dexcel Partners in profitable dairying™ FarmFact

3-13 Improving effluent pond treatment systems

Why improve pond treatment systems?

Dairy farms have intensified over the past 20 years, including increasing cow numbers. One of the consequences is that effluent pond systems have become undersized, leading to poor performance.

To determine if your effluent pond treatment system is adequate see *FarmFact 3-12*.

Reduce effluent volume

Minimising the volume of your dairy shed effluent is very important. Reducing effluent volume will allow the effluent to be treated to a higher standard and will allow pond systems to continue to be acceptable, economical and practical.

Stormwater diversion

One of the major contributors to effluent volume is water. Not only does water increase the volume of effluent that you have to treat, it also:

- Dilutes the amount of micro-organisms that live and work in your ponds treating the effluent
- Decreases the temperature of the ponds
- Reduces the retention time by 'flushing' the effluent through the system too fast

It is therefore important to 'capture and divert' any excess water away from your effluent pond system. An effective stormwater diversion decreases the amount of rainwater entering the system.

Consider an average combined yard and roof area of 250m^2 – an annual rainfall of 1200 mm will add 300m^3 (300,000 litres) of water to the pond system. No stormwater diversion means you will need much bigger ponds or an additional disposal system.

Undersized anaerobic pond

Undersized anaerobic ponds, is one of the most common reasons for poor performance of your effluent pond treatment systems. If the anaerobic pond is undersized the retention time is shorter than that required for adequate treatment and the pond system fails.

To improve the situation of an undersized anaerobic pond:

- Increase the size of your anaerobic (first) pond. Either increase the size of your existing pond, or add another anaerobic pond until your total anaerobic volume meets the recommended size for your herd plus any additional effluent inputs. (E.g. feed pads).
- Add on another treatment system such as applying effluent to land. Use your effluent ponds as storage and irrigate from the aerobic (second) pond.

Ineffective baffle or T-piece

By allowing solids to move from the anaerobic pond to the aerobic pond, you are overloading the aerobic capacity of these ponds and essentially turning them into another anaerobic pond.

To retain solids in the anaerobic pond ensure that:

- A baffle or Tee is set up correctly on the discharge pipe. The position of the inlet and outlet pipe is very important for optimizing the capacity of your ponds. The inlet should be diagonally opposite the outlet pipe.

Undersized aerobic pond/s

An undersized aerobic pond (assuming that the anaerobic pond is adequate) results in elevated faecal bugs and ammonium nitrogen levels in your wastewater.

To make improvements:

- Increase the size of your existing aerobic pond
- Have two average-sized ponds, which is better than one large aerobic pond
- Add another treatment system, such as application to land and pump your effluent from the aerobic pond.

Add another pond to the system. It is an inexpensive and simple solution when herd size and/ or property sizing increases. The additional pond should be at least half the surface area of the aerobic pond (second pond).

Apply the effluent to land rather than discharging to a waterway. Land application is generally the preferred option of Regional Councils, and is gaining popularity with farmers. The pond system can provide an excellent first treatment and storage facility.
See *FarmFacts 3-3 and 3-11*

Pond system overloaded by other effluent sources

The addition of effluent from the following sources, to an existing system, is likely to result in overloading and the contamination of receiving water:

- Standing off cows on the farm dairy yard for extended periods
- Feed pad effluent
- Stand-off pad effluent

Options for improvement include:

- Construct additional ponds, in conjunction with the existing ponds, or as a separate treatment
- Increase the size of existing ponds
- Add another treatment system, such as land application from your aerobic ponds

Additional treatments

Attaching an additional treatment to the end of the pond system can solve the problems of poor effluent quality.

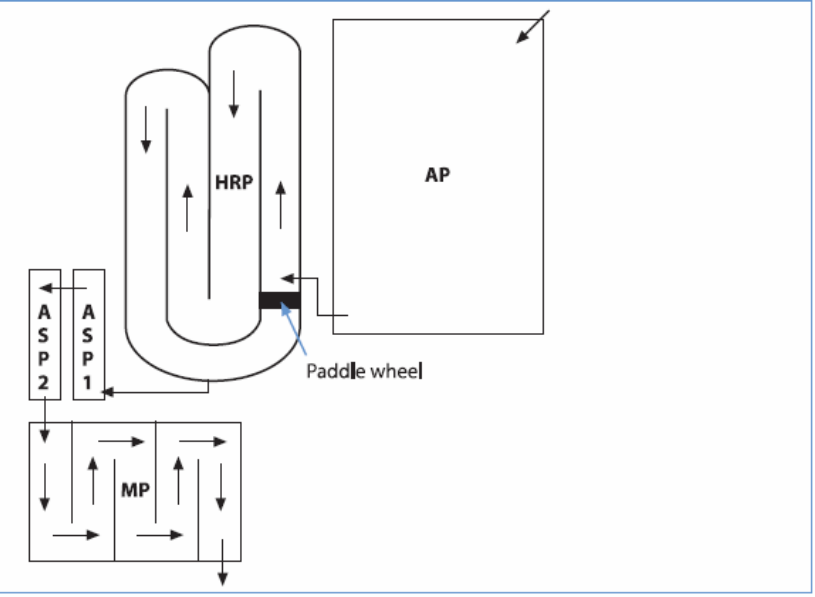
Advanced pond systems

The four-pond system retains the existing anaerobic (first) pond, but replaces the existing anaerobic (second) pond with three other types of ponds. These are a high rate pond, algae settling pond and a maturation pond, which together replace the conventional Aerobic pond. The table below shows the characteristics and the function of each pond.

POND FUNCTION IN THE ADVANCED POND SYSTEM

Type of pond	Design features	Function
Anaerobic pond	Deep (4 m), rectangular in shape with a length to width ratio of 2:1	To promote sedimentation and anaerobic breakdown and to enable removal of the settled sludge
High rate pond	Shallow (0.1-0.3 m), long, meandering raceway mixed by a paddle wheel.	To promote algal growth for uptake of nutrients and release of oxygen to reduce BOD, plus disinfecting of micro-organisms by exposure to sunlight.
Algae settling pond	Deep (3 m) at in-flow end, sloping to shallow (0.5-1 m) at the out-flow end.	To promote settling of large algae in the still, deep pond conditions and enable ease of collection (allowing removal of nutrients).
Maturation pond	Depth of 1 to 3 m with baffles to raise residence time.	Polishing of effluent by allowing zooplankton to graze remaining algae, and further removal of micro-organisms by solar radiation, sedimentation and protozoan grazing.

THE ADVANCED POND SYSTEM LAYOUT



Constructed wetlands

The plants in wetlands are generally species adapted to flooded conditions for part of or for the entire year. The plants provide a good wildlife habitat as well as water purification.

Constructed wetland systems are designed to simulate and optimise the filtering and organic matter breakdown processes that occur in natural wetlands.

During summer months, such a system may even result in zero discharge to waterways, due to evapotranspiration of water from the wetland.

The advantages of constructed wetlands are that they:

- Have the ability to treat a wide range of contaminants
- Have the ability to handle shock loadings of effluent
- Do not normally rely on electricity or machinery
- Have aesthetic value and provide wildlife habitat
- Are more acceptable to Maori than direct discharge to surface waterways
- Require minimal ongoing capital expenditure and maintenance once established
- Operate successfully over a wide range of climate regimes (as long as cold temperatures do not affect the functioning of the pre-treatment ponds).

Constructed wetlands are not 'stand alone' treatment systems. They are designed to polish effluent flowing from a pond system before it reaches a surface waterway.

For constructed wetlands to operate successfully the pond system must be working adequately and effluent flowing from the pond system must be treated to a high standard.

Consider mechanical aeration.

Mechanical aerators:

- Introduce air into the effluent.
- Expose more effluent surface area to the air. This is commonly achieved by spraying effluent into the air or agitation of the effluent.

Chemical and biological additives

Several kinds of additives are available and are claimed to dissolve and disperse solids build-up particularly crusting. These additives vary in their effectiveness. Current evidence shows that they are not a long-term solution to reducing sludge and crusting problems.

Better management of effluent pond systems

- ✓ Divert stormwater from the farm dairy and prevent water run-off from the land entering the pond system
- ✓ Prevent excessive chemical from entering ponds (such as hoof treatment and cleaning chemicals)
- ✓ Prevent other wastes, such as gloves, syringes, plastic bags, tail switches etc. entering the ponds. These can block the pipes and reduce the effectiveness of the pond system.
- ✓ Ensure the ponds are sealed
- ✓ Ensure that groundwater is not entering through the pond floors. If groundwater is entering then you can bet that effluent is exiting in this way!
- ✓ Where ponds are lined with a plastic liner, ensure that the pumps or other machinery don't damage the liner. Contractors should be made aware that a liner is present.

- ✓ Ensure pipework is installed correctly. Inlet and outlet pipes placed in the wrong position can result in short-circuiting effluent through the system, rather than optimizing retention through pond capacity.
- ✓ Prevent damage to pipework and embankments.
- ✓ An effective maintenance programme must be followed, including desludging, weed control and care of pipe work.
- ✓ Effluent ponds must be at least 45m from the farm dairy.

Updated: September 2006

FUNDED BY NEW ZEALAND DAIRY FARMERS THROUGH Dairy InSight