient application per shift

Step 1. Determine total applied. An application depth of 1 mm = 10 m^3 effluent applied per hectare. So, for example, if the average application depth was 18 mm:

AVERAGE APPLICATION DEPTH (MM)				M^3 APPLIED/HECTARE
18 mm	X	10	=	180 m^3/ha

Step 2. Calculate loading. For this example, assume the nutrient concentration from the lab is 0.42 kg nitrogen/m^3

m^3 APPLIED/ HECTARE		Nutrient concentration (kg N/m^3) (from the lab results)		m^3 applied/hectare
180 m^3/ha	X	0.42 kgN/ m^3	=	75kg N/ha

If you are putting on too much nutrient per pass, the fertiliser value is wasted and you risk environmental losses. In this case 75 kg N/ha is too high for plant uptake. Aim to apply less than 50 kg N/ha/pass. Speed up irrigator to apply less effluent, or consider lower rate effluent applicators.

Step 3. Compare

Compare your nutrient loading against your consent, permitted activity rules or Compliance Checklist. The amount of nutrient may be specified as a per event or annual loading. If it is an annual loading you will have to multiply the per pass amount by the number of times the applicator is run in that position.

Using an OVERSEER nutrient budget to size your effluent application area is the most financially and environmentally efficient approach. Application rates based on N-loading requirements may result in excess K. Good practice is to size the effluent block to meet maintenance K application. This can be difficult on medium to high-input systems. The general rule is to avoid grazing springers, calvers or recently calved cows on any effluent paddocks.

4.4.4 Using a nutrient budget to size the effluent application area

Using a nutrient budget to check the nutrient status of your effluent block will ensure you:

- size the effluent block to get the maximum value from nutrients in your effluent
- use fertiliser efficiently
- avoid animal health problems from potassium (K) build-up
- comply with rule/consent conditions regarding N loading
- some regional council consent conditions may also specify the size of your effluent block. Make sure you do not exceed this.

Example of a nutrient budget showing an under-sized effluent block before it is expanded

This nutrient budget is for the effluent block on a 112 ha dairy farm with flat, well drained soils. The effluent block is currently 12 ha. For the example, this regional council recommends a maximum loading of 150kg N/ha/yr to pasture.

Other farm details:

Stocking rate = 3.2 cows/ha

Supplement = 1.3 t/ha grass silage

Production = 975 kg MS/ha

N loading from the effluent and fertiliser added is currently 292 kg N/ha/yr, exceeding the recommendation of 150kg N/ha/yr.

K levels are excessive and can cause metabolic problems

Nutrient budget for effluent original block (12 hectares)

BEFORE

(kg/ha/yr)	N	P	K	S	Ca	Mg	Na	H+
Inputs								
Fertiliser and lime	60	45	0	60	80	0	0	0.0
Farm effluent added	232	28	246	18	37	15	5	-5.7
Atmospheric/clover N	50	0	2	4	2	4	17	0.0
Irrigation	10	0	6	10	37	9	38	0.0
Slow release	0	3	4	0	3	5	6	0.0
Supplements imported	39	3	33	3	7	2	2	-1.2
Outputs								
Product (milk, meat, fibre)	68	11	17	4	14	1	5	0.0
Net transfer	39	4	38	3	6	2	1	-0.9
Supplements removed	0	0	0	0	0	0	0	0.0
Atmospheric	86	0	0	0	0	0	0	-0.6
Leaching/runoff	33	1	68	75	70	16	54	-2.4
Net immobilisation/absorption	165	29	0	13	0	0	0	-0.6
Change in inorganic soil pool	0	35	168	0	75	16	8	-2.5

The increase in P in the soil pool is predicted to raise the Olsen P by 3.5 units per year. This may raise P above optimum levels, depending on soil test values.

Recommendation: The effluent area must be increased to lower K and N loading, and current fertiliser application is excessive. The following example shows the effect of increasing the effluent area from 12 to 19 hectares, reducing P fertiliser and cutting out extra N fertiliser on the effluent block.

N loadings of 146 kg N/ ha/yr with no additional N fertiliser are now within the recommended loadings.

Effluent K levels have been reduced significantly but are still above pasture requirements. Using the effluent block for silage or a crop will reduce pasture K levels and lower the risk of metabolic problems.

Nutrient budget for an expanded effluent block (19 hectares)

	(kg/ha/yr)	N	P	K	S	Ca	Mg	Na	H+
AFTER	**Inputs**								
	Fertiliser and lime	0	20	0	60	80	0	0	0.0
	Farm effluent added	146	18	156	11	23	10	3	-3.6
	Atmospheric/clover N	81	0	2	4	2	4	17	0.0
	Irrigation	10	0	6	10	37	9	38	0.0
	Slow release	0	3	5	0	3	5	6	0.0
	Supplements imported	39	3	33	3	7	2	2	-1.2
	Output								
	Product (milk, meat, fibre)	68	11	17	4	14	1	5	0.0
	Net transfer	39	4	39	3	6	2	1	-0.9
	Supplements removed	0	0	0	0	0	0	0	0.0
	Atmospheric	60	0	0	0	0	0	0	-0.3
	Leaching/runoff	27	0	58	71	66	16	54	-1.9
	Net immobilisation/absorption	81	28	0	11	0	0	0	-0.3
	Changes in inorganic soil pool	0	1	90	0	66	10	6	-1.3

Soil P is not predicted to change much under this scenario, as inputs and outputs are balanced. Using the nutrient budget to reduce fertiliser inputs will result in savings for the farm.

4.4.5 Sizing your effluent area to meet potassium (K) maintenance levels

Over time, K levels on effluent blocks can become elevated. This can increase the potential for metabolic problems in cows at calving/lactation. Sizing the effluent area to meet maintenance K levels is good practice and N application rates will be well within council requirements.

Potassium is a valuable element, so making full use of levels contained in effluent can reduce your K fertiliser bill. Management considerations for K levels are:

- aim to keep K levels below soil test level QTK 10
- avoid grazing effluent irrigation areas with the springer herd and recently calved cows. Where this is not possible, take additional measures to prevent metabolic disorders, such as increasing magnesium supplementation
- take herbage samples – they shouldn't exceed 3-3.5% K. Adjust feed/supplementation in consultation with a farm consultant or veterinarian if necessary
- harvest silage or hay off your effluent blocks to reduce K levels, if levels are very high, consider a crop such as maize.

5. Collection and pond storage

Having adequate storage offers flexibility for effluent application to fit around farm activities and irrigation conditions.

Key points for effluent collection and storage:

- collect effluent from all sources in a sealed storage facility
- reduce the water volume of effluent where you can
- have enough storage to meet management and compliance requirements
- keep storage as empty as possible to make the most of the capacity you have when you need it.

5.1 Sealed facilities

Storage facilities must be sealed so they do not leak or allow contaminants to seep out. All areas where effluent or leachate is stored should be sealed to prevent leachate losses to groundwater. Avoid placing effluent storage facilities in sites with high water tables or a risk of flooding.

The use of well installed and guaranteed synthetic (e.g. plastic, rubber or concrete) liners is recommended. You may be asked for a producer statement to demonstrate the pond and liner can meet the construction and sealing requirements for your district or regional council.

See the DairyNZ publication *Farm Dairy Effluent Pond Design and Construction* for more information about storage and sealing.

5.2 Storage capacity

You need enough storage for:

- rainy periods when the soil is too wet to irrigate
- busy periods when farm labour is stretched and you do not want to irrigate
- equipment failures (pumps or irrigator) when you cannot irrigate.

Adequate storage will allow you to keep effluent for use when nutrients are most needed (i.e. drier months or when putting down a crop).

5.2.1 The Dairy Effluent Storage Calculator

A *Dairy Effluent Storage Calculator* has been developed by Massey University and Horizons Regional Council to allow calculation of effluent storage volume requirements.

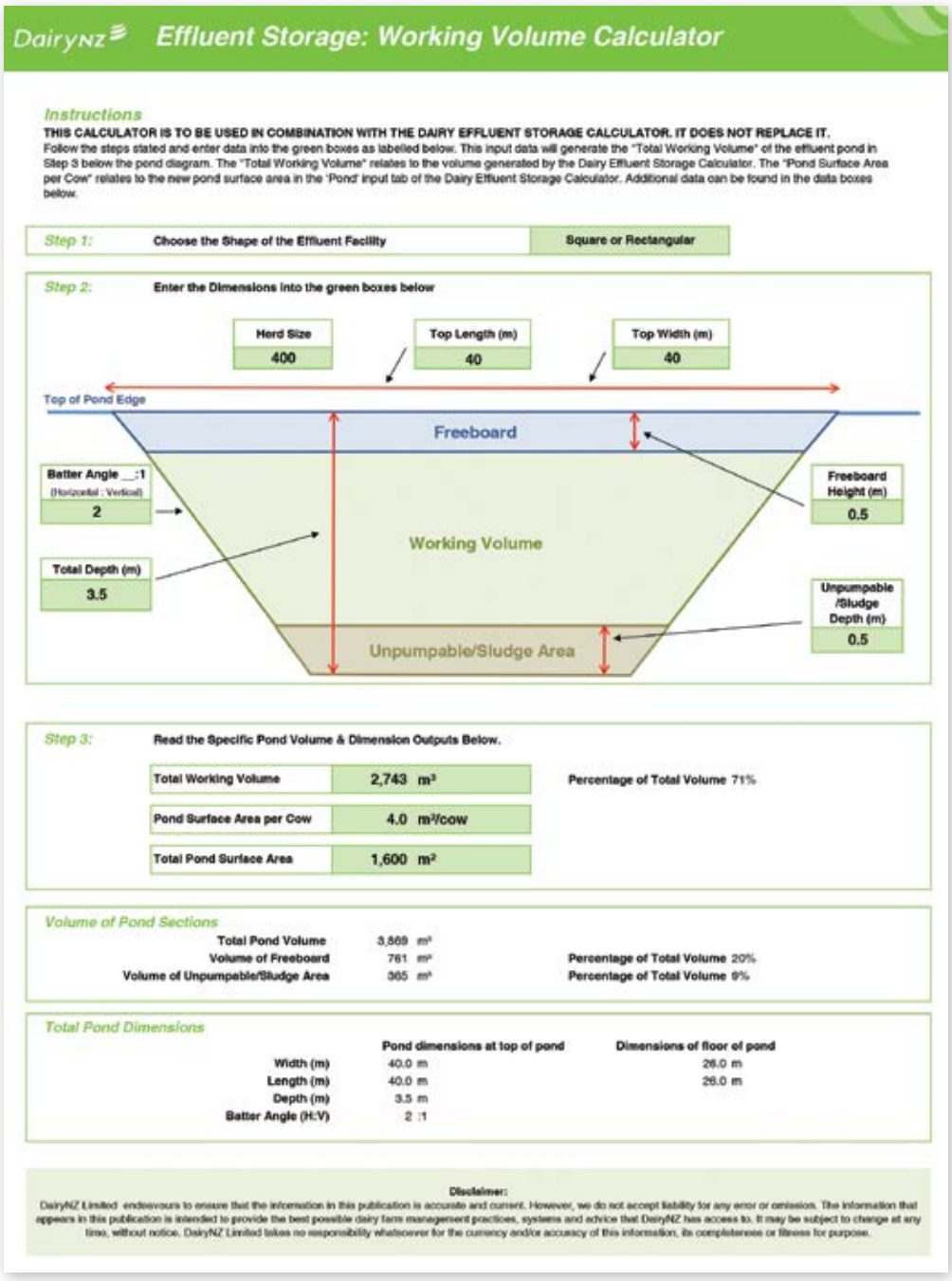
The calculator uses farm specific data such as:

- soil risk for effluent irrigation (high risk, low risk soil types, see pg 14)
- milking routine (number of cows, water use in the dairy, etc.)
- rainfall catchment area – what is the total surface area collecting rain water and directing it into the storage facility
- storage facilities currently on farm
- irrigation system and equipment
- climate (annual daily rainfall).

The *Dairy Effluent Storage Calculator* provides a storage volume recommendation based on the daily rainfall events over the last 30 years and the number of days conditions would have been suitable to apply effluent.

The *Dairy Effluent Storage Calculator* is available in all regions. DairyNZ recommends you take storage volume advice from a qualified and reputable consultant. Contact your regional council, your milk processor or DairyNZ to find a suitable person to do the calculation for your farm.

5.2.2 Effluent Storage: Working Volume Calculator



A screenshot of the Effluent Storage: Working Volume Calculator

DairyNZ has developed a calculator to find the dimensions and working volume of your existing effluent pond or tank. The calculator can be found on the DairyNZ website dairynz.co.nz/effluent-storage with the other Effluent resources under the Environment tab. This should be used in combination with the effluent storage volumes generated from the *Dairy Effluent Storage Calculator* or for calculating the working volume of existing ponds or tanks.

NOTE: this tool does not calculate your effluent storage requirements, but it can be used to find dimensions for a volume obtained from the *Dairy Effluent Storage Calculator*.

5.3 Managing storage volumes

Pond levels throughout the year

Having an empty pond will give you the capacity you need when you can't irrigate because of unsuitable conditions, or if you have factored in extra storage for times of year such as calving.

A full pond may overflow or cause odour problems, and may result in financial loss as you lose control of effluent and capital investment tied up in the pond.

Seasonal targets

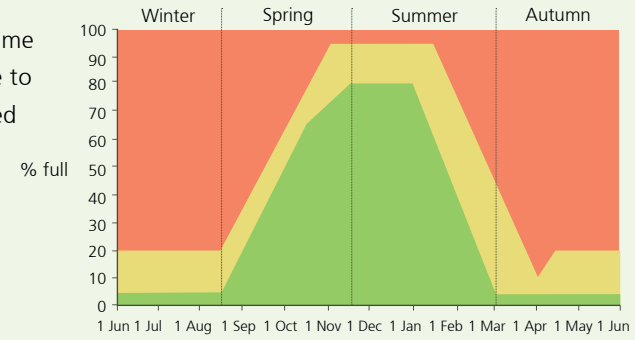
Spring – the pond is filling with effluent, particularly during wet weather, or when the farm team are too busy to manage the effluent system. Small volumes of effluent can be irrigated as soil water deficits allow

Summer – the pond should be kept as empty as possible

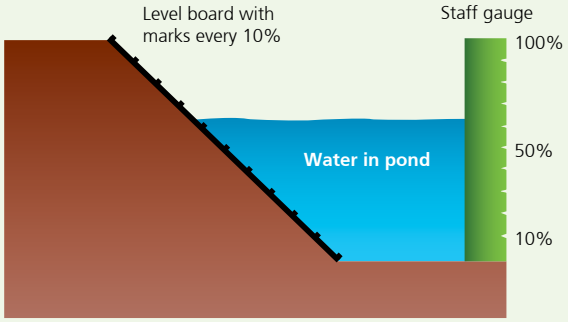
Autumn – the pond should be maintained at a low level through autumn. It is important to try and get the pond as empty as possible while conditions still permit

Winter – the pond should be kept as empty as possible. Where possible prevent stormwater entering the pond, off unused yard areas etc. Any areas contaminated with dairy effluent cannot be diverted.Consider using the safety escape ladder for your pond level marking system.

Ideal storage volume targets as a guide to managing deferred irrigation



Construct a water level gauge to help measure the volume of effluent stored in a pond



The designer/installer of the system should be able to help set this up, and mark out the different gauge levels. Bear in mind that if the pond has a sloped side where the bottom of the pond is narrower than the top (as in the diagram above), then the halfway-mark on the ladder won't be the same as 'half full'. Train the staff about how to use the gauge for decision making.

The *Effluent Storage: Working Volume Calculator* can be used to find the gauge level depths.

5.4 Minimising the volume of effluent to manage

Reducing effluent volume will save time and money on handling and pumping effluent, as well as reduce the amount of storage you require.

Ways to reduce water use:

- guttering and downpipes to direct roof water away from the effluent collection system
- bund the concrete tanker apron to prevent water from the tanker loop flowing onto it
- if permitted by your council, use a stormwater diversion system to take clean rainwater off the yard into stormwater drains and not into the ponds
- if you are standing your herd off, consider a system that requires less water for effluent collection (e.g. bark peeling pad or a barn system with slats/bunkers to collect effluent
- in high rainfall areas, consider covering and diverting the roof water from large feed and standoff pads to reduce the catchment area for the effluent system
- pre-wet the yard before milking to speed up the hosing process
- use a rubber scraper to remove solids before hosing
- low water-use backing gate wash-down options
- look at ways to reduce the water usage on the milking platform – e.g. water used to get cows off platform, and automatic cup wash systems and repair any leaks
- consider using recycled water for flood wash systems for yard and pad wash-down. There are strict food safety guidelines for this relating to minimum distances and water quality and method of application. Contact your milk quality advisor from your dairy processor before going ahead with this option.

5.4.1 Stockmanship

Good stockmanship will help reduce the amount of effluent generated. To help with this:

- plan herd management so that stock spend less time in the yards and dairy
- eliminate slippery surfaces and sources of excessive noise or stray voltage in the yards
- train staff in good stockmanship practices.

5.4.2 Stormwater diversion

When used properly, a stormwater diversion system will reduce the volume of effluent you need to manage. Stormwater diversion systems can only be used when the yards or feed pads are completely clean but roof water can be delivered all year. Stormwater must be diverted prior to the stone trap. The best systems are close to the dairy and have a visible reminder for staff. Train staff in the use of these systems. Reminders can include:

- an ear-tag on the vacuum pump switch which has to be moved before milking
- a flashing light visible from the farm dairy and yard area
- a flag system on the yard gate latch, which has to be moved to open the yard gate
- diversion system connected to dairy plant power / pump switch.

See the DairyNZ publication *Farm Dairy Effluent Pond Design and Construction* for more information about storage and sealing.

FIND OUT MORE

Smart Water Use Resources
Order or download from dairynz.co.nz

5.5 De-sludging and de-watering effluent solids

Large storage ponds

A stirrer system which continuously agitates the entire storage facility will keep all solids in suspension and remove the need for desludging. Consult your effluent system designer for advice on your system, as stirrers need to be matched to liner type.

Remember to inform anyone doing any maintenance work on the pond what kind of liner is present. A damaged liner can be an expensive mistake.

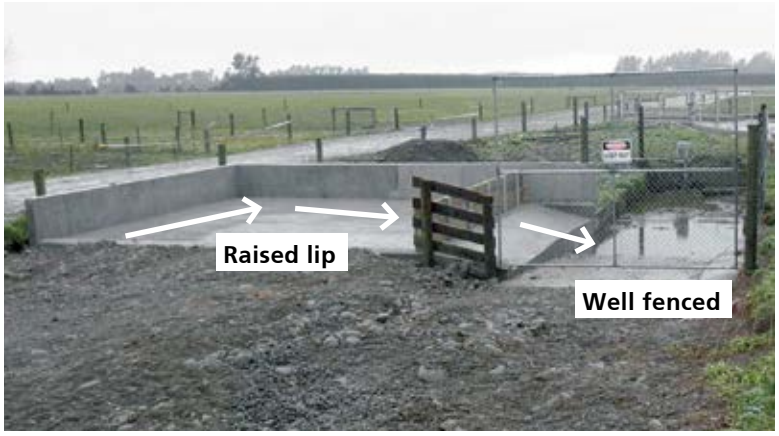
- Prior to desludging, stir the pond to mix the various layers of the pond before emptying (caution: wave action created by pond stirrers can damage clay liners)
- Solids should be stirred and sucked out with a hose to minimise risk of damaging the pond liner. Do not use excavation equipment for desludging lined ponds due to the risk of damaging the liner
- Sludge usually has a higher nutrient content than liquid effluent, so application rates need to be lower. See 6.1.3 pg 36 for more on applying solids to land.

Check the nutrient concentration before application if you can. This applies whether you or a contractor are applying the sludge. Higher application depths may be used on crop areas due to the higher nutrient removal. This can be calculated on the DairyNZ *FDE Spreading calculator*.

- Allow for at least a 10-day stock withholding period before grazing.

Stone traps and sumps

Stone traps need to be emptied regularly to perform well. A concrete dewatering pad should be built adjacent to the storage facility with all liquids draining back into the system.



Concrete pad for dewatering stone trap solids.

FIND OUT MORE

DairyNZ FDE Spreading calculator
Order or download from dairynz.co.nz

6. Stand-off areas and feed pads

Stand-off areas and feed pads should include an effluent management system providing:

- sealed storage areas for any solid effluent scraped off the area (e.g. sawdust, manure)
- sufficient capacity in your storage and application system for additional liquid effluent
- sealing, bunding and collection of liquid effluent from the pad so that it cannot drain into groundwater or surface water. Sealing means that the pad does not leak; sealing is usually achieved with fit-for-purpose synthetic liners such as concrete, rubber or plastic. Drains underneath soft surfaces should have a sealed layer below them and should direct effluent to a storage system. The use of unsealed stand-off areas or "sacrifice paddocks" should be avoided.

Different surface materials (such as concrete, limestone, wood chip, bark or sawdust); require different management. Some wood-based products are highly absorbent and can be scraped and composted or spread to land. But you may still be asked to demonstrate that you have an appropriate seal and collection system beneath the pad to ensure no effluent is reaching groundwater.

Effluent from feed pads must not run off to waterways or leak into ground water.

Slatted concrete floors where effluent collects and dehydrates before removal.

6.1 Including a feed pad or stand-off area in your effluent system

When adding a feed or stand-off pad to your farm, you will need to upgrade the effluent system to cater for the higher volume, nutrients and solids content. Plan your effluent system around a high-use scenario to allow for future flexibility.

To cope with the increased load on your effluent system, you may need:

- extra storage for liquid and solid effluent
- a means of removing the solids and fibrous material from the effluent before irrigating
- a plan for handling and spreading solid effluent products (including access to land and machinery)
- more irrigation area to deal with the extra volume and nutrients.

Talk to your regional council prior to putting in a new feed pad or stand-off pad to check if there are any resource consent or rule implications.

FIND OUT MORE

Stand-off Pads: your essential guide to planning, design and management
IPENZ Practice Note 27 Dairy Farm Infrastructure Part 5: Feedpads
Order or download from dairynz.co.nz

6.1.1 Dealing with more effluent from feed and stand-off pads

A pad can generate up to ten times the effluent coming from a farm dairy, depending on:

- the size of the pad and cow numbers
- the time stock spend on the pad
- the feed given, and any lost feed
- cleaning methods (scrape vs. wash) and wash-down frequency
- exposure of the surface to rainfall.

You can reduce effluent volume from the pad by:

- using a stormwater diversion system when the pad is clean
- covering the pad
- designing the pad for scraping to reduce the frequency of wash-down
- using recycled yard water for wash-down.

6.1.2 Coarse solids from feed and stand-off pad effluent

Effluent from pads includes coarse solid materials and grit which can cause blockages and wear in the effluent system.

Solids washed off the pad can be:

- held behind a weeping wall structure
- removed with mechanical solids separators
- settled out in a separate pond with a baffle or T-piece outlet to retain the solids.

Settling ponds receiving effluent from a feed pad will need to be sealed, and will require more frequent desludging Retained solids can be dried on a sealed surface and spread on land at a suitable rate to avoid nutrient overloading.

6.1.3 Applying effluent solids to land

Effluent solids need to be spread at a much lower depth than normal effluent to account for the increase in nutrient value, and the high solids contents will blind the soil surface. Effluent sampling prior to application, use of the DairyNZ *FDE Spreading calculator* and your nutrient budget, will help to work out the area you will need to spread solids to comply with council rules and good practice. Rest pasture for at least 10 days, or as long as possible between application of solids and grazing for stock health and pasture palatability reasons.

Treat effluent solids as a fertiliser asset and consider incorporating them into cultivated land for crops.

Note that some of the N will be separated out with the solids, but much of the K is soluble and will remain in the liquid. Test the liquid portion of effluent for K content.

Do not to apply solid effluent to any soils not suitable for liquid effluent irrigation. Spreading effluent solids should follow the same distances from waterways and buildings as liquid effluent. Ideally solid effluent should be applied uniformly across the area covered.

DairyNZ has developed a calculator to help you calculate a suitable application depth or volume/ha for effluent solids. This uses either your own lab test results or a best guess based on lab test results from other samples. To download the tool go to: dairynz.co.nz/effluent-management.

The longer cows spend on a feed pad, the greater the volume of effluent and its value as a fertiliser.

6.1.4 Farm Dairy Effluent (FDE) Spreading Calculator

DairyNZ **Farm Dairy Effluent (FDE) Spreading Calculator**

Quick Calculator

Use this calculator before applying effluent to land. You can estimate the nutrient loading and recommended application rates to achieve your nutrient requirements. Complete the green boxes below.

Step one:
Select an option 1-8 from the blue box which matches your **effluent type.**

2

Step two:
Select a spreading option to base the calculations on. Either a desired nutrient loading (kg N/ha), OR a desired application depth (mm).

kg N/ha

Effluent Type	Effluent Description	If you have tested your own effluent sample insert the results into the calculator to the right. DM%	%N	%P	%K
1	Your Lab Test Results	18.7	0.5	0.12	0.5
2	Farm Dairy Effluent	0.8	0.045	0.006	0.035
3	Feed Pad -Slurry	4	0.15	0.03	0.1
4	Feed Pad- Liquid (post separation)	0.3	0.025	0.003	0.03
5	Feed Pad- Solids (post separation)	20	0.45	0.08	0.2
6	Stand Off Pad Solids	25	0.2	0.15	0.2
7	Wintering Pad Scrapings	15	0.2	0.03	0.075
8	Wintering Shelter Bunker	20	0.5	0.2	0.75

These nutrient values are taken from the DairyNZ Facts and Figures Guide book and work done by AgResearch and DairyNZ. They are provided to give an estimate of nutrient concentration in effluent for land application. Accurate calculations can only be derived by obtaining a representative sample of the effluent being applied and having them tested for nutrient content.

Step three:
Enter the N application rate you want to achieve in the yellow box (right). Base this on Regional Council rules, consent conditions, or good practice. e.g. 50 kg N/ha. (Press Enter to calculate)

50 **kg N/ha**

To achieve this N loading you need to apply the application rate or depth in the grey box below.

Application Rate	Application Depth
111.1 m^3/ha	11.11 mm

If your application depth is too high for your regional council rules or effluent consent try a lower N loading.

Also applying

Phosphorus	Potassium
6.7 kg P/ha	38.9 kg K/ha

A screenshot of the Farm Dairy Effluent Spreading Calculator.

7. The farm team

The importance of effluent management needs to be highlighted to the whole farm team.

A lack of time or knowledge in the effluent system's operation and maintenance are key causes of system failure and potential non-compliance regardless of the sophistication/quality of the effluent infrastructure. Owners (including absentee owners), sharemilkers, managers and staff can be all held responsible for effluent non-compliance.

> See **dairynz.co.nz/effluent-management** for a series of tools and resources to use with your farm team including training and recording templates, posters and operation guides for travellers and low rate systems.

Good practice for farm teams includes:

- setting clear expectations around effluent management in staff contracts, job descriptions and sharemilker agreements – including daily tasks and supervision responsibilities
- acknowledging and rewarding good effluent management through staff performance and incentive systems
- having rosters for daily effluent tasks and routine maintenance with names assigned to each one
- posting the consent conditions on the wall of the farm dairy.

7.1 Orientation and training

An orientation and training package for every team member should include:

- the health and safety risks, and good practice around the effluent system
- a walk-through of the system, including important daily jobs
- explaining the effluent consent conditions as they affect each staff member and their level of responsibility
- explaining the scheduled maintenance tasks and how and when to do them
- clarifying responsibilities and who to ask if a staff member is unsure what to do
- problems to look out for and basic troubleshooting
- a buddy system for an initial period where new staff are closely supervised
- contingency plans for what to do when things go wrong, e.g. who to call, back up equipment.

The AgITO provide entry and manager level courses for effluent management. Your effluent system designer or installer may also be able to provide on-farm training on your system with the farm team.

7.2 Farm team effluent management plans

An effluent management plan covers the effluent related tasks, and who will be responsible for doing them. The plan also covers basic trouble-shooting, including what to do, and who to call when something goes wrong.

Plan ahead and make arrangements in advance, so that accidents and breakages can be managed before there is an environmental risk. For example, keep spare hose clips, nozzles, seals, grease and other items which may be required if there is a breakage.

For bigger issues, consider making an agreement with neighbours about equipment which could be borrowed in an emergency situation, e.g. backup pumps, generators, slurry wagons, irrigators and front end loaders.

Make sure that staff know that the most important issue after their personal safety is to make sure that effluent does not reach waterways.

These details need to be kept up-to-date at the dairy or staff notice board.

Use the DairyNZ *Effluent Management Plan* poster to tailor to your own system and hang it in the dairy. Go to **dairynz.co.nz/effluent-management.**

FIND OUT MORE

The DairyNZ HR toolkit
The DairyNZ Compliance Toolkit- Staff Orientation Checklist and Staff Records
A Staff Guide to Operating Your Effluent System
Top Tips for Effluent Irrigators Poster
Irrigator Run sheet template
Effluent Management Plan Poster
Effluent Pump Maintenance Hazard
DairyNZ Farmfacts
Order or download from dairynz.co.nz

8. Safety around the effluent system

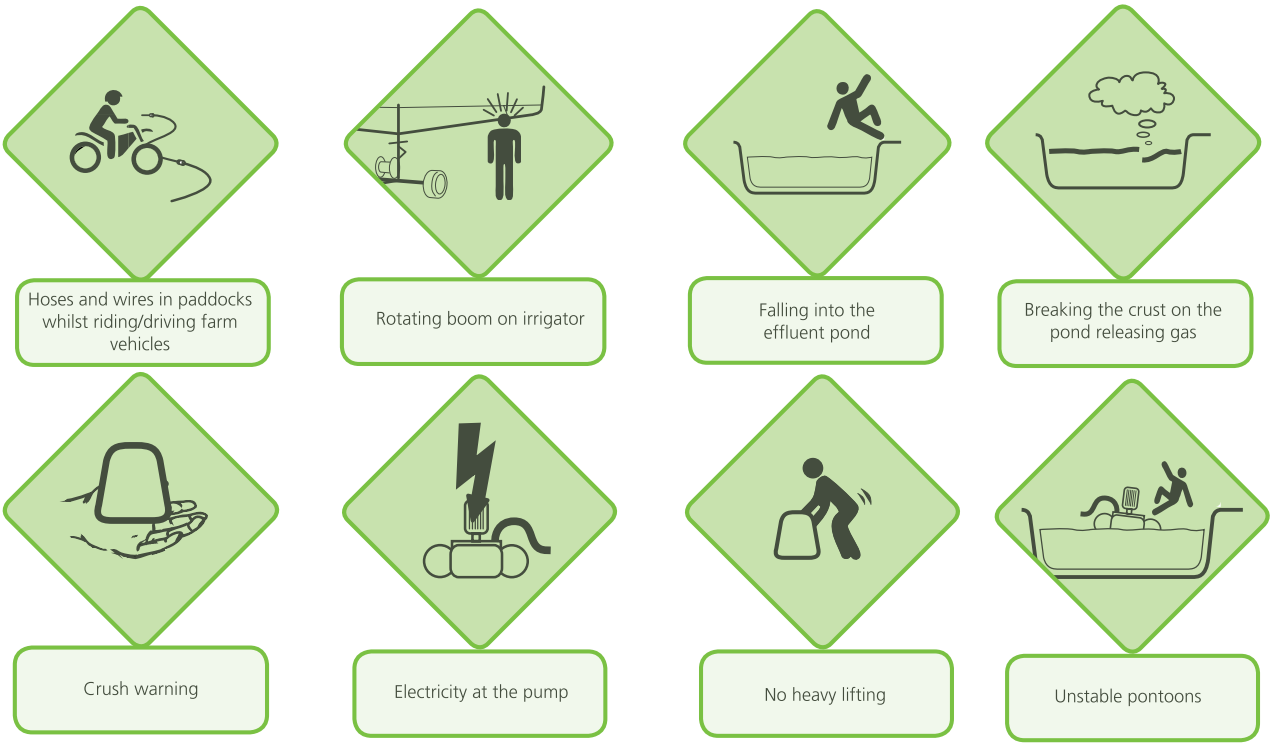
Every year people are seriously injured or killed carrying out everyday tasks on farms. The effluent system is a particularly hazardous area. A Health and Safety Plan is a legal farm requirement. Use the DairyNZ *Compliance Toolkit* **(compliancetoolkit.co.nz)** to ensure you meet your obligations to keep people safe on your farm.

A health and safety induction is an important first step when bringing people onto the farm, including new staff and contractors.

Practical things to consider when designing or managing your effluent system include:

- training for system-operators relating to safe operation and maintenance of the effluent system. Safety information, including emergency protocols, should also be covered in the farm operations manual and included in farm induction
- making sure staff and visitors are aware of hidden hazards, like pipework, wire ropes, hydrants in the paddock and overhead or buried power lines. Provide a mainline and electrical cables map where possible
- earth all electrical equipment
- turn off and secure moving parts when shifting or checking irrigators (boom arms, etc.)
- guard moving parts on pumps or machinery
- use non-slip surfaces next to storage facilities
- install barriers or fences around ponds, sumps, stone traps, sludge bunkers or weeping walls
- stabilise pontoons and have an approved gantry for servicing pumps and stirrers. Never allow staff to get on pontoons without supervision, any maintenance around ponds, stone traps and sumps should be done in pairs
- ensure exit/rescue options are in place, e.g. ropes and ladders for effluent storage facilities.

Potential hazards of effluent irrigation



FIND OUT MORE

DairyNZ Farmfacts
Order or download from dairynz.co.nz/farmfacts

9. Working with effluent spreading contractors

9.1 Keeping contractors safe

The DairyNZ *Compliance Toolkit* has templates for creating health and safety induction sheets for contractors. Most contractors should have their own health and safety plan, but it's important to point out any hazards particular to your farm and secure their working environment by turning off power and pumps while anyone is working around the system.

9.2 Environmental compliance

No matter who is applying the effluent, consent conditions and permitted activity rules still apply. Farm owners and contractors can both be liable for non-compliance.

It is important to tell the contractor what is required in writing. Make the following clear:

- health and safety considerations specific for your farm
- care with pond liners
- maximum application depth (depending on solids and nutrient content of the effluent)
- no ponding or runoff to waterways
- all regional council rules or consent conditions (refer to the *Compliance Checklist* for more detail about the rules).

It is recommended not to apply solid effluent to any soils not suitable for liquid effluent irrigation. Spreading effluent solids should follow the same distances from waterways and buildings as liquid effluent. Ideally solid effluent should be applied uniformly across the area covered. Make your expectations and requirements about this explicit to contractors.

Employment contracts for services

When employing casual or contracted service providers, it is recommended that farmers seek legal advice for drawing up contracts. This can help to ensure that the contractors are suitably qualified to do the work and have insurance and good operating procedures. Federated Farmers have contract templates available for purchase on their website (**fedfarm.org.nz**).

Communication

To complement the employment contract, there is a DairyNZ *Effluent spreading contractors*' communication template for farmers to use with contractors (included on the Compliance Toolkit website). This is a way to provide contractors with important instructions and any special care requirements such as what type of pond liner is present. Providing clear instructions in writing can help ensure you get the exact service you are expecting. The communication template can be used to meet some of the points listed above.

9.2.1 Calculating the depth and volume of effluent solids to apply

For high-solids effluent such as sludges and slurries at the bottom of ponds, and weeping wall solids; the application depth will need to be less than normal effluent to account for the additional nutrient loading.

Good practice is to test the nutrient content of effluent prior to application to calculate a suitable depth. For example, an effluent consent may state that effluent can be applied to a depth of 20 mm, but based on nutrient testing an appropriate depth of application for solids may be 5 mm.

DairyNZ has developed a calculator to help you find the suitable application depth or volume/ha for effluent solids for your farm. This uses either your own lab test results or a good estimate based on lab test results from other samples. To download the tool go to: **dairynz.co.nz/effluent-management**.

FIND OUT MORE

The Compliance Checklist
Download from dairynz.co.nz/effluent-compliance

10. Operating and maintaining an effluent system

Principles for smooth operation of the effluent system:

1. plan ahead, discuss pond level, soil conditions, weather forecast, etc with team regularly
2. stay on top of maintenance so it doesn't get on top of you
3. adjust your plan according to conditions (e.g. soil moisture, weather or labour availability)
4. set up your irrigation system properly for optimum performance (observe that it is actually going before you leave)
5. don't "set and forget". Be vigilant – use cell phone reminders to come back and check.

10.1 Irrigator run sheets and calibration recording

Check your council rules/resource consent or *Compliance Checklist* to see what types of records are required.

Records can help in the following ways:

- to avoid applying effluent to the same area too many times, and optimise nutrient use
- to ensure maintenance gets done
- for compliance – to show that any issues with the irrigator have been fixed quickly or to demonstrate that farm infrastructure has been built to meet compliance requirements, e.g. pond or stand-off pad sealing standards.

Keeping records of effluent application

During the season, record actual effluent application runs, noting when each shift occurred and observations about soil conditions. Adjust the plan accordingly. Keep a running log sheet to record applications (an example of a DairyNZ template is shown below).

Effluent application recording sheet example

Paddock	Date	Run number	Signature	Comment (e.g. signs of ponding or runoff)
1	*15/8/10*	*7*	*FNP*	
1	*16/10/10*	*8*	*FNP*	
1	*12/12/10*	*4*	*WJP*	
2	*6/9/10*	*10*	*WJP*	*Ponding at south end, too wet?*

Make planning, setting up and recording runs easier. Mark irrigator runs by painting the top of fence posts or attaching numbered ear tags or ice-cream container lids to them. This also works well for lines of sprinklers.

Keep the day-to-day records in an easy access location such as a folder in the dairy, so that they are more likely to be used. Alternatives to using this template include use of the Fonterra Dairy Diary or photocopies of farm maps with a new sheet for each month. The farm team can date and draw the runs onto each paddock as the irrigator is shifted.

FIND OUT MORE

A Staff Guide to Operating Your Travelling Irrigator
A Staff Guide to Operating Your Low Rate Application System.

Irrigator run sheet template
Order or download from dairynz.co.nz

10.2 Tips for operating a travelling irrigator system

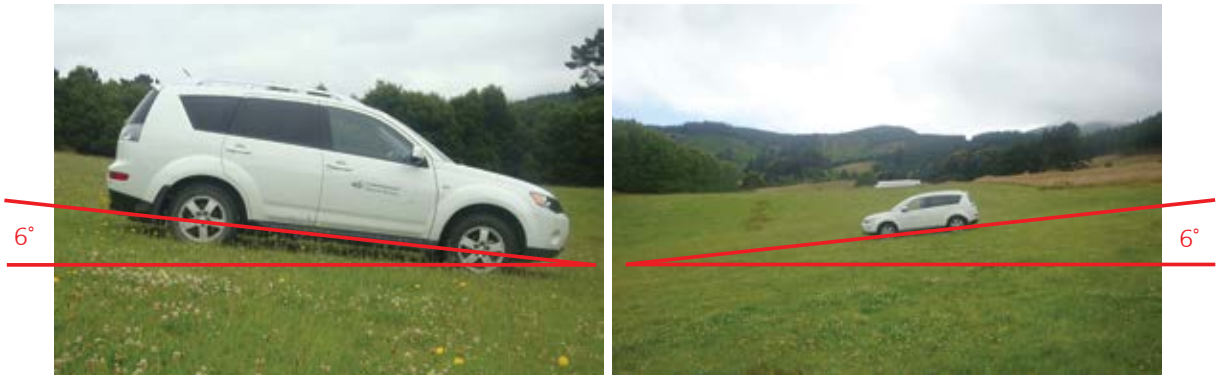
DairyNZ has a guide for the operation of a travelling effluent irrigation. The guide is designed for farm staff and covers setup, maintenance and trouble shooting. Below is a summary of tips for travelling irrigators.

Travelling irrigator application depth varies according to the speed they travel (faster speed = lower depth applied). Good practice is to run the irrigator on its fastest setting. Correct hose layout is critical for optimal travelling irrigator performance.

Avoid using travellers on slopes

Travelling irrigators are not recommended for use on slopes great than 7˚, as these soils are categorised as high risk (see page 14 for more about soil risk categories). Low application systems such as sprinklers are preferred to cover these areas.

A 7˚ slope is gently rolling country. See the diagram below depicting a vehicle on a 6˚ and 14˚ slope.



A 6˚ slope – this is the upper limit of what a traveller should be used on, to manage effluent runoff risks.

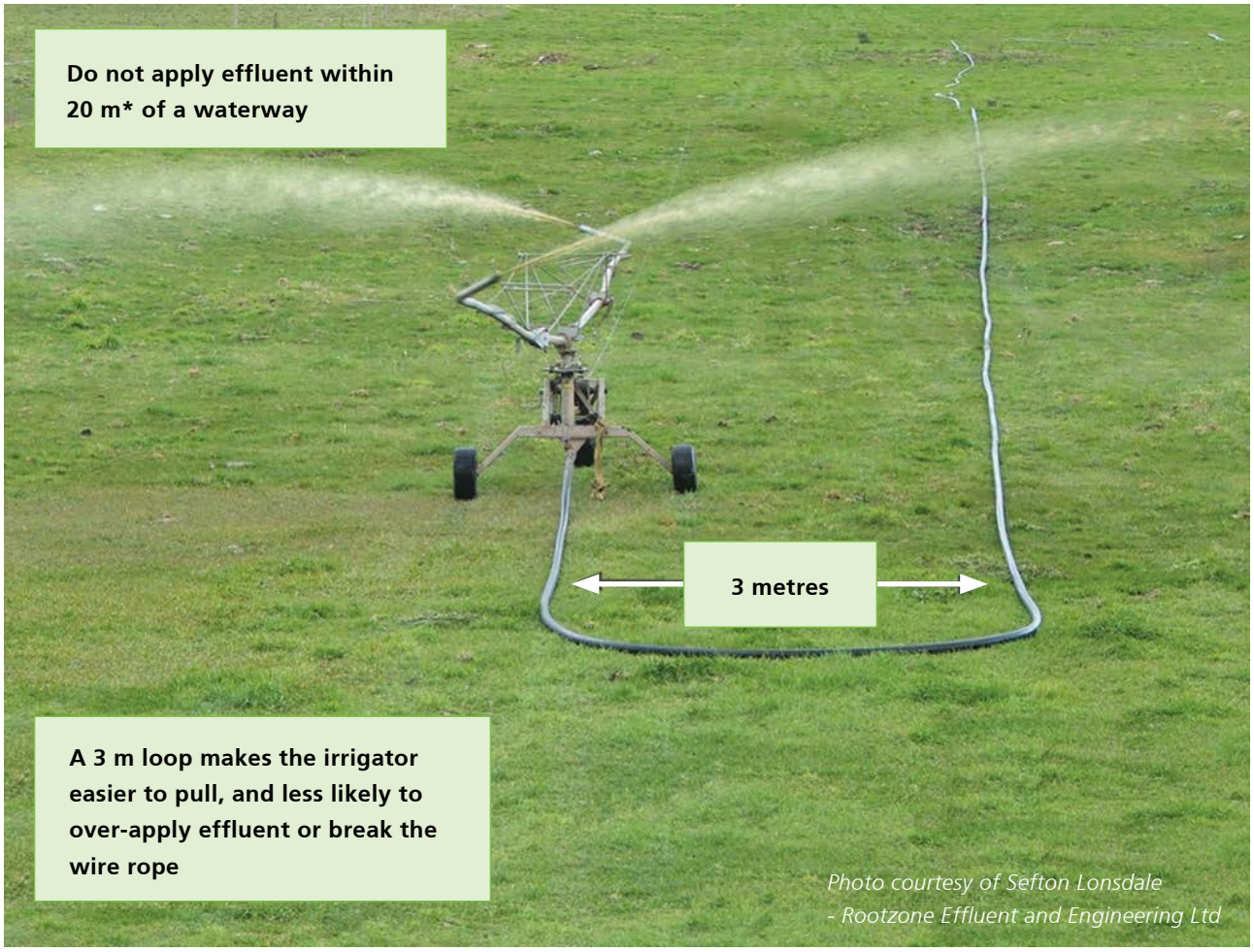
A 14˚ slope – this is too steep for irrigation with a travelling irrigator, a suitable low rate system should be used instead.

Operational tips

The drag hose can be very heavy, especially if it is too long; this can cause excessive wear on the gears and over application of effluent. Keeping the hose loop tight behind the irrigator will reduce drag. Here are some additional considerations:

- the wire rope should be well secured away from waterways
- camlock couplings should face the opposite direction the hose is pulled to stop them getting caught and breaking off
- be sure you have enough run length left for the time you plan to irrigate
- set a reminder on your cell phone to tell you to shift the irrigator

- when shifting to the next spot, tow the irrigator no faster than walking pace
- replace irrigator nozzles every time you replace the rubberware in the dairy, or earlier if they are split, perished or they have stretched
- ask your effluent service and maintenance expert to do a pressure test at the irrigator at the furthest point from the pump to make sure there is enough pressure to drive the traveller.



See pg 17 for more on measuring the depth and rate of application for travelling irrigators.

FIND OUT MORE

Top Tips for Effluent Irrigators Poster
A Staff Guide to Operating Your Effluent Irrigation System
Order or download from dairynz.co.nz

* In some regions like Otago, there must be a 50 m buffer between effluent application and waterways. Be familiar with your regional council rules.

10.3 Tips for operating a low application sprinkler system

Low rate systems such as sprinklers and pods suit a wide range of situations, and are particularly useful for irrigating on high risk soils. See page 14 for definitions of high and low risk soils with regard to effluent management.

Sprinkler systems usually have fixed application rates. The application depth is controlled by the length of time the effluent is applied. Sprinkler systems with timing control can be pulsed, e.g. 15 minutes on and 45 minutes off, giving control over the total depth applied and the hourly rate. Spacing and pressure must be correct with these systems.

Any reduction in pressure at the irrigator can result in effluent being applied at higher application depths and rates. This can result from:

- low pump capacity or poor pump performance
- nozzle damage
- too much hose or incorrect hose layout.

After starting your applicator, visually check that it appears to be operating at the correct pressure by observing the width of the diameter of the wetted area created by the spray.

Period of time between moving pods to achieve 15 mm depth

Know your system's application rate, then use the table below to determine the length of time between moves.
For example: If you run your system 20 min on / 20 min off and your application rate is 4 mm per hour you could leave the pods 7.5 hours before moving.

Minutes operating		Your system's average application rate per hour								
		2 ml	3 ml	4 ml*	5 ml	6 ml	7 ml	8 ml	9 ml	10 ml
On	off	Period of time between moves (hrs)								
15	15	15.00	10.00	7.50	6.00	5.00	4.25	3.75	3.25	3.00
15	30	22.50	15.00	11.25	9.00	7.50	6.50	5.75	5.00	4.50
15	45	30.00	17.25	15.00	12.00	10.00	8.50	7.50	6.75	6.00
20	20	15.00	10.00	7.50	6.00	5.00	4.25	3.75	3.25	3.00
20	40	22.50	15.00	11.25	9.00	7.50	6.50	5.75	5.00	4.50
30	30	15.00	10.00	7.50	6.00	5.00	4.25	3.75	3.25	3.00
60	60	15.00	10.00	7.50	6.00	5.00	4.25	3.75	3.25	3.00
On continuously		7.50	5.00	3.75	3.00	2.50	2.00	1.75	1.75	1.50

* Use 4 ml application rate if you have not had your system tested and hence do not know your systems specific application rate.

See pg 18 for more on measuring the depth and rate for sprinkler systems.

FIND OUT MORE

A Staff Guide to Operating Your Travelling Irrigator
A Staff Guide to Operating Your Low Rate Application System
Order or download from dairynz.co.nz

Correct operation of irrigation systems

Optimal pressure to deliver the correct depth of effluent.

Systems operating at the correct spacing and layout to deliver good application depths and a uniform spread.

No ponding. Irrigator set to fastest speed and hose layout is correct.

Sub-optimal operation of irrigation systems

Sub-optimal pressure and blocked nozzles mean system delivers higher depths of effluent.

Sub-optimal pressure or incorrect spacing can give a high depth of effluent even from a low application system.

Poor hose layout creates drag on the irrigator; irrigator slows down and applies too much effluent.

10.4 Tips for maintenance

- Make maintenance a routine which invovles all the farm team
- Have a maintenance schedule posted in the farm dairy and sign off on maintenance tasks as they are done
- Leave a list of important phone contacts in the farm dairy in case of equipment failure. If in doubt, have your equipment serviced by a professional every year.

10.4.1 Suggested tasks for travelling applicator maintenance

Daily

- ☐ Soil is dry enough to apply effluent without ponding, runoff or leaching
- ☐ No sign of ponding in low-lying parts of the application area
- ☐ Pump sounds normal when switched on
- ☐ Effluent application is recorded (run, paddock, etc.)
- ☐ The irrigator is set up correctly (not slowed down by the drag line) and securely anchored
- ☐ Auto stop is far enough away from the end to stop before hitting the post or effluent entering waterways
- ☐ Irrigator is in gear at the start of the new run with no overlapping wire
- ☐ Irrigator appears to be operating normally
- ☐ The irrigator is turned off when the run is finished/use of cut-off switches and wire stoppers
- ☐ Irrigator is operated during daylight hours so that the operation can be monitored
- ☐ No evidence of uneven or excessive spray pattern on the ground
- ☐ No sign of effluent getting into drains
- ☐ No effluent getting into water troughs
- ☐ Sprinkler nozzles are not blocked, split or damaged.

Weekly

- ☐ Drag-line is free of cuts and splits
- ☐ The irrigator is set to the highest travel speed
- ☐ Cut-off on the winch winding facility is working
- ☐ Clean and grease all moving parts and grease nipples
- ☐ Check the cable, bearings, gear mechanisms, anti-siphon valves and other moving parts for signs of wear and repair before a breakage occurs
- ☐ Pipes running in and out of the pond are not blocked
- ☐ Anti-siphon valves are not blocked
- ☐ Effluent stone trap cleaned out
- ☐ Flush clean water through the delivery line and sprinklers to prevent blockages
- ☐ Float switches are clear and working
- ☐ Grease the pump (they must never run dry) – there are ____ grease nipples.

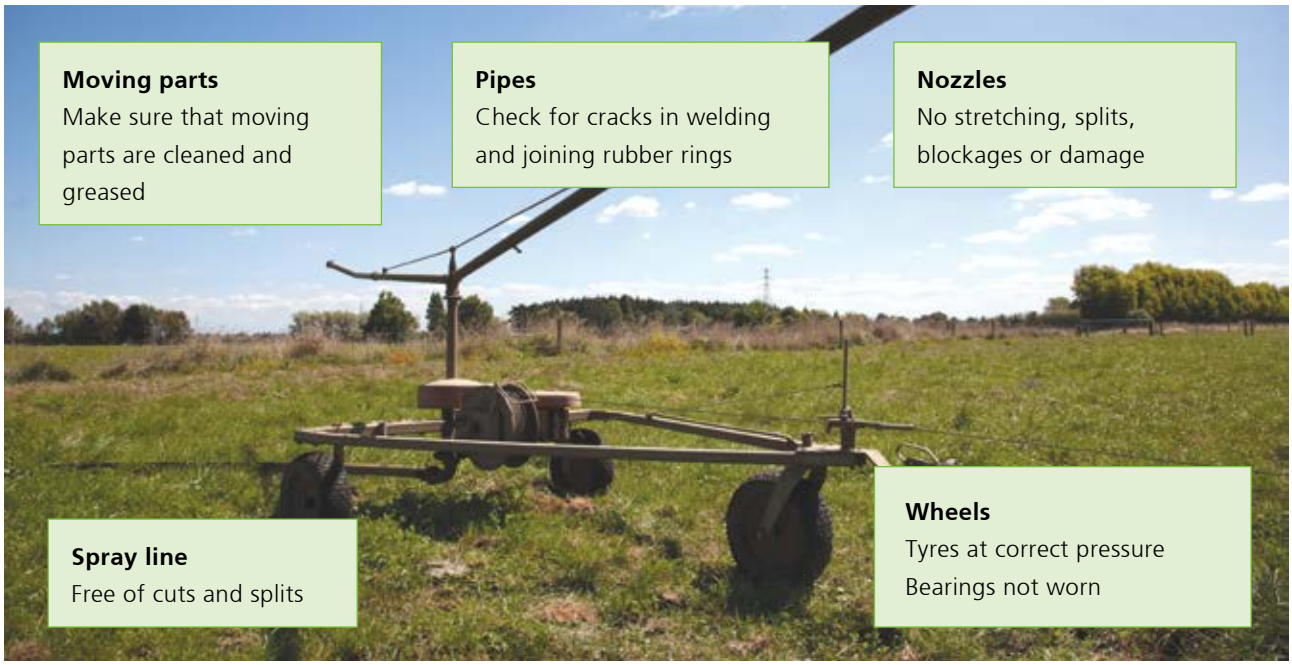
Monthly

- [ ] Pump pressure OK (use a pressure gauge)
- [ ] No leaks in pump and reticulation lines
- [ ] Tyres are at the correct pressure
- [ ] Water blast or clean the irrigator.

Seasonally

- [ ] Test the application depth and rate are within acceptable limits (3-4 times per season)
- [ ] Training staff in effluent management
- [ ] Clear tile drain outlets of vegetation so that they can be easily checked
- [ ] Pump maintenance (strip down the pump for inspection, oil and cleaning, check the pump seals, check the pump impeller and casing for wear)
- [ ] Nutrient analysis on stored effluent, and nutrient budget and fertiliser recommendation for effluent application area
- [ ] Complete a *Compliance Checklist* to stay proactive about compliance requirements.

Correct irrigator maintenance:



10.4.2 Suggested tasks for sprinkler applicator maintenance

Daily

- ☐ Soil is dry enough to apply effluent without ponding, runoff or leaching
- ☐ No sign of ponding in low-lying parts of the application area
- ☐ Shifted to a new run, not too close together, or overlapping recent applications or high risk areas
- ☐ No effluent leaking from sprinklers at low points after the pump is shut down
- ☐ Pump sounds normal when switched on
- ☐ Effluent application is recorded (run, paddock, etc.)
- ☐ No uneven or excessive spray patterns on the ground
- ☐ No sign of effluent getting into drains
- ☐ No effluent getting into water troughs
- ☐ Sprinkler nozzles are not blocked or damaged.

Weekly

- ☐ Drag-line is free of splits or leaks
- ☐ Grease the pump (it must never run dry) – there are ____ grease nipples
- ☐ Pipes running in and out of the pond are not blocked
- ☐ Solids are not getting into the pond
- ☐ Separation system is working
- ☐ Effluent stone trap cleaned out
- ☐ Anti-siphon valves are not blocked
- ☐ Flush clean water through the delivery line and sprinklers to prevent blockages
- ☐ Float switches are clear and working.

Monthly

- ☐ Pump pressure OK (use a pressure gauge)
- ☐ No leaks in pump and reticulation lines.

Seasonally

- ☐ Test the application depth and rate are within acceptable limits
- ☐ Training staff in effluent management
- ☐ Check that correct nozzle size is on for season depth required
- ☐ Clear tile drain outlets of vegetation so that they can be easily checked
- ☐ Pump maintenance (strip down the pump for inspection, oil and cleaning, check the pump seals, check the pump impeller and casing for wear – this should be done by a suitably qualified person)
- ☐ Nutrient analysis on stored effluent, and nutrient budget and fertiliser recommendation for effluent application area
- ☐ Complete a *Compliance Checklist* to stay proactive about compliance requirements.

10.4.3 Suggested tasks for storage maintenance

Daily

- [ ] Before and after milking, check that the stormwater diversion is in the correct position
- [ ] Prevent rubbish entering the system – have rubbish bins in the farm dairy and yards
- [ ] Remove any rubbish on grates
- [ ] Check levels on storage ponds, and that float switches are clear and working.

Weekly to monthly

- [ ] Clean and clear the effluent stone trap; store on a sealed surface or apply directly to land if conditions allow
- [ ] Check that the pond walls are stable, and that there is no seepage (visible wetness or pasture that is growing exceptionally well are indicators of seepage problems)
- [ ] Control weeds in and around ponds
- [ ] Check that the fencing remains child and stock proof
- [ ] Make sure that stock don't have access to the pond wall embankments
- [ ] Guide wires that secure pumps, stirrers, and pontoons are correctly aligned so that the pump stays level
- [ ] Make sure guide wires are not rubbing on any pond lining surface.

Six-monthly – annually

- [ ] Remove trees and other woody vegetation growing near the pond. There should be no large trees within 40 meters of a pond bank
- [ ] Remove solids from the weeping wall (if you have one)
- [ ] Maintain/service mechanical separator (if you have one)
- [ ] Assess whether the pond requires desludging
- [ ] Maintain drains around the storage facility so that rainwater doesn't enter the pond
- [ ] Agitator service
- [ ] Pump service.

11. Tools and resources available to help with effluent management

The following are a series of practical tools which have been developed by DairyNZ with farmers. They are available to download on the **dairynz.co.nz** website under publications, or order a copy by calling 0800 4 DairyNZ (0800 4 324 7969).

Training staff

Effluent Training Record

To help make sure you cover all the bases when training new staff. Serves as a file away record of training should you ever need it

AgITO Dealing with Dairy Farm Effluent

A one-day course looking at the reasons why, and how to treat dairy effluent on farm. Suitable for all the farm team. Includes a one-on-one practical assessment on the participant's farm. AgITO 0800 691 111

AgITO Effluent Management Planning

A one day course for farm owners, herd managers, supervisors, sharemilkers etc. Templates and tutor expertise to help you create an effluent management plan for your farm. Includes a follow up session to discuss practical implications. AgITO 0800 691 111

Top Tips for Effluent Irrigators

Make sure your staff get it right every time with this poster for the dairy, outlining top tips for trouble free effluent irrigators

Effluent Management Plan

A visual plan to pin up in the dairy so all staff know the drill with effluent management

A Staff Guide to Operating Your Effluent Irrigation System

A visual and practical guide aimed at farm staff, covers setting up and monitoring an effluent irrigation system

Managing and monitoring

Irrigator Run Sheet

Get the best financial return from the fertiliser in effluent by recording where it goes with this one page template for recording irrigator runs. Includes: date, paddock number, run number and sign off area for person responsible for moving the irrigator

Compliance Checklist

A summary of the regional council rules and requirement for effluent in each area. Complete the checklist over winter and again mid-season to make sure you are on track with effluent compliance

DairyNZ Effluent Storage: Working Volume Calculator

Calculate the working volume of a potential or existing pond. This can be used with the *Dairy Effluent Storage Calculator*

DairyNZ FDE Spreading Calculator

Use to determine a suitable depth or volume to apply FDE solids to land. Use with the *Effluent spreading contractors' communication* form if you are hiring a contractor to empty the pond or spread the solids

Effluent Spreading Contractors' Communication Form

Use when employing contractors to empty a pond or spread solids, to minimise the risk of communication breakdown. compliancetoolkit.co.nz/index.asp?pageID=2145891142

A Staff Guide To Operating Your Travelling Irrigator

Understanding how to operate your effluent irrigation system properly is an essential task on farm. This booklet helps take farm staff through the important parts of operating and maintaining a travelling irrigator effluent system

A Staff Guide To Your Low Rate Application System

Understanding how to operate your effluent irrigation system properly is an essential task on farm. This booklet helps take farm staff through the important parts of operating and maintaining a low rate application system

Upgrading your system

Farm Dairy Effluent Systems: Planning the Right System for Your Farm

A farmer's guide to the farm dairy effluent system design standards and code of practice. Helps you plan your system with your designer so you get a system which is fit for purpose

▶ Visit dairynz.co.nz/effuent-systems

Improving farm performance

Nutrient management on your dairy farm

A farmer's guide to understanding how nitrogen and phosphorus enter, cycle through and leave your dairy farm.

▶ Visit dairynz.co.nz/nutrient-management

FarmFacts

A set of fact sheets explaining all things dairy including effluent – one of DairyNZ's most popular resources

▶ Visit dairynz.co.nz/farmfacts

Farm Enviro Walk

A good practice self-assessment for environmental performance on farm. Covers effluent, soil, nutrient, waterways and other hotspots on farm. A useful training tool

▶ Visit dairynz.co.nz/enviro-walk

Designing an effluent system

Farm Dairy Effluent (FDE) Design Standards and Code of Practice

These resources have been developed in partnership with the effluent industry to provide good practice advice for upgrading your existing effluent systems or building a new one from scratch

Pocket Guide to Determine Soil Risk for Farm Dairy Effluent Application

Soils across New Zealand have been classified into high and low soil risk categories for farm dairy effluent application. This field guide will take you step by step through the process of working out the soil risk for a farm

▶ Visit dairynz.co.nz/effluent-systems

Effluent storage ponds

Farm Dairy Effluent (FDE) A farmer's guide to building a new effluent storage pond

When making the decision to install a new farm dairy effluent storage pond, there are a number of things to be considered. This guide aims to help farmers through the process and various factors to consider when building a new effluent pond including; planning, working with consultants and contractors, and design options

IPENZ Practice Note 21: Farm Dairy Effluent Pond Design and Construction

The Institution of Professional Engineers (IPENZ), with support from principal sponsors DairyNZ, has brought together a group of professionals from civil, geotechnical, agricultural, and environmental engineering backgrounds to develop a Practice Note on the design and construction of FDE ponds

▶ Visit dairynz.co.nz/effluent-storage

Smart Water Use

Smart Water Use Resources

Smart Water Use resource materials address water use in the dairy shed (including practices to minimise effluent volumes) and management of the farm water system (to ensure secure water supply for stock). The focus is on using water as efficiently as possible and reducing water loss in operations. These have been tested extensively with farmers to ensure they are both comprehensive and easy to use

▶ Visit dairynz.co.nz/smart-water-use

Notes:

dairynz.co.nz

Report on pre-hearing meeting

Section 99 of the Resource Management Act 1991 (RMA)

From: Glen Cooper, Chairperson

To: Commissioner(s) or Committee appointed to hear and determine the resource consent applications by White Waters Limited lodged with Environment Southland (APP-20181247)

Date: 10 August 2018

Pre-hearing meeting

1. On 23 July 2018 the Environment Southland (ES), conducting its function as consent authority under the Resource Management Act 1991 required White Waters Limited, who has applied for resource consent, and all persons who are submitters on the application, to meet. The meeting was required by ES at the request of the applicant, for the purpose of clarifying a matter or issue or facilitating resolution of a matter or issue.

2. The application was notified and submissions closed 27 June 2018, 4 submissions were received, 3 who opposed the application, and 1 neither in support or opposition. All submitters indicated they wished to be heard at a hearing. The required meeting was therefore a pre-hearing meeting held under section 99 of the RMA.

3. The final draft meeting agenda, circulated by the Chairperson on 22 July 2018, outlined suggested agenda items for clarification or resolution, and incorporated feedback on earlier drafts of the agenda.

4. Agenda items were confirmed and prioritised by participants at the meeting as follows:
   a. Preliminary matters
   b. Previous compliance with conditions of consent
   c. Effluent storage
   d. Effluent application methods
   e. Discharge area
   f. Environmental effects, including monitoring

5. The meeting was held on 23 July 2018 at Environment Southland, Cnr Price St & North Rd, Invercargill, starting at 2pm.

6. The following participants were in attendance:

Name	**Party**	**Organisation**
J Smyth	Submitter	Fish and Game
D Whaanga (part of the meeting) S-R Blair		Te Ao Marama Inc
T Scott L Robertson R Brown		Public Health South

A Ching N Yozin		DOC
H Vernooij	Applicant	
Q Scandrett J Scandrett	Applicant's Agents	
E Allan J Gilroy	Reporting Officer / Consent Authority	Environment Southland
G Cooper	Chairperson	AECOM

7. This report has been prepared by the Chairperson.

Statutory and procedural matters

Requiring and requesting attendance

8. Consent authorities may require persons to attend a meeting only with the consent of the person who made the application. In this case ES required the applicant and all submitters to attend.

9. The applicant's agent requested the meeting by email to Ms Allan on 9 July 2018.

Non-attendance of required persons

10. If persons required to attend a pre-hearing meeting do not attend, the consent authority can decline to process the application and decline to consider the person's submission.

11. Representatives on behalf of the applicant and all submitters were in attendance. No issue regarding non-attendance arises.

Attendance of those delegated to make decisions

12. Section 99(4) states that an officer of the authority who has the power to make the decision on the application may attend, subject to the agreement of all the parties attending and participating, and if the consent authority is satisfied their presence is appropriate.

13. No such as person participated.

Chairperson to prepare this report

14. Section 99(5) and (6) require the chairperson of the meeting to prepare a report outlining particular matters, and to circulate that report to all of the parties and the consent authority (meaning, the commissioners or hearings panel that will hear and determine the application) no less than 5 working days before the hearing.

15. The report must, for the parties who attended the meeting:
    a. Set out the issues that were agreed; and
    b. Set out the issues that are outstanding

16. However, the report must not include anything communicated or made available at the meeting on a without prejudice basis.

17. In addition, the report may, for all the parties:
    a. Set out the nature of the evidence that the parties are to call at the hearing; and
    b. Set out the order in which the parties are to call the evidence at the hearing; and

c. Set out a proposed timetable for the hearing.

18. No commentary on the matters in paragraph [17] is provided in this report. These matters are reserved for the direction of the hearing panel. A tentative hearing date is set down for 3-4 September 2018.

Status of this report and next steps

19. Section 99(6) requires the chairperson to send this report to the consent authority and all the parties so that they have it at least 5 working days before the hearing. The report was sent in draft form by email to the parties on 1 August 2018.

20. At the time of writing, no parties have advised that they no longer wish to be heard, and the application is tentatively scheduled to be heard on 3-4 September 2018.

21. Section 99(7) **requires** the consent authority (meaning, the commissioners delegated power of the consent authority by to determine the application) to **have regard to** this report in making the decision on the application.

Introduction

22. The Chairperson opened the meeting and provided an overview of the statutory setting for the meeting. This was followed by introductions by the participants, a health and safety moment, agreement on the outcomes sought from the meeting, and agreement and prioritisation of the agenda items.

23. The agreed outcomes sought from the meeting were:
    a. To provide information to address submitter's concerns
    b. To clarify the scope of the application

24. Please note for the purposes of this report, and the informal and without prejudice nature of the meeting, individual participants are not linked to particular commentary. Reference to the applicant includes the applicant's agents. For the most part submitter's are referred to as the collective, rather than a particular submitter. If any conflict arises by grouping in this way, this can be explored further at the hearing.

Preliminary matters

25. It was agreed that no opposition arises in relation to the proposed water take application.

26. ES staff clarified that its section 95 notification report contained an error regarding the discharge permit activity status. The proposed discharge of effluent, and overall activity status, should be assessed as a discretionary activity, not non-complying (the section 104D 'gateway test' will not apply).

Previous compliance with conditions of consent

27. A key issue relates to actual and potential adverse effects of the effluent discharge to land. Submitters expressed concern with the level of previous non-compliance, uncertainty and lack of clarity arising from the evolving nature of the resource consent application, and the limited information and environmental effects assessment to support the proposal (as identified and clarified below). This helped to set the scene from the remainder of the agenda items.

28. Clarification was sought on whether the applicant has a non-compliance history relating to the operation of the dairy farm.

29. The applicant acknowledged an incident in December 2017 where the effluent sump overflowed. Upgrades had been made to avoid future breaches, including an automation system to alert by txt message.

30. ES staff informed the group there had been 16 inspections of the dairy farm. On 12 occasions non-compliance with consent conditions had been identified. These records are publicly available.

31. There was some discussion that the dairy farm didn't comply (past tense), but the situation has improved regarding the farm's operation and no new environmental issues have arisen. It was noted that the previous resource consents to discharge effluent to land expired in 2017, and ES has issued an Abatement Notice to prevent effluent discharge to land. The farm is currently operating without resource consent by trucking away the effluent off-site for disposal.

32. The applicant clarified the proposal consists of:
    a. No change to farm area previously consented
    b. No change to stocking numbers
    c. No change to current effluent storage capacity (no longer proposing to increase this)
    d. Adding another primary method of irrigation (previous consent allowed for this)

33. There was agreement that the land use for dairy farming on the property is a permitted activity under the relevant planning instruments, and no issue arises in that regard. The primary concern relates to the discharge of effluent to land (either by system failure or application rate and/or depth).

Effluent storage

34. A key issue concerned the adequacy of the current effluent storage pond built in 2012. There was general discussion around the pond's ability to mitigate adverse effects (i.e. by deferring irrigation), particularly during times of high rainfall and/or a low soil moisture deficit. The likelihood of effluent entering surface water (or groundwater) in the event that storage was at capacity and irrigation occurred when the soil had a low moisture deficit was also a key issue.

35. The applicant clarified that the existing effluent pond could store 1,500 cubic litres in total (not the 1,100 cubic litres stated in the original application); of which the pumpable volume is 1,238 cubic litres. Under the previous resource consent 1,200 of storage was required. The dairy farm produces 25.5 cubic litres of effluent per day, the existing pond has 50 days of storage (from empty), and calving starts at the end of August, which is one month later than other farms).

36. While a KlipTank pond was proposed in the original application as additional storage, the applicant suggested that this additional storage if implemented would not achieve a positive outcome. Thus, the preferred alternative mitigation method is to use low rate irrigation (a Larall Smart Hydrant Sprinkler system, which has evolved from the further information response where it was initially planned to run two large sprinklers (pods) from the dairy shed sump).

37. The following matters were discussed:
    a. Differences between the original proposal and notified proposal.
    b. Uncertainty if and when consents could be granted.
    c. Clarification on existing effluent storage tank and sump (x2 at the dairy shed, total = 30 cubic litres, with slurry tanker as contingency).
    d. Clarification around emergency storage pond – existing storage pond negates the need for emergency storage, and slurry tanker can be used to transport effluent.

e. Storage pond location:
    i. Pumped from sump to pond along a distance of approximately 1.3 km, lift of 20 m, pipe diameter 90 mm and well buried;
    ii. Centred in the middle of the farm discharge area so (slurry tanker) cartage time is reduced, soils in that part of the farm are better suited, location mitigates odour risk.

38. The clarification provided and matters discussed above flowed on to the issues relating to the proposed effluent discharge method. There was general consensus that the need or otherwise for additional pond storage was dependant on the proposed effluent discharge application method.

Effluent application method

39. A key issue related to uncertainty regarding the operation of the (now) proposed use of low rate application pods (x2) combined with the slurry tanker. The financial situation of the property was also discussed, and ES staff requested confirmation of the feasibility of implementing the proposal. It is not necessary to comment on this further; whether this is a relevant consideration in determining the application is best addressed in evidence or at the hearing.

40. The applicant clarified that the following application methods are proposed:
    a. 25 ha – low rate application
    b. 75 ha – slurry tanker application

41. Of the 25 ha identified for low rate application, which represents approximately half of the farm discharge area of particular concern to submitters. Representatives of Te Ao Marama Inc sought clarification that the 25 ha is within the Whitestone Catchment, which was confirmed.

42. Clarification was sought by submitters on the slurry tanker application rate and performance assessment. This was tested under the previous consent. The suitability of this application method was not resolved. While there may be some support in principle for the low rate application pods, there is no information on product, no assessment of effects, and uncertainty remained as to how the low rate application pods would work in combination with the slurry tanker.

43. On several occasions ES staff sought clarification that the low rate application pods would be the primary application method. The applicant proposed that both methods would work together.

44. When questioned on why 25 ha were chosen for low rate application, the applicant confirmed this was largely because of cost-efficiency (while cost efficiency was a large focus, the applicant considers that 25 ha provides enough area to meet the minimum discharge area required of 4 ha/100 cows annually). While the discharge area could potentially be doubled, the costs would increase (such costs were not quantified by the applicant).

45. The discussion returned to the existing storage pond and ES intend to call expert evidence on the existing storage pond's capability.

46. The following key matters remain unresolved:
    a. Submitter's concerns in relation to the 75 ha slurry tanker application area – while there is plenty of potentially suitable flat area, the topography creates higher risk of surface flows.

b. The lack of assessment of effects on the 25 ha (low rate application) v 75 ha (slurry tanker).

47. Upon questioning from the Chairperson, ES staff clarified that the Regional Land & Water Plan promotes the spreading of adverse effects of effluent discharge, not concentrating effects.

Discharge area

48. The key issues and discussion centred on the lack of information on the soil type in the proposed discharge area, and the potential presence of freshwater springs and unknown sub-surface drains.

49. The applicant confirmed that a 2012 soil report has been undertaken but not provided in the application documents. ES staff confirmed they had a copy of the report, although the onus is on the applicant to provide it as part of their application. This was agreed to as an action point.

50. The soils in the proposed discharge area consist of 90-100% Te Anau soils, with Kakapo soils predominantly in the low areas. The soils have not been re-investigated since 2012, although more tests may allay submitter's concerns. Further information was sought by submitters on the ability of the soils to contain or loose contaminants.

51. The applicant clarified that most of the open drains are now closed. Tile drains are mapped in the application documents.

52. The following matters remain unresolved regarding soil type in the proposed discharge area:
    a. Information supplied v not yet available
    b. Uncertainty regarding freshwater springs
    c. Clarity on well drained soils v imperfectly drained soils
    d. How much nitrates from the farm are escaping down catchment
    e. Number and location of sub-surface drains in the Te Anau soils

Environmental effects, including monitoring

53. There was agreement that the environmental effects of the proposal can be narrowed to the effluent discharge, not the land use itself for dairy farming. A key issue concerned whether the environmental effects could be adequately mitigated, including monitoring and consent duration.

54. There was general discussion on the following:
    a. Bore location issues, and no groundwater monitoring data from previous consent
    b. Surface water monitoring, including ES surface water monitoring programme that has now ceased
    c. After 5 years since previous consent was granted, not much is known about effects
    d. Financial constraints
    e. How will soil moisture deficit be calculated (raised several times by representatives from Public Health South) – further information is sought

55. In addition, the applicant raised several matters for clarification, which remain unresolved and are likely to be key issues for the hearing and in making a determination on the application:
    a. How much monitoring is required as part of an application v leaving this to consent conditions?

b. Farming effect v effluent effect – 350 KgN cycled by stock v 10 KgN from effluent, and how to determine which activity (farming of dairy cows v discharge of effluent) may potentially be having a negative impact on water quality?

56. In relation to monitoring two themes were discussed:
    a. Monitoring appropriate soil moisture prior to effluent application
    b. Ongoing monitoring of effects if consent is granted

57. ES staff signalled to the applicant that based on the application and assessment of effects as it currently stands, the recommendation to the hearing panel would likely be to decline. ES have a blanket internal policy of not suggesting conditions where the reporting officer is recommending to decline. The Chairperson queried whether such an approach would be helpful to the hearing panel determining the application, and suggested that the applicant may wish to consider whether they volunteer consent conditions, including monitoring conditions, as part of the application.

58. Before wrapping up there was a brief discussion on whether the applicant would consider a shorter term consent duration than the 10 years applied for. While there was a level of support from the applicant and some submitters in principle, consensus could not be reached and this would be unlikely to mitigate the apparent information and effects assessment gaps in the application.

59. The applicant agreed to provide further information and clarification on the proposal. Several action points were noted.

60. The Chairperson enquired with ES staff if a hearing date had been set down. While a tentative hearing date has been scheduled for 3-4 September 2018, this is to be confirmed and notice sent to the parties.

61. Working backwards from that date, ES staff advised that the section 42 evaluation report would need to be circulated by 13 August and completed for printing 1-2 days prior (11/12 August). To provide sufficient time for ES staff and submitters to consider any updates to the application there was agreement that the applicant would need to provide this information within one week following the meeting.

Conclusion

62. The Chairperson thanked all participants for the good level of discussion. During the two hours set aside for the meeting all agenda items were able to be covered. The clarification and information provided by the applicant will hopefully go some way to addressing the concerns of submitters and ES. While some areas of agreement were identified, a number of matters remain outstanding. These mostly relate to information and effects assessment gaps.

63. During the meeting a rolling list of issues were captured on the whiteboard. This list is reproduced as Attachment 1, and should be read in conjunction with the commentary provided in this report.

64. The following action points were noted for the applicant to consider following up:
    a. Circulate the updated Farm Environmental Management Plan
    b. Request a letter from the bank
    c. Confirm the proposal – e.g. update AEE
    d. Circulate the 2012 soil report
    e. Circulate information brochure on low rate application pods
    f. Discuss with ES staff concerns over existing pond calculations and infiltration at dairy shed

g. Address key issues and information gaps (refer to Attachment 1)
h. Look at volunteering monitoring conditions as part of the application

Meeting closed at 4.05pm

The participants were invited to review a draft of this report. On 3 August 2018, the applicant circulated suggested minor or technical changes, which have been accepted and incorporated into this report. No other comments were received. This report is an accurate record of the meeting.

Glen Cooper
Chairperson
Principal Planner, AECOM

Attachment 1 – List of issues (photo of notes captured on the whiteboard at the meeting)