

EFFLUENT BEST PRACTICE

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The dairy industry objective for Effluent is to “Keep all effluent out of surface and groundwater”.

To achieve this you need to achieve the following best farm practices.

Collection and storage

- Collect all effluent prior to treatment
- Have appropriate sealed storage facilities.

Pond treatment

- Ensure effluent is contained in a sealed pond system and does not enter water bodies in an untreated state.

Land application

- Ensure that applied effluent does not result in ponding or run off
- Keep the applied effluent in the root zone.

Nutrient management

- Ensure the annual Nitrogen (N) loading meets local rules e.g. < 150 kg N/ha/yr on effluent block
- In any one application of effluent, do not apply excess nutrients, e.g. > 50 kg N/ha in any one application
- Calculate area of the effluent block based on N and K loadings in an OVERSEER®) nutrient budget.

System management

- Have the effluent system designed and installed by a qualified and experienced professional
- Have an effluent management plan including:
 - Records
 - Staff training
 - Maintenance schedule and results
- Have a contingency plan in case of system break down or wet soils
- Comply with any rules and regulations.

Best farm practice considerations to help you meet industry objectives for effluent

Collection and storage

Collect all effluent prior to treatment (pond or land application)

Storage (or holding) ponds are built to store effluent before it is applied to land. This is particularly necessary during wet periods when land application is impractical and undesirable, in many cases effluent irrigation during these times will result in surface ponding and runoff.

There are a number of advantages to using this option:

- Greater flexibility - the effluent can be applied when it is more likely to meet plant nutrient and water requirements e.g. not applying effluent when soils are wet
- The provision of storage allows the application to fit in when time or labour are available, so there is less stress on staff and time
- If possible pump from the aerobic (second) pond, as the low solids content means fewer problems with pumps, pipe blockages and spraying equipment
- Utilise the sand trap to collect solids before they enter ponds or treatment systems.

Have appropriate sealed storage facilities

It is crucial that any pond is sealed to ensure effluent is not leaching into groundwater and that groundwater cannot enter the pond.

There are a number of options available for sealing ponds. Compacted clay is a good option if it is available and if constructed correctly. More costly options include plastic liners or concrete, these will definitely ensure your ponds are sealed. Should an artificial liner be required, specific engineering advice should be sought regarding the installation.

Make sure you will be able to clean the sludge pond with a digger – do not make the sludge pond too wide or too deep. A good idea is to put a barrier on the bottom of the pond (eg on railway tracks) so that when the digger cleans the pond to reduce the risk of breaking the pond seal.

Notes:

Pond treatment

Ensure effluent is contained in a sealed pond system and does not enter water bodies in an untreated state

In two pond systems effluent enters the first (anaerobic) pond where solids settle and are broken down by bacteria which thrive in the absence of oxygen. This reduces the level of nutrients flowing into the second pond. Anaerobic ponds need to be *at least* 3 metres deep (4 to 5 m being ideal).

The second (aerobic) pond is shallower, enabling the penetration of sunlight and aeration of the water by wind to maintain higher oxygen levels. In some cases, second ponds have a bottom layer where there is no oxygen – these are more correctly called facultative ponds. Aerobic and facultative ponds are generally less than 2 metres deep.

Effluent leaving the second pond into a waterway is considered “treated” and has to meet strict guidelines that will be set out in the resource consent. Council may measure Biological Oxygen Demand (BOD), nutrient levels and faecal bacteria test levels to ensure the discharge is not having significant effects on water quality.

Land application

Ensure that applied effluent does not result in ponding or run off

Soil consists of solid, water and air components. To gain benefit from effluent application it is necessary to provide enough water in the soil for good plant growth. Since the air and water components compete for available pore space between the soil particles, a combination of over application and poor drainage will cause too much of the pore space to be filled with effluent water, resulting in low aeration, impacting on soil life and limiting plant growth and ponding of effluent on the surface. This will also influence the risk of leaching and contamination of water.

Keep the applied effluent in the root zone

The maximum application depth (mm) is the amount of effluent applied at any one time. Over application will result in saturated conditions in the root zone, which will reduce pasture growth and may damage pasture due to excessive solids build up. Ponding is often the visible symptom of over application of effluent. To avoid ponding you need to consider the soil type, rooting depth of the plant species in the paddock where you are applying, and what the soil can hold in the root zone.

Nutrient management

Ensure the annual Nitrogen (N) loading meets local rules e.g. < 150 kg N/ha/yr on effluent block

The application area that receives effluent is often calculated on the basis on the nitrogen content of the effluent. It is essential to have a large enough receiving area to prevent N leaching into waterways. Use an OVERSEER® Nutrient Budget to assess the current nutrient loading per hectare from fertiliser and effluent. Then use Overseer to calculate the actual area required to meet your local regulation. The N content of your effluent should be measured, doing several tests over the year. This information can be used to inform the Nutrient Budget. The N content of farm effluent varies due to differences in the actual nutrient content of the faeces and urine (varies with diet, age and season), as well as the amount of washdown water used at the farm dairy which dilutes the effluent. The nutrient composition of effluent also changes during storage.

In any one application of effluent, do not apply excess nutrients, e.g. > 50 kg N/ha in any one application)

The quantity of nutrients applied in the effluent should be closely matched to the nutrient uptake of the pasture or crop, to obtain the best value from the fertiliser and to reduce nutrient loss. Nutrient uptake and availability to pasture are dependent on a number of factors including:

- • soil type
- • pasture growth stage and composition
- • soil temperature and moisture. (There is a lower nutrient requirement in winter.)

Recent research shows that 1 kg N from effluent is equivalent to 1kg N from urea, in terms of pasture production, composition and nitrate leaching. Therefore farm dairy effluent can produce a good pasture response. For example, 10 to 15 kg DM per kg N applied in the effluent. Most of the potassium, calcium, magnesium and other nutrients in effluent are also available for pasture uptake.

Applying at rates greater than plant uptake means that the Nitrogen (and other nutrients) is lost via leaching, and a production opportunity is also lost when the N is not converted to pasture growth for cows.

Notes:

Calculate area of the effluent block based on N and K loadings in an OVERSEER®) nutrient budget

The application area is that area of farm land set aside for the receiving of effluent as a nutrient and irrigation treatment.

The size of the application area is largely determined by:

- the volumes and nutrient content of the effluent
- the soil and drainage (including overland and subsurface) characteristics of the land the effluent is to be applied to
- The influence on natural waterways.

The best way to calculate the area required for an effluent block on your farm is to use the OVERSEER® nutrient budget programme. The importance of allowing a large enough area of the property for land application of effluent cannot be overemphasised.

Adequate provision of land area:

- reduces nitrate leaching and, therefore, wasted nutrients and groundwater contamination
- minimises metabolic problems due to excessive potassium (K)
- prevents ponding and surface runoff of effluent or sealing of the soil surface
- avoids physical deterioration of soil
- stops weed invasion of the treated area
- makes best use of the nutrients for pasture growth.

If there is not enough suitable land, arrangements must be made to apply the excess effluent on suitable land elsewhere or have an alternative back-up effluent treatment system.

Generally applications of 150 – 200kg N / ha / yr is economically and environmentally optimal.

Phosphorus loading from effluent is close to matching pasture requirements. Olsen P soil test levels need to be monitored on effluent blocks to ensure they remain in the optimal range. If not supplemental fertiliser may be required.

Often the potassium loading from effluent is greater than necessary. Maintenance soil requirements are around 70 – 80 kg K / ha / yr and effluent applications of K can be twice this amount (120 – 130 kg K / ha / yr). This results in potassium levels in the raising above optimum. This is likely to result in a higher risk of metabolic problems i.e. inducing milk fever or staggers.

If soil nutrient reserves are depleted below optimum levels, additional nutrients may need to be applied as fertiliser.

The key to matching effluent nutrient loading with pasture requirements is regular nutrient monitoring and nutrient budgeting. This will ensure that potassium levels are kept at an optimum and that excessive potassium applications do not result.

System management

Have the effluent system designed and installed by a qualified and experienced professional

It is essential that farmers know the system they are using is able to meet high performance standards, and that their own management of it is best practice. A good system starts with a good design that is correctly installed and applies effluent with appropriate scheduling. System maintenance is critical to ensure performance attains the levels intended by the design.

What should a farmer be looking for in an effluent system?

Design

The Designer must:

- have a way of demonstrating competence and quality (e.g. through providing appropriate testimonials and references)
- have excellent knowledge of the range of options available for effluent management and how they work in different farming systems
- have a sound knowledge of regional council regulations relevant to FDE and how they apply on your farm
- explain to you why the system they recommend is best for your situation

The Design must:

- start with analysis of soils and local climate
- include assessment of effluent volume and composition
- consider site selection carefully, identifying sensitive areas, including topography, connectivity to waterways.
- avoid or minimise risks to people or the environment
- include farm expansion or intensification plans appropriately – be inclusive of any future plans e.g. increased stocking rate, greater imported feed. Consider intensification over the lifespan of the equipment.
- provide estimates of labour requirements for system maintenance and management
- provide estimates of annual operational costs
- include a risk management plan (if the machinery fails, poor weather, leaky pond etc.)

Notes:

- ensure compliance with regional council rules and regulations
 - The purchase/supply contract must
- state prices, dates and terms for project completion
- address the process for managing variations as the project progresses
- clearly state the key performance indicator values relevant to the system (see below)
- address dispute resolution
- allow for training of system use and maintenance
- include a management plan for the farm
 - The system must:
 - optimise balance of capital and operating costs
 - ensure ease of use and reliability, and allow for flexibility
 - suit farm labour; training, supervision and availability

Key performance indicators

When investing in an effluent system, it needs to cover all the legal and practical requirements for each particular farming system. The following is a checklist that designers and installers should include in a proposal which will allow you to compare different proposals from different suppliers in a similar format. This should reduce confusion and give you standards that the system conforms to, to deliver good results on farm.

Some indicators farmers should discuss with designers and suppliers include:

- Compliance with Food Safety regulations (refer to your Farm dairy assessor)
- Compliance with Resource Management Act including:
 - Regional plans
 - Permitted activity rules
 - Consent conditions
 - Hydrological design
 - Daily effluent volume including all collection areas and stormwater
 - Number of days available for application to land (not wet)
 - Storage volume requirement, allowing for storage through wet periods
 - Maximum available soil water holding capacity
 - Maximum allowable depth applied in a single event
 - Soil infiltration and permeation rates
 - Flood risk
 - Maximum allowable effluent application rate
 - Maximum allowable annual nutrient loading
 - System performance

- System minimum and maximum effluent applied depth
- System effluent application rate
- System effluent application uniformity
- Number of days available storage
- Pump outlet operating pressure
- Mainline maximum and minimum flow speeds
- Applicator operating pressure
- Applicator design speed or stationary system run time
- Energy demand
- Operating requirements
- Daily run time at peak demand
- Daily labour and equipment use
- Staff capability and training needs
- Maintenance schedule and estimated costs
- Investment
- Design system life
- Capital cost
- Estimated annual operating costs
- Return on Investment

Have an effluent management plan including

- Records
- Staff training
- Maintenance schedule and results

Maintain an effluent management plan (EMP) to help you manage your effluent system.

An EMP describes your approach to effluent management, staff training, machinery and equipment maintenance, contingency planning and nutrient management.

Application map showing irrigation runs, risk areas and waterways

A written effluent application plan can help you identify suitable areas of the farm for effluent application, and can help all staff to see this and to keep accurate records.

Notes:

From a plan or map of the farm, identify waterways, natural drainage patterns, prevailing wind direction and neighbours' dwellings, soil types and sub-surface drainage

Mark out the ideal area for effluent application, noting irrigator runs for each paddock and colour-coded risk zones.

Risk zones include mole or tile drainage areas, very wet soils or very free-draining areas with underlying gravels and accessible groundwater. No-application zones include all land within 20m of a drain, waterway or bore, or the boundary of a neighbouring property.



Record where the applicator has been and who was responsible

Paddock	Date	Run number	Signature	Comment (e.g. signs of ponding or runoff)
1	15/8/07	7	FNP	
1	16/10/07	8	FNP	
1	12/12/07	4	WJP	
2	6/9/07	10	WJP	Ponding at south end, too wet?

Staff – trained, record keeping

Staff training is essential for successful operation of the effluent system. As well as how to operate the system, staff (including relief staff) should be informed about why this is important – the nutrient value of effluent, and the importance of protecting surface water and groundwater for the good of the environment and people, as part of a responsible industry.

Skill	Date	Trainer	Trainer signature	Employer signature
Minimising water use				
Rainwater diversion				
Yard wash-down				
Checking for leaks				
Avoiding water wastage				
Effluent pump maintenance				
Cleaning stone trap				
Greasing pump				
Irrigator set up and maintenance				
Positioning of irrigator and hose				
Checking nozzles for blockages				
Checking irrigator for wear				
Greasing irrigator				
Changing speed on the irrigator/using gears				
Measuring application rate				
Monitoring				
Checking for ponding and run-off				
Checking irrigator for problems				
Checking for tile and mole drain discharges				
Checking level of storage ponds				

Maintenance – scheduled

Record who is responsible for maintaining the system and when maintenance was done.

Equipment failure can lead to waterway pollution but good maintenance reduces the risk.

Gradual deterioration can also increase contamination risks – e.g. worn nozzles can result in higher application rates.

Notes:

Maintenance and record keeping for land application systems

Daily

- Before and after every milking, check the rainwater diversion is in the correct position
- Assess whether the soil is dry enough and the water table is low enough to allow effluent application to pasture without ponding or runoff
- Adjust application rates according to soil conditions to avoid ponding or surface runoff
- Record effluent application information.

Regularly

- Shift the spray applicator system to a new area that has been recently grazed, and is in the correct rotation according to the effluent management plan
- Make sure the spray application system is not sending effluent into water troughs
- Check waterways to ensure effluent is not moving into the water. Also check what is coming out of tile drains
- Clean and clear the effluent stone trap and gratings
- Check that the float switches are clear and working
- Grease all moving parts on the applicator, ensure above-ground connections are clear of dirt, and the sprayline is free of cuts or splits
- Check that the nozzles are not blocked or damaged
- Flush clean water through the delivery line and sprinklers to keep them from blocking
- Check tyre pressure on the irrigator
- Check level of storage ponds
- Visually inspect the entire effluent pipe network.

Six-monthly to annually

- Service the pump
- Check wheel bearings on the irrigator
- Check the pump seals as these are the components most susceptible to wear
- Have a nutrient analysis done on the stored effluent, soil and pasture
- Measure what your irrigator is actually applying (should be no more than 25mm per application)
- Remove sludge from the storage pond and spray any weeds growing on surface
- Train staff in correct effluent management practise
- Check the conditions of any hydrants, cupplings or any potential weak spots on the effluent pipe network and replace if necessary.

Have a contingency plan in case of system break down or wet soils

You must have contingency measures in place to cover not being able to irrigate effluent:

- When the soil is water logged from prolonged or extreme wet weather
- There is an equipment breakdown or power cut

Contingency measures include having enough storage to cope with pump failure or prolonged wet periods. Holding pond storage is one option to provide flexibility so that you

don't have to apply effluent when it is wet but also gives back up capacity in the case of pump failure. The amount of storage you will need depends on individual property data, but should include the number of cows (now and future increases), feed pad and stand-off pad effluent, the volume of water off all the yards and farm dairy roof, and the estimated volume of rainwater falling directly into the pond (i.e. in areas with high rainfall, storage systems that have a large surface area will need extra storage capacity) - see the above design standards.

Breakdowns

In the event of power failure, pump or motor breakdown have a plan so that staff know what to do. A petrol / diesel / PTO back up pump is a good idea, or have access to a back up one locally. If you have no storage:

- Contact repairer immediately to assess problem
- Limit or cease water use in the dairy yard and scrape effluent where possible
- Complete repairs or install the back-up pump before the next milking. Where necessary arrange for a vacuum tanker empty the sump and spread effluent to the discharge area.
- Leave a list of Important Phone Contacts in the shed.

Comply with any rules and regulations

Intensive use of land, such as dairy farming, will have some impact on water, air and soil. Finding the balance between successful dairy production and the degree of impact that may be acceptable to society is a key factor in determining sustainable dairying.

Under the Resource Management Act (1991) the major responsibility for natural resource management was passed to 'Local Authorities'. Local authorities include Regional Councils and District Council or City Councils. Unitary Authorities combine the functions of Regional and District/City Councils. The Unitary Authorities are Gisborne, Nelson, Marlborough and Tasman.

Regional Councils are charged with managing the use of water (i.e. damming, taking or diverting water and discharging contaminants into water) while District Councils have control over the use of land (e.g. rules about subdivision and development). Regional Councils may control some activities on land if they are likely to have an impact on natural resources.

Regional Councils are required to establish rules in their Regional Plans that are intended to ensure the sustainable management of water as a resource. If a farming activity does not

Notes:

comply with a rule in a Regional Plan that is a breach of the Resource Management Act. . It is critical that all rules and regulations relating to your farming operation are met, if not you could be issued with an infringement fine or prosecuted. Generally if you are meeting industry best practice for a farming activity, you will be complying with the rules.

Regional council responsibilities that might relate to your farming operation include:

- Sustainable use of resources. Ensuring water, air, land and geothermal resources are used in a sustainable manner that considers the needs of current users as well as future generations and minimises environmental effects
- Clean air. Dealing with pollution. Controlling the release of gases, odours, dust, and smoke into the air
- Clean water. Controlling the release and runoff of human, agricultural, mining, forestry and industrial wastes
- Secure land. Maintenance and protection against erosion and natural hazards such as flooding. Regulating the disturbance of the beds of lakes and rivers
- Waste disposal. Minimising the impacts of the disposal of waste (e.g. farm dairy effluent, industrial effluent and sewage) onto/into land or into water
- Environmental awareness. Providing education and information services.