

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

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Disclaimer

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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.

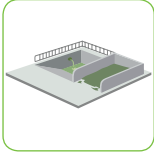
There are a huge number of stormwater diversion designs available, including manual and mechanical. Regardless of design, care needs to be taken to manage the stormwater diversion correctly. Installing an automatic facility or warning devices is advised.

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 400m² roof or yard = 40m³ of water. If pumping from the effluent pond at 15m³/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

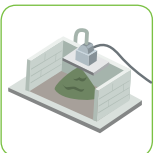
Solid separation involves the removal of coarse solids from the effluent resulting in a liquid effluent which is stored until use.

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.

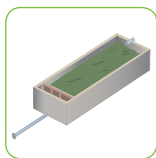
There are two main methods of solids separation:



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)	<ul style="list-style-type: none"> • Low risk of breakdown • Very low ongoing labour input • Low energy usage 	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Liquid effluent is better filtered • Requires smaller physical area • Produces a drier solids product, to store and spread 	<ul style="list-style-type: none"> • 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 homoeonising 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
<p>Traveller – application depth 8mm+</p>	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • Unsited 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.
<p>Low rate sprinkler systems – application depth 1-10mm+</p>	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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.
<p>Pivot – application depth 1mm+</p>	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Very low capital invested in system • Very low labour requirement • Empties pond fast • Proof of placement. 	<ul style="list-style-type: none"> • Reliant on contractors timeframes • Less benefit from regular water and nutrient application • Must make sure contractor applies with rules • Cost of contractors.
Slurry tankers	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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
- anti-drain valve at paddock.

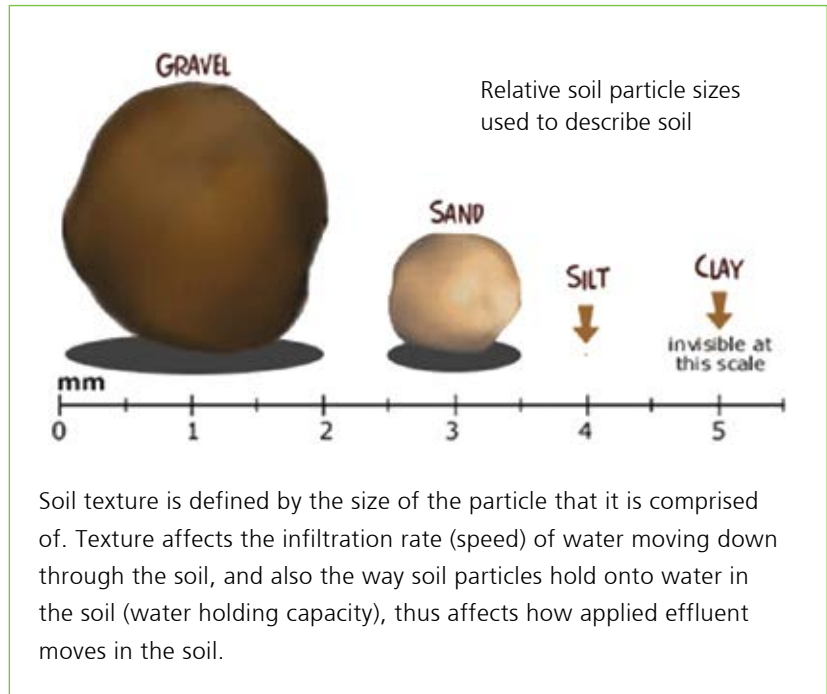
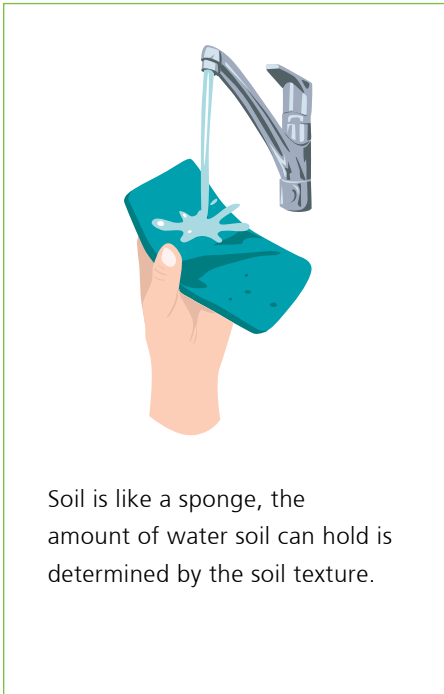


3. How landscape and climate affect effluent system design and management

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

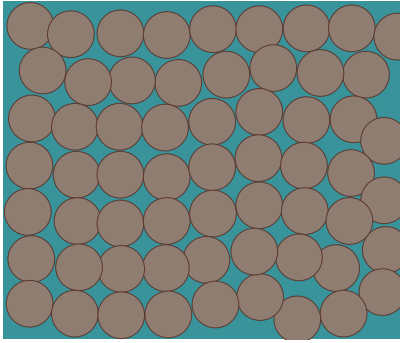
- the soil drainage characteristics
- landscape contour and topography
- climate.

3.1 Soil texture



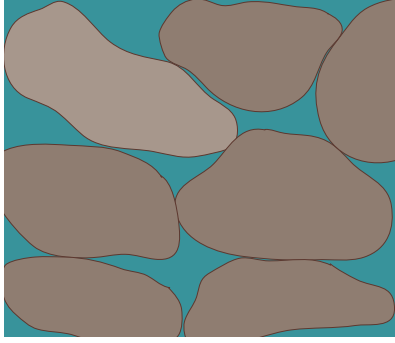
The water holding capacity and the current water content of the soil determine the depth of effluent which can be applied before it goes past the root zone to groundwater.

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

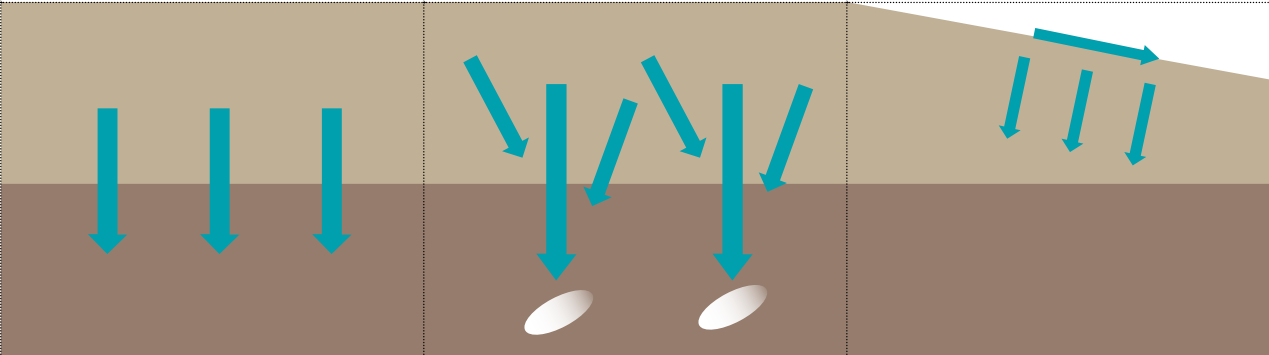


Sandy soils have larger pores and hold less water, but make it easier for the plant roots to extract the water. Effluent drains freely through the large pores and care must be taken so that it does not go straight to groundwater.

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:

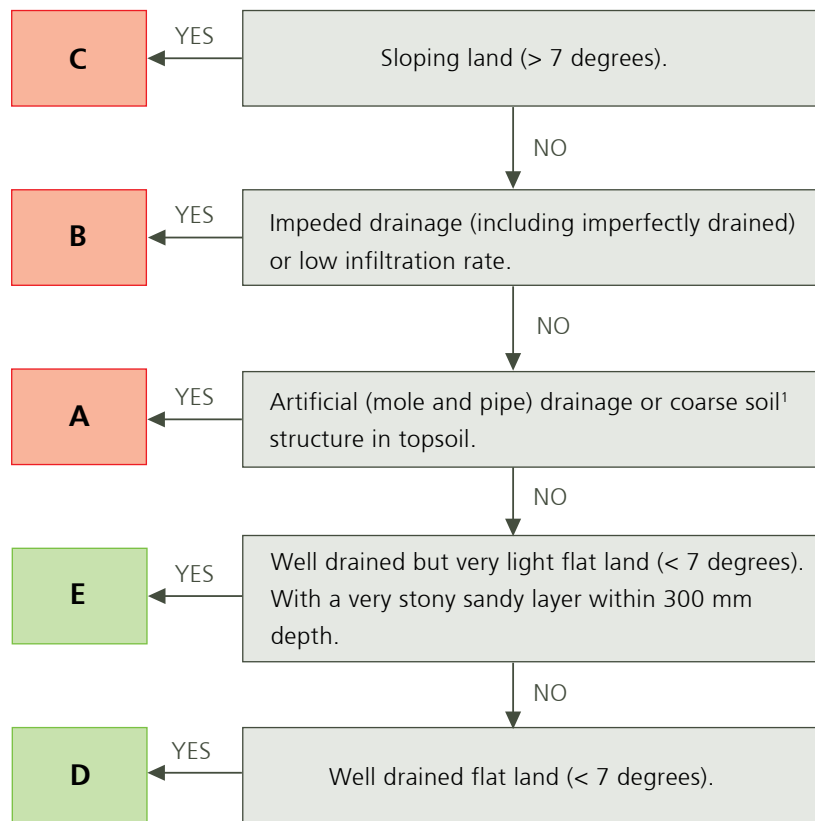
Matrix flow	Preferential flow	Surface runoff
<ul style="list-style-type: none"> Uniform movement down through the soil. 	<ul style="list-style-type: none"> Water fast tracks through soil through cracks and channels. 	<ul style="list-style-type: none"> Very little infiltration, water moves across the surface or ponds.
<ul style="list-style-type: none"> High infiltration rates Well drained soil profile High porosity Fine soil structure 	<ul style="list-style-type: none"> Poor natural drainage Mole and pipe drainage Heavy or course soils 	Influenced by: <ul style="list-style-type: none"> 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 Calculator* 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.

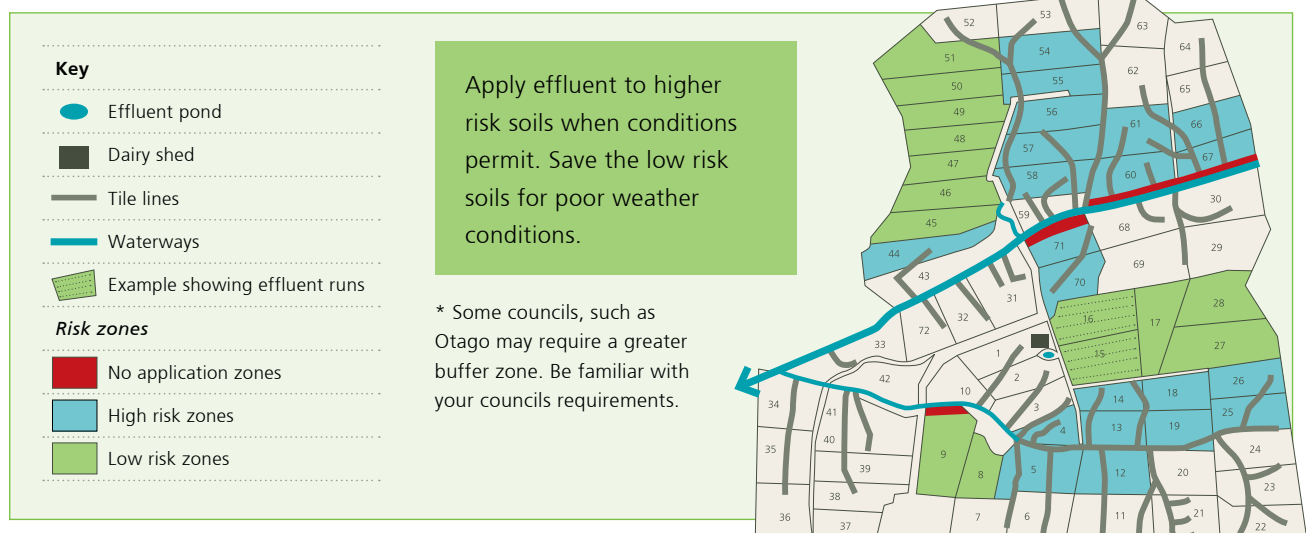
3.3 Effluent application plans

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.



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:

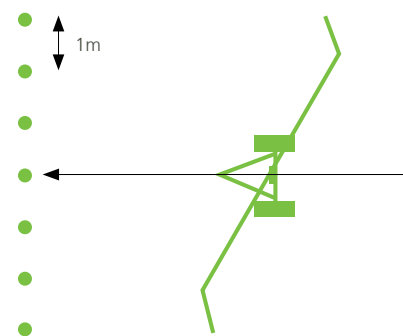
1. 1-2 metres apart
2. use enough containers across the spray width of the irrigator
3. put a stone in each container to stop it blowing over.

Step 2:

Run irrigator

Run the irrigator as normal:

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



HOW LONG



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.

For RECTANGLE TRAYS WITH SLOPING SIDES:

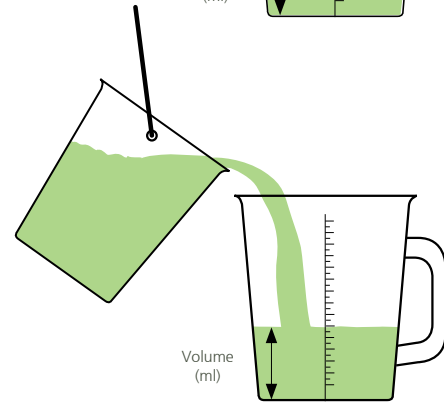
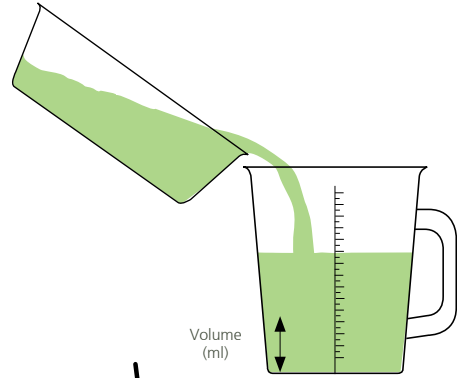
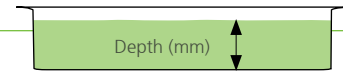
1. remove stone
2. tip effluent into measuring jug record the volume (ml)
3. write down volume for each container.

For ROUND BUCKETS WITH SLOPING SIDES:

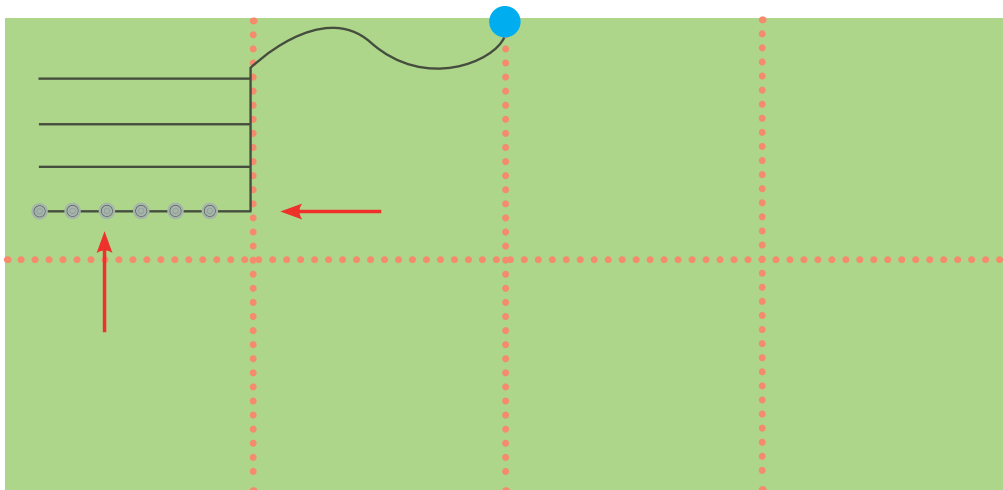
1. remove stone
2. tip effluent into measuring jug record the volume (ml)
3. write down volume for each container.

Go to pages 20-22 for calculation steps.

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

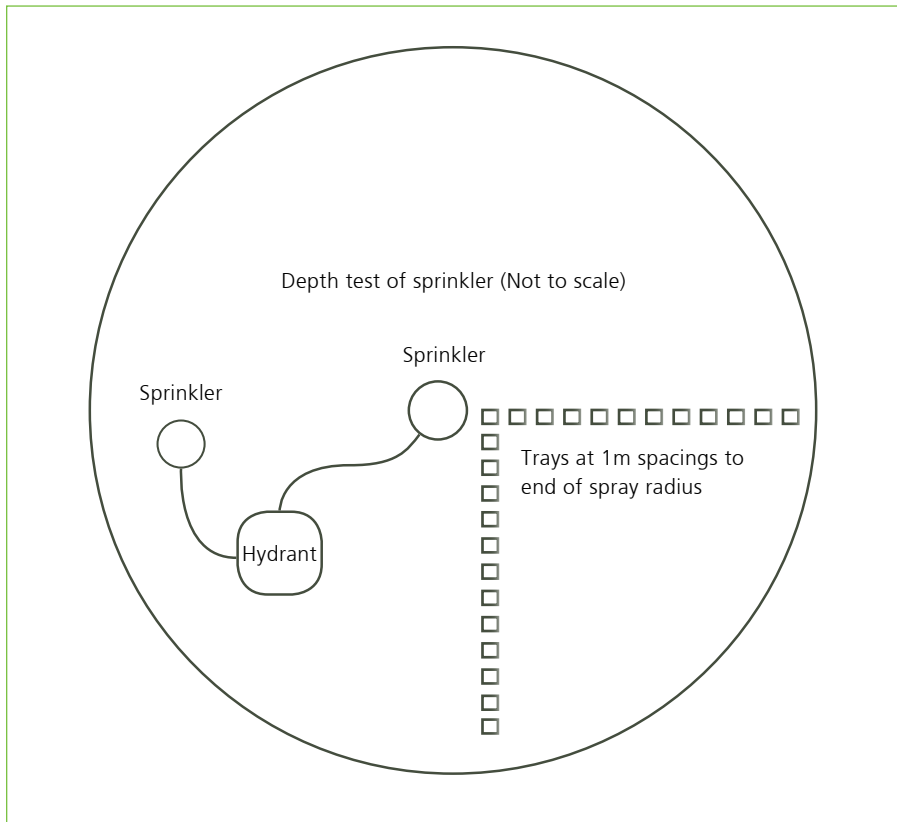
**Low rate application systems****Step 1: Location**

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.



Land application

Step 3: Turn on

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



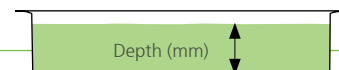
Step 4: Measure how much

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

For RECTANGLE TRAYS WITH STRAIGHT SIDES:

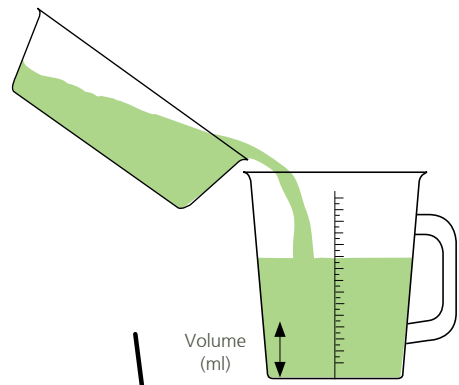
1. use a tape measure
2. remove the stone
3. measure how deep the effluent is in each container (mm)
4. write down depth for each container.

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



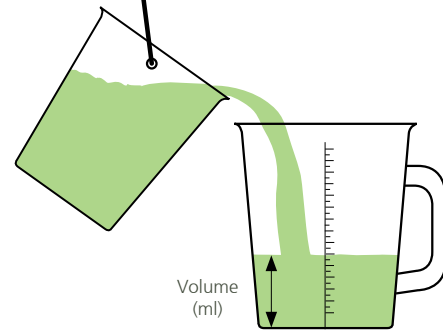
For RECTANGLE TRAYS WITH SLOPING SIDES:

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



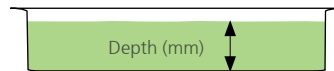
For ROUND BUCKETS WITH SLOPING SIDES:

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 ...

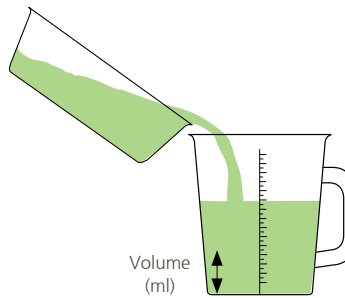
+	+	+	+	+	+	+	TOTAL (mm)	
TOTAL (mm)		÷	NUMBER OF CONTAINERS		=			AVERAGE APPLICATION DEPTH (mm)
AVERAGE APPLICATION DEPTH (mm)		÷	TIME (hrs) (e.g 1hr 15 mins = 1.25 hrs)		=			AVERAGE APPLICATION RATE (mm/hr)

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

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)							CONTAINER LENGTH (mm)		CONTAINER AREA (mm ²)
							÷	=	
1000							×		=
AVERAGE VOLUME (ml)							CONTAINER AREA (mm ²)		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.

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.

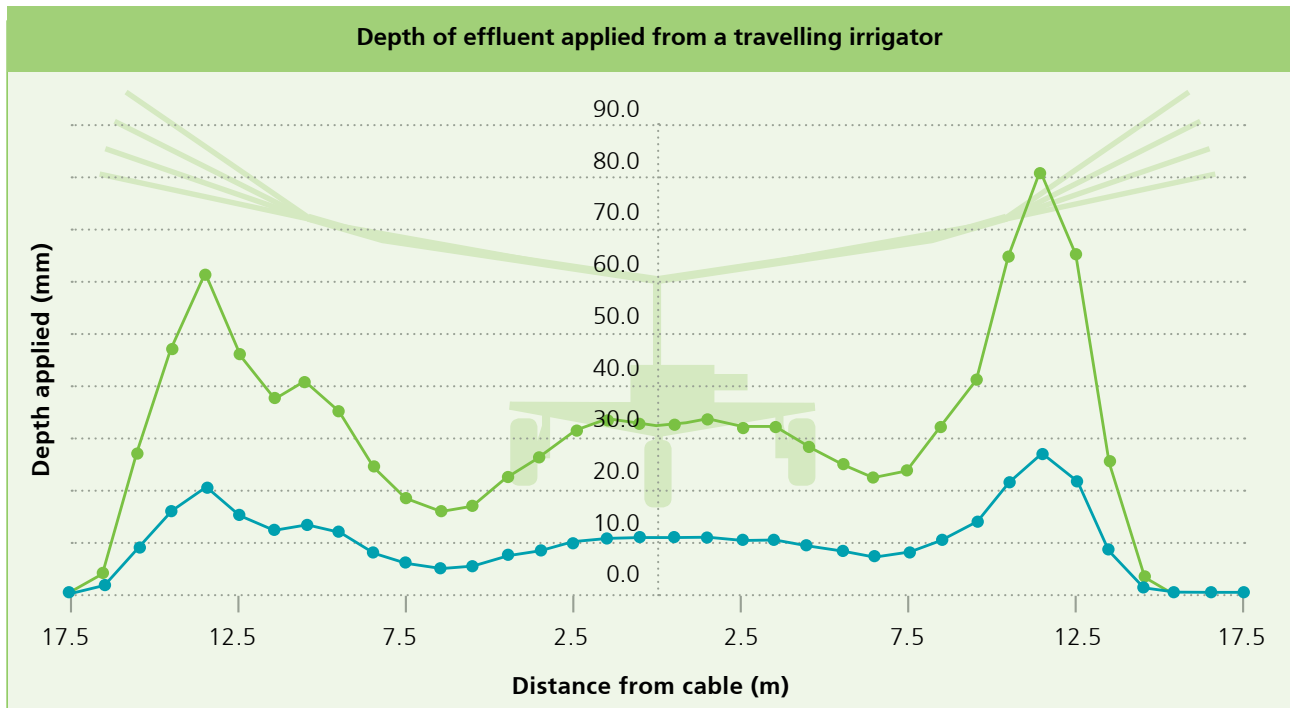
4.3.1 The effect of uneven spray patterns

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.



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

4.4 Nutrient management – know the nutrient loading from effluent application

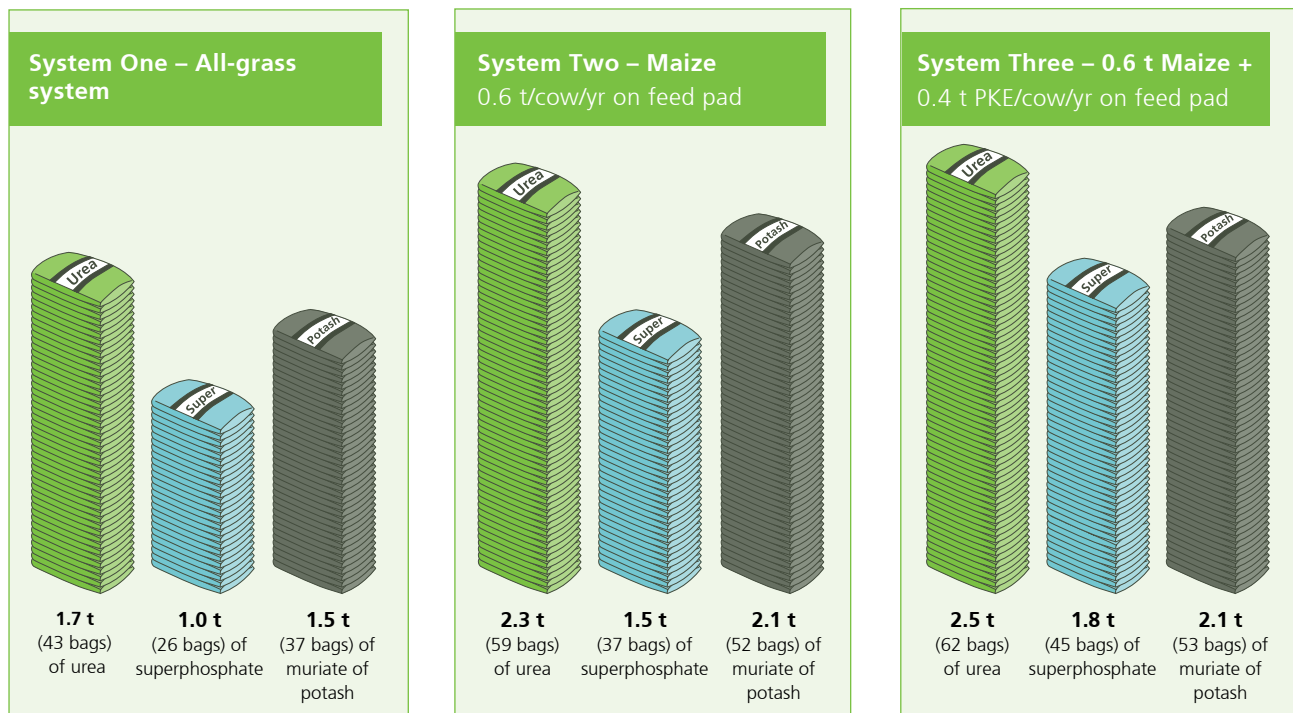
4.4.1 Nutrient value of effluent

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

Land application



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 m³ 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/m³

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)

(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	

Land application

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

Instructions
THIS CALCULATOR IS TO BE USED IN COMBINATION WITH THE DAIRY EFFLUENT STORAGE CALCULATOR. IT DOES NOT REPLACE IT.
 Follow the steps stated and enter data into the green boxes as labelled below. This input data will generate the "Total Working Volume" of the effluent pond in Step 3 below the pond diagram. The "Total Working Volume" relates to the volume generated by the Dairy Effluent Storage Calculator. The "Pond Surface Area per Cow" relates to the new pond surface area in the "Pond" input tab of the Dairy Effluent Storage Calculator. Additional data can be found in the data boxes below.

Step 1: Choose the Shape of the Effluent Facility: **Square or Rectangular**

Step 2: Enter the Dimensions into the green boxes below

Herd Size: 400
 Top Length (m): 40
 Top Width (m): 40

Batter Angle (Horizontal: Vertical): 2:1
 Total Depth (m): 3.5
 Freeboard Height (m): 0.5
 Unpumpable/Sludge Depth (m): 0.5

Step 3: Read the Specific Pond Volume & Dimension Outputs Below.

Total Working Volume	2,743 m ³	Percentage of Total Volume 71%
Pond Surface Area per Cow	4.0 m ² /cow	
Total Pond Surface Area	1,600 m ²	

Volume of Pond Sections

Total Pond Volume	3,869 m ³	Percentage of Total Volume 20%
Volume of Freeboard	761 m ³	Percentage of Total Volume 9%
Volume of Unpumpable/Sludge Area	365 m ³	

Total Pond Dimensions

	Pond dimensions at top of pond	Dimensions of floor of pond
Width (m)	40.0 m	26.0 m
Length (m)	40.0 m	26.0 m
Depth (m)	3.5 m	
Batter Angle (H:V)	2:1	

Disclaimer:
 DairyNZ Limited endeavours to ensure that the information in this publication is accurate and current. However, we do not accept liability for any error or omission. The information that appears in this publication is intended to provide the best possible dairy farm management practices, systems and advice that DairyNZ has access to. It may be subject to change at any time, without notice. DairyNZ Limited takes no responsibility whatsoever for the currency and/or accuracy of this information, its completeness or fitness for purpose.

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.

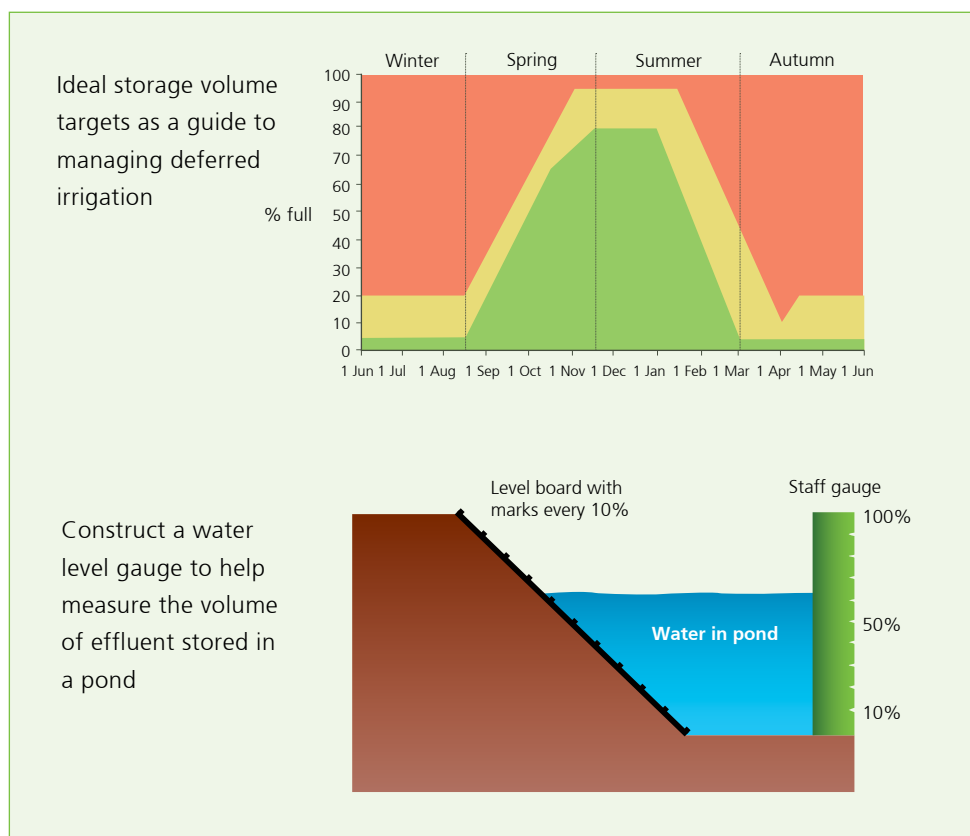
Seasonal targets

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.



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.

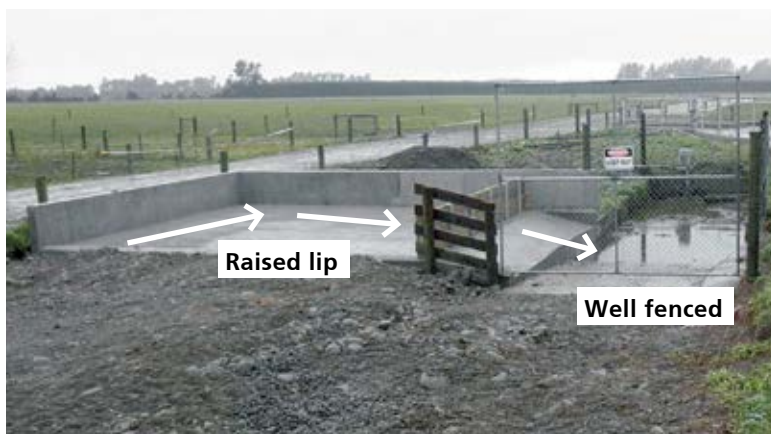
- Prior to desludging, stir the pond to mix the various layers of the pond before emptying (caution: wave action created by pond stirrers can damage clay liners)
- Solids should be stirred and sucked out with a hose to minimise risk of damaging the pond liner. Do not use excavation equipment for desludging 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

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 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

	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	111.1 m ³ /ha	Application Depth	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	6.7 kg P/ha	Potassium	38.9 kg K/ha	

A screenshot of the Farm Dairy Effluent Spreading Calculator.

Solids and slurries

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.

The poster is titled "Effluent management plan" and contains the following sections:

- Form fields:** Farm name, Date, Maximum application depth (mm), Maximum application rate (mm/hr), Maximum N loading (kg N/ha), and a field for "Do not apply effluent if soil moisture is:".
- Effluent duty person is:** A table with columns for "Who" and "Date done".
- Task categories:**
 - Daily Tasks:** e.g. Make sure irrigator is in the right place.
 - Weekly Tasks:** e.g. Empty effluent sump and stone trap.
 - Monthly Tasks:** e.g. Check nozzles are not blocked or damaged.
 - Annual Tasks:** e.g. Do application rate test.
- Farm Policy:** A list of bullet points including:
 - Effluent system is checked at least daily
 - No effluent puddles in any paddocks
 - Problems with effluent: tell your manager
 - Check and record effluent irrigation events
 - Any leak or breakdown is dealt with IMMEDIATELY
 - No effluent gets into waterways
 - No effluent into or near soakholes or bores
 - All staff given adequate training before using system
- What to do if...:** A table for troubleshooting common issues like "Too wet to irrigate", "Irrigator stalled / breakdown", "Pump failure", etc.
- Emergency contact numbers:** A table for "Farm contact person", "Effluent equipment", "Electrical problems", "Milk company - Effluent specialist", "Pump breakdown and service", "Effluent collection tanker", "DairyNZ - Effluent specialist", and "Regional Council".

At the bottom left, it provides contact information: dairynz.co.nz, 0800 4 DairyNZ (0800 4 334 7969). At the bottom right is the DairyNZ logo.

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* (compliance toolkit.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

Irrigator run sheet template

A Staff Guide to Operating Your Low Rate Application System.

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.



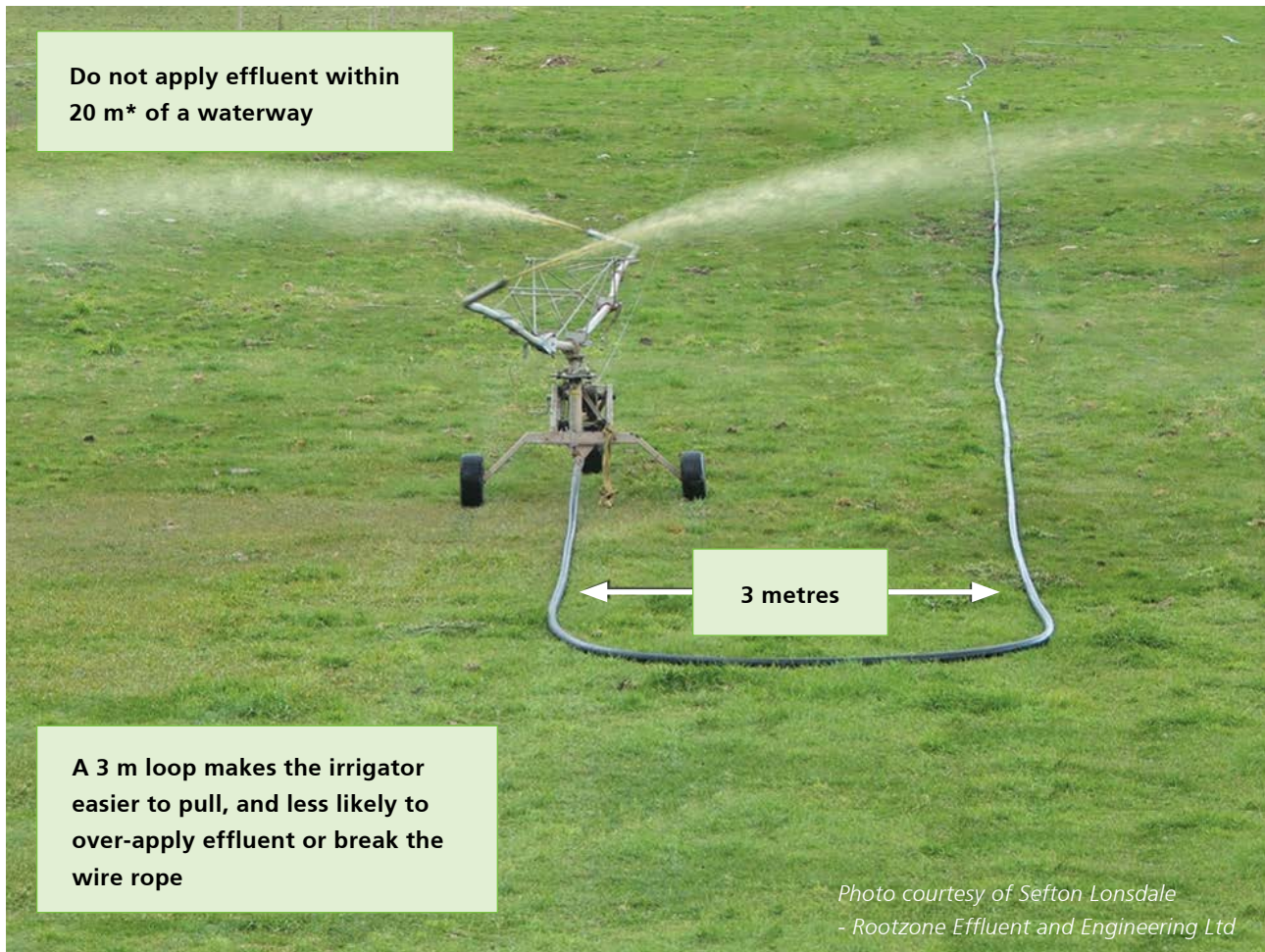
A 14° slope – this is too steep for irrigation with a travelling irrigator, a suitable low rate system should be used instead.

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 involves 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.

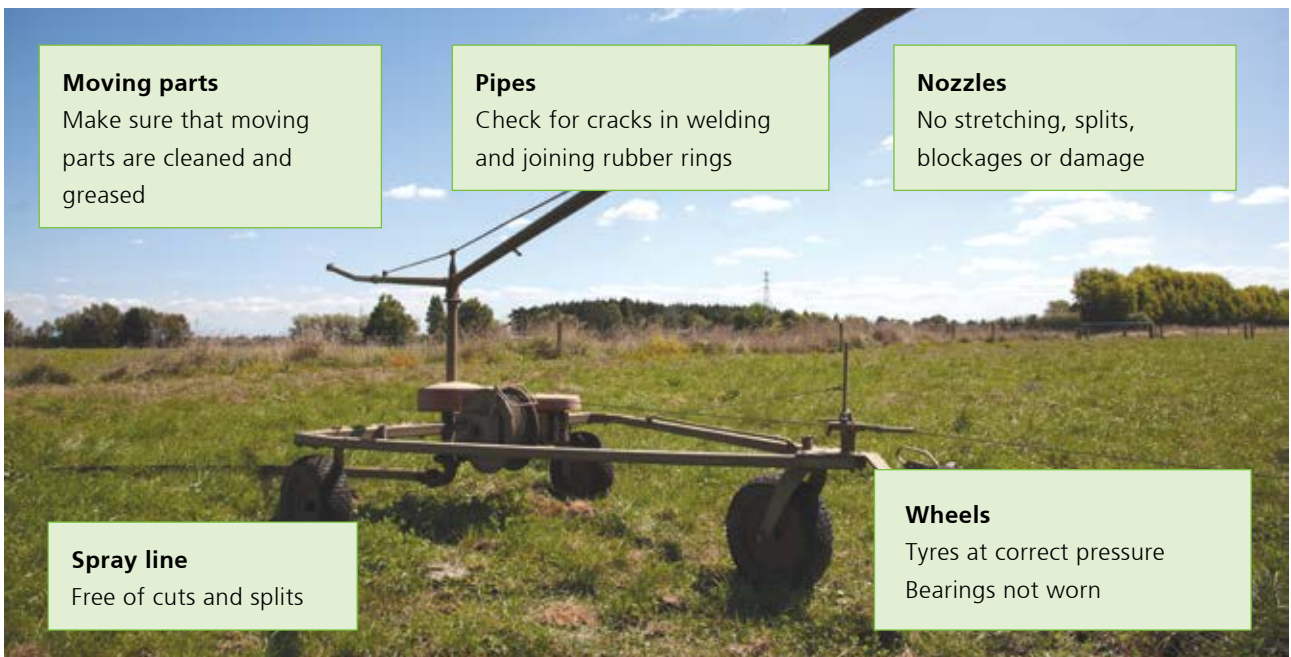
Monthly

- 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/effluent-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