Appendix VII

Good management practices for discharge of agricultural effluent

Appendix VIIA
Good management practices for discharging farm dairy effluent to land

In the Taranaki region the application of farm dairy effluent on to land is a controlled activity requiring a resource consent. Where there is a failure to comply with conditions outlined in the regional rule regarding application of effluent on to land then the activity becomes a discretionary activity.

The material presented in this appendix must not be considered as a set of rules that will be applied universally. Each individual situation will be considered by the Taranaki Regional Council on its particular merits and circumstances, with regard for the level of environmental protection that is appropriate in that situation.

This appendix contains information relating to the discharge of farm dairy effluent to land. The material is laid out so that information relating to the treatment and discharge system is addressed first, then information relating to site selection is presented.

1. Improving existing effluent treatment systems

1.1 Reducing clean water entering the system

Prevent clean water from entering the effluent system as it unnecessarily adds to the volume of effluent to be disposed of, increasing the cost of treatment.

- Rainwater from roofs should not run into the sump. Install roof guttering and downpiping.
- Use a stormwater diversion to redirect the yard stormwater to a soak hole or waterway between milking. Stormwater must be directed to the farm dairy effluent treatment system during milking and washdown of the yard. This will ensure that contaminated stormwater cannot discharge to local waterways.
- Clean water from plate coolers should be reused as washdown water.

1.2 Reducing manure

Manage the herd to reduce effluent. Consider the following:

- Reduce noise and herd stress - treat the stock gently before yarding and milking, be even tempered, do not use dogs in and near the farm dairy, and check for, and stop, stray electricity.
- Improve cow flow. Extra time spent on the yard and raceways will increase the total amount of manure. If using the farm dairy yards as a wintering pad or as a stand off pad remember - more effluent has to be treated.
- Split larger herds during milking.
- Do not feed the herd during milking.

1.3 Reducing washwater and waste

Speed up final cleaning and minimise the amount of washdown water by prewetting the yard before milking**,** and by using manual scrapers and squeegees, and shovelling off the manure pats.

Also prevent afterbirth, rubbish and waste products from entering the effluent treatment system. Have a trash drum outside the farm dairy to dispose of rubbish.

2. Effluent collection

2.1 The stone/sand trap

Stone or sand traps hold back sand, gravel, bale twine and clumps of grass that are washed off the yard. This prevents any blockage in drain lines, the pump and in effluent spray systems.

The stone trap should be large so it does not require continual cleaning and so it can be cleaned easily using either a wide mouthed shovel or a tractor's front end loader bucket.

2.2 The sump and storage facilities

Sumps should be large enough to allow easy cleaning and a 300mm freeboard from the top of the sump to the highest effluent level must be allowed for. When the sump is pump drained, it is better if the sump is large and the pump is operated on a timer mechanism rather than float switches or probes.

Provide an overflow, especially if the sump is small. This should lead to a temporary holding basin.

From the sump, the effluent is best stored in a holding pond, or an active or disused oxidation pond, and applied to land when the soil and climatic conditions are suitable. Minimum storage is $10m^3$ per 100 cows. This will allow 8 milkings storage should the land application system fail. Storage also offers farmers flexibility, as they are able to choose the best time for effluent application and it is back-up storage in case of system breakdown. It also allows for the settling of solids that may otherwise damage the pump.

3. Land application system selection

Land application usually involves the use of a spray application system. There are a variety of different systems available. Alternatively, a contractor may be employed to apply the effluent from a holding pond several times annually.

3.1 Spray application

Most spray application systems consist of a pump, delivery line and applicator frequently applying effluent onto the pasture. Figure 1 gives the components of a typical spray application system.

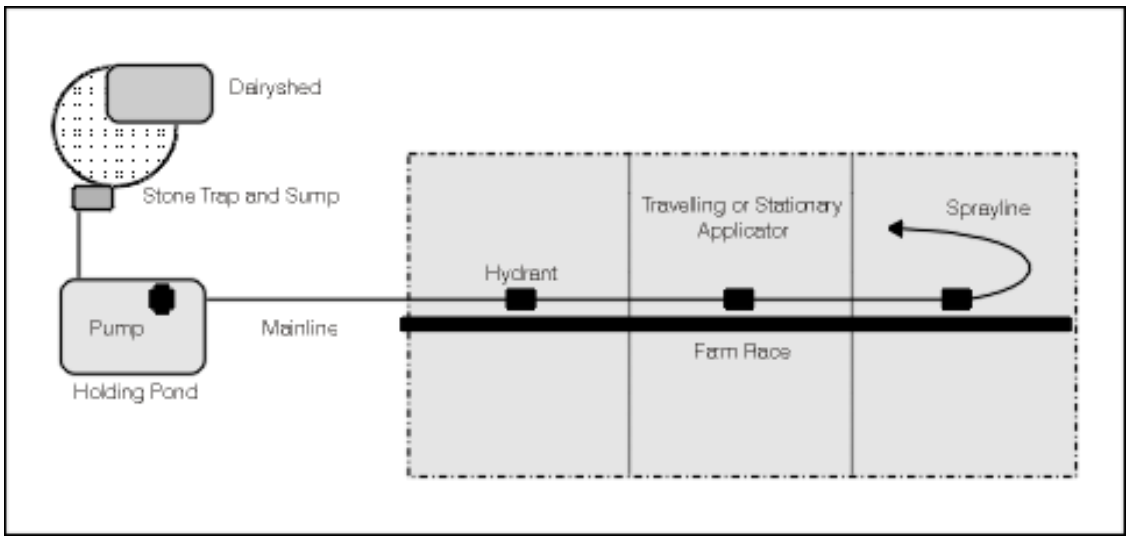

Figure 1 Components of a spray application system

Where topography allows a gravity fed system can be used to convey the effluent from holding or storage ponds to the area that needs to be irrigated. However, most systems involve the use of a pump feeding the irrigators.

Pumps operating from a pond can be seated on a float. Electric motor driven pumps, manufactured especially for effluent, are best.

The delivery pipeline is made up of the mainline carrying effluent to the application site, and the sprayline carrying effluent from the hydrants to the applicator. The delivery pipeline should utilise swept 'bend' fittings in preference to sharp 'elbow' fittings otherwise flow will be restricted.

Place the mainline along fence lines so it can service two adjacent paddocks and is away from cultivating machinery.

When the land around the hydrant is to be treated, the sprayline is coupled to the hydrant. A valve is necessary at any hydrant where the pond is at a higher level than the application site. This will prevent the holding pond draining when the pump is turned off. Also a non return valve is necessary when pumping uphill.

The applicator is fed by the portable polyethylene sprayline. The sprayline should not be greater than 150m long. Pressure loss increases with distance. Also it is difficult for a farmer or a travelling applicator to drag a long sprayline full of effluent. For ease of handling the sprayline can be broken down to sections with camlock joints. When shifting the sprayline take large sweeping turns to avoid kinks.

Travelling applicators have advantages over stationary applicators. Stationary applicators require frequent shifting, which is often a problem when other farm duties require time.

Travelling applicators winch themselves using a wire rope which is fixed to a metal peg at the end of the run. Beware of using fence line posts as an anchor for the wire rope. Posts can be pulled from the ground.

Select a travelling applicator that applies effluent low to the ground, has a wide wetted width and variable travel speeds and that automatically shuts down at the end of a run. Galvanising is also important as the effluent is very corrosive.

3.2 Contractors

Contracted spreading gives the most flexibility when applying effluent to land. The application site is not limited to a fixed area and effluent can be spread in late spring on to silage and hay paddocks, and in mid summer onto pasture to combat dry weather.

Pond sites and fencing should allow vehicle access. The effluent must be stirred to mix the various layers into a liquid slurry, before removing it from storage. If the storage facility is sealed with a liner, take care not to damage it with the stirrer or suction end of the pipe. Make contractors aware of the liner. When stirring ponds, take care backing the tractor up to the pond. If the tractor slopes back too far, lubricating oil in the tractor engine will fall away from the front crank bearing, damaging the engine.

When using contractors or hiring equipment, make sure that the equipment used has been cleaned before use on your farm. This is so diseases are not transferred within the effluent from one property to another.

There are two types of contracting operations - pump spreaders and vehicle spreaders (honey wagons). It is the pump spreading operation that is best used in most cases.

Pump spreading contractors use a large pump set up on a mobile platform which is capable of pumping up to 800m through a pipeline to a travelling/stationary applicator.

This enables 100 to 150ha to be reached around a pond and there is no damage to races, gateways or paddocks with the operation of heavy equipment.

Vehicle spreading contractors suction draw effluent from a holding pond into a mobile tank. Effluent is pump sprayed from the rear of the mobile tank on to the land. The vehicle spreader runs up and down paddocks in strips, covering the application area. The vehicle and tank moving across the land can cause damage to the pasture and soil, especially around gate entrances. Use vehicle spreaders when soils are dry.

4. Land application

4.1 Site selection

When choosing a site to apply effluent to land, select a large enough area, where the land is relatively flat, the water table is deep and the soil is free-draining.

- Hygiene: do not apply effluent within 45m of the farm dairy as disease causing micro-organisms may live in the effluent and can pose a risk to both animal and human health. Separation distances for hygiene purposes are specified in the Dairy Industry Farm Dairy Code of Practice.
- Recommended proximity to groundwater and surface water: not within 50m of a bore or well, or 25m of a surface water body. If effluent accidentally enters a waterway it may decrease the ability of the waterway to sustain life as well as cause a health risk to people and animals. The regional rule for discharge of farm dairy effluent to land states that no contaminants shall be discharged to surface water. The direct application of effluent into surface water can result in legal action by the Taranaki Regional Council.
- Recommended proximity to dwellings and public roads: not within 150m of any dwelling house and not within 20m of any road. Effluent can cause a nuisance to the public because of its odour and it may attract flies.

4.2 Area required

Apply up to 200kg/ha of nitrogen each year. This limit is used throughout New Zealand as the generally accepted upper limit beneficial to pastures. A higher rate may result in high nitrate levels in groundwater. Also, the clover content of pasture and the amount of nitrogen fixed by the clover may be reduced.

Table 1 gives the area required for various herd sizes. The area required is the minimum, and it is preferable to have a larger area. 200kg/ha of farm dairy effluent nitrogen each year is approximately the same as setting aside an application area of 3 hectares per 100 cows.

Table 1 Application area for a N loading rate of 200kg/ha/yr

Cow numbers	Area Required (ha)
100	3.0
150	4.5
200	6.0
250	7.5
300	9.0
350	10.5
400	12.0
450	13.5
500	15.0

4.3 Fertiliser value

There is fertilising benefit to be gained when applying effluent to pasture and cropping land. Farm dairy effluent offers a source of N, P, K and S fertilisers and trace elements to increase pasture or crop production. The organic matter in the effluent can improve soil water holding capabilities, soil aeration and drainage, and soil tillage characteristics. Application of effluent on to pastoral soils may also increase earthworm numbers. Application of effluent that has been treated by a two-pond oxidation pond treatment system offers additional benefits, as much of the nitrogen in farm dairy effluent is converted to ammonia during the treatment process. This form of nitrogen is much more readily available for plant uptake.

Table 2 gives typical nutrient values for farm dairy effluent. Note, however, that the fertiliser value of effluent from a single property will vary between milkings and between seasons. Also, effluent stored in ponds changes in nutrient content.

Table 2 Equivalent fertiliser value of effluent from 100 cows

Nutrient (kg/yr)					Solid Fertiliser Equivalent (tonnes/yr)
N	P	K	S	Mg	
590					1.3 of Urea
	70	540	80		1.3 - 2.2 of 50% Potash Super
				100	0.2 of Mg Oxide

Farm dairy effluent from 100 cows, spread over 3 hectares will provide approximately:

- 200kg/ha of N.
- 23kg/ha of P.
- 180kg/ha of K.
- 27kg/ha of S.
- Magnesium and calcium.

Not all the nutrients are available to plants in the first year. Most potassium is available for pasture uptake, but nitrogen and phosphorus will require time to be broken down into plant available forms.

4.4 Application management

A very heavy application of effluent may result in surface ponding, runoff into waterways, leaching and groundwater contamination, or odour problems. It may also damage the pasture, blocking out light and rotting the sward at ground level.

The maximum application (mm) is the maximum amount of effluent that should be applied at any one time. This is generally two milkings worth of effluent. The application interval (days) is the minimum time interval between applications to allow the soil to recover. These are dependent on the soil type and Plant cover. Table 3 gives recommendations for pastoral soils.

For cropping land, larger volumes of effluent may be applied to bare soil. Allow the soil to dry out, then work the effluent into the subsoil before sowing or planting.

Table 3 Application recommendations for various soils types under pasture cover

Soil Type	Maximum Application	Application Interval
Sand	15 mm	5 days
Sandy loam	24 mm	15 days
Silt loam	24 mm	20 days
Clay loam	18 mm	20 days
Clay	18 mm	20 days
Peat	20 mm	15 days

4.5 Pasture management

Where possible, wait for rain or allow a 7 day stock withholding period before grazing. This will ensure pasture is sterilising by sunlight and air or washing by rainfall.

It is ideal to graze stock in front of the area to be treated, a few days before application. This will provide short pasture and will allow time for sterilisation and the recovery of palatability before stock return. Also, short pasture will benefit most from the nutrients with less risk of the sward rotting.

For hay and silage, effluent should not be applied within the 7 days before harvesting.

5. Management and maintenance

Ensure applicators are shifted frequently.

Regularly check and repair pumps, applicators and other effluent equipment.

If the system is not going to be used for a long time, flush it with water before close down. This will prevent the effluent settling, solidifying and blocking the pipeline.

5.1 Monitoring the system

The resource consent holder has primary responsibility for monitoring the functioning of the system.

The following guides indicate a poorly operating land application system:

- Effluent ponding on the pasture surface.
- Pasture spoilage with areas of mucky pasture.

Both indicate that the application system is applying too much effluent on too small an area. Shift more frequently or ensure contractors are applying the effluent sparingly.

Where it is suspected that the land application system is operating poorly, also consider the options in ‘Improving existing effluent treatment systems', above. Contact the Taranaki Regional Council.

References

Heatley, P.R., 1996. "Dairying and the Environment Manual: Managing Farm Dairy Effluent". Dairying and the Environment Committee, New Zealand Dairy Research Institute, New Zealand.

Standards Association of New Zealand, 1973. NZS 5103: “Code of Practice for the Design, Installation and Operation of Sprinkler Irrigation Systems”. SANZ, Wellington, New Zealand.

Vanderholm, D.H., 1984. “Agricultural Waste Manual”. New Zealand Agricultural Engineering Institute Project Report No. 32. NZAEI, Lincoln College, New Zealand.

APPENDIX VIIB

Appendix VIIB

Good management practices for discharging farm dairy effluent to water

In the Taranaki region the discharge of treated farm dairy effluent to water is a controlled activity requiring a resource consent. Where there is a failure to comply with conditions outlined in the regional rule regarding discharge of effluent to water then the activity becomes a discretionary activity.

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This appendix contains information relating to the discharge of farm dairy effluent to surface water. The material is laid out so that information relating to treatment and the discharge system is addressed first, then information relating to site selection is presented.

1. Improving existing effluent treatment systems

The pond system will not work well:

- If it is too small.
- At temperatures below 20°C.
- When bottom sludge or surface crusting has built up sufficient to affect performance.
- If the retention time is less than 60 days.

For a poorly operating pond system to continue to be an acceptable and practicable option, the volume of effluent often needs to be reduced and be treated to a higher standard. Pond sizes may also need to be increased, see 1.4 for further detail.

1.1 Reducing clean water entering the system

Prevent clean water from entering the effluent system as it unnecessarily adds to the volume of effluent to be disposed of.

- Rainwater from roofs should not run into the sump. Install roof guttering and downpiping.
- Use a stormwater diversion to redirect the yard stormwater to a soak hole or waterway between milking. stormwater must be directed to the farm dairy effluent treatment system during milking and washdown of the yard. this will ensure that contaminated stormwater cannot discharge to local waterways. Make sure it is open during the day and night, and it is closed during milking and washdown.
- Clean water from plate coolers should be reused as washdown water.

1.2 Reducing manure

Manage the herd to reduce effluent. Consider the following:

- Reduce noise and herd stress - treat the stock gently before yarding and milking, be even tempered, do not use dogs in and near the farm dairy, and check for, and stop, stray electricity.
- Improve cow flow. Extra time spent on the yard and raceways will increase the total amount of manure. If using the farm dairy yards as a wintering pad or as a stand off pad remember - more effluent has to be treated.
- Split larger herds during milking.
- Do not feed the herd during milking.

1.3 Reducing washwater and waste

Speed up final cleaning and minimise the amount of washdown water by prewetting the yard before milking**,** and by using manual scrapers and squeegees, and shovelling off the manure pats.

Also prevent afterbirth, rubbish and waste products from entering the effluent treatment system. Have a trash drum outside the farm dairy to dispose of rubbish.

1.4 Additional Treatments

Attaching an additional treatment as part of the pond system can solve the problem of poor effluent quality. Different methods of providing additional treatment are listed below:

- Apply the effluent to land rather than discharging to a waterway. The pond system can provide an excellent first treatment and storage facility. Refer to Appendix VIIA 'Good management practices for discharging farm dairy effluent to land'.
- Add another pond to the system. This is an inexpensive and simple solution to a herd size increase. The additional pond should be at least half the surface area of the facultative pond (second pond). An alternative is to divide the second pond in two with a curtain wall.
- Increase the size of the pond system.
- Install constructed wetlands. They use water, plants, air, sunlight, and bacteria to further 'polish' pond effluent before it reaches the surface waterway. This is not always successful as the option requires high capital expense and management to work well.
- Consider mechanical aeration. Aerators introduce oxygen to the effluent so that facultative bacteria can more effectively break it down. There are significant operational costs when using mechanical aeration. Compare these to those lesser costs associated with land application systems.
- In an emergency use chemical and biological additives. These control odours and break down crusting and solids. Additives do not reduce the polluting properties of effluent but make it more manageable.
- Desludging of the ponds. Desludging is recommended on an 'as necessary' basis.

2. Pond systems

2.1 Pond system design

The pond system is an attractive option for treating effluent because it is:

- Low in cost.
- Simple to install, taking 2 to 3 days to construct.
- Low in maintenance requirements.

The key standard is that effluent from ponds must discharge into receiving waters capable of diluting the effluent by at least 100:1 at the discharge point.

Pond systems have two or more ponds in a series. Effluent is piped to the anaerobic pond (first pond) from the farm dairy sump. The anaerobic pond acts like a septic tank, collecting a sludge on the bottom and slowly breaking down the effluent.

Effluent then flows to the facultative pond (second pond) by a pipe and baffle. In the facultative pond further breakdown occurs. The effluent then passes through an additional treatment or is discharged directly into a waterway.

2.2 Site selection

When choosing a site to construct a pond system, select an area where the water table is deep and the soil is heavy and impermeable. Silt or clay soils are ideal for pond

foundations and construction. Avoid building ponds over coarse sands, gravels, fractured rock or other materials that will allow effluent to seep out of the pond or allow groundwater to enter in.

An officer of the Taranaki Regional Council must be present at the time a site is chosen.

- Hygiene: not within 45m of the farm dairy as disease causing micro-organisms may live in the effluent and can pose a risk to both animal and human health. Separation distances for hygiene purposes are specified in the Dairy Industry Farm Dairy Code of Practice.
- Recommended proximity to dwellings: no part of the system to be within 150m of any dwelling house. If possible, site the ponds downwind from dwellings, roads and other public places. The greater the distance from a potential complainant the better.
- Recommended proximity to public roads: no part of the system to be within 20m of any road or farm boundary.
- Allow for a straight run of pipelines, tractors and desludging vehicles to the ponds.
- Site in an open area so as to take advantage of the sun and wind, which assist the efficient operation of the facultative pond and thus improve the quality of the discharge.
- Keep systems away from overhead or underground power lines.
- Avoid sites that are likely to flood, have steep slopes that run towards a waterway, spring or bore hole, are pipe drained or mole ploughed, are likely to freeze over, or have recently been cleared of trees or similarly disturbed.
- Construct the system below the farm dairy so that gravity can be used to carry the effluent.
- Orientate the longest side of the pond at right angles to the prevailing wind.

2.3 Pond sizing

Pond size depends on the loading being applied to the system. Figures 1 and 2 in conjunction with Tables 1 and 2, give the major design recommendations for a pond system. Pond size is based on cow numbers and assumes all stormwater is prevented from entering the ponds (refer 'Improving Existing Effluent Treatment Systems', above).

- Have a length to width ratio of at least 2:1. This maximises the 'flow path' of the effluent, ensuring the effluent is kept within the system as long as possible.
- Keep pond width less than 24m because of the 'reach' limitations of excavator and desludging machinery.
- Orientate ponds with the long axis perpendicular to the prevailing wind. This will maximise the settlement of solids and help minimise intense odours.
- Provide for 500mm freeboard in the design.

2.3.1 The anaerobic pond

Anaerobic ponds are deep treatment ponds that exclude oxygen and encourage the growth of bacteria which break down the effluent. Construct:

- To a depth of 4m. Depths greater than 4m should be avoided due to limitations of desludging machinery.
- With a small surface area. A small surface area minimises the area in contact with oxygen at the pond surface, reduces heat loss, encourages mixing, promotes the formation of an undisturbed surface layer and minimises the surface area to catch rainfall.

2.3.2 The facultative pond

Facultative ponds are shallow and contain algae which produce oxygen that is used by bacteria to further break down the effluent. Odours are removed and most disease causing

micro-organisms die-off. The larger the surface area of the facultative pond, the better its performance. Construct:

- To no deeper than 1.2m.
- As two smaller ponds rather than having one very large facultative pond when cow numbers in the herd are over 200, or when the pond is likely to be too large for effective desludging and stirring, or when the pond is too long for the site and interferes with existing structures such as fences.

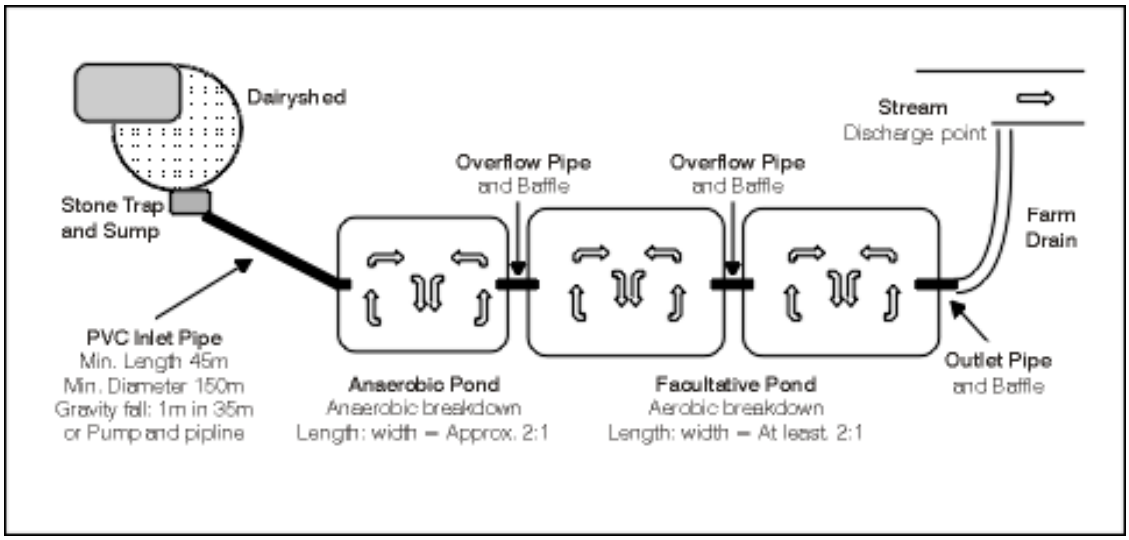

Figure 1 Layout of oxidation pond treatment system

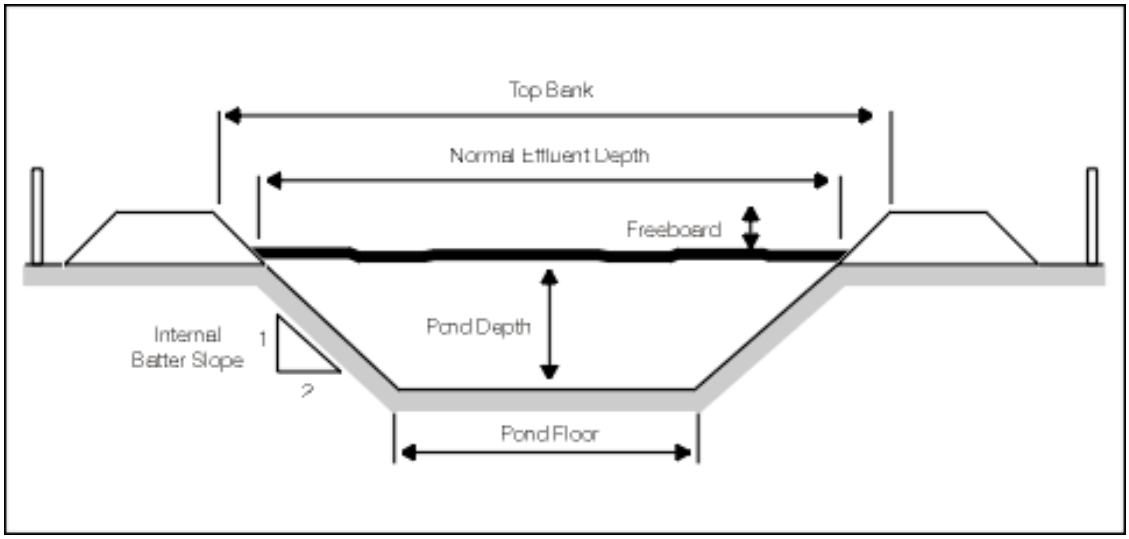

Figure 2 Construction parameters for oxidation ponds

Table 1 Recommended anaerobic pond sizing

Cow Nos	Required Volume	At Normal Effluent Depth			Top Bank Size	Pond Floor Size
		Depth	Size	Surface Area		
100	525 m^3	4.0 m	16 m x 19 m	300 m^2	18 m x 21 m	0 m x 3 m
150	615 m^3	4.0 m	18 m x 21m	380 m^2	20 m x 23 m	2 m x 5 m
200	810 m^3	4.0 m	18 m x 26 m	470 m^2	20 m x 28 m	2 m x 10 m
250	1000 m^3	4.0 m	18 m x 31m	540 m^2	20 m x 33 m	2 m x 15 m
300	1200 m^3	4.0 m	18 m x 36 m	650 m^2	20 m x 38 m	2 m x 20 m
350	1390 m^3	4.0 m	18 m x 41 m	740 m^2	20 m x 43 m	2 m x 25 m
400	1580 m^3	4.0 m	22 m x 35 m	770 m^2	24 m x 37 m	6 m x 19 m
450	1770 m^3	4.0 m	22 m x 38 m	840 m^2	24 m x 40 m	6 m x 22 m
500	1970 m^3	4.0 m	22 m x 42 m	920 m^2	24 m x 44 m	6 m x 26 m

Note 1: Batter slope on interior bank = 2 : 1.
Note 2: Freeboard = 500 mm.
Note 3: Based on 0.09kg BOD/cow/day

Table 2 Recommended facultative pond sizing

Cow Nos	Required Surface Area	At Normal Effluent Depth			Top Bank Size	Pond Floor Size
		Depth	Size	Volume		
100	370 m^2	1.2 m	18 m x 21 m	340 m^3	20 m x 23 m	13 m x 16 m
150	560 m^2	1.2 m	18 m x 31 m	540 m^3	20 m x 33 m	13 m x 26 m
200	740 m^2	1.2 m	22 m x 33 m	720 m^3	24 m x 35 m	17 m x 28 m
250	*920 m^2	1.2 m				
300	*1100 m^2	1.2 m	Build an appropriate combination of			
350	*1280 m^2	1.2 m	the above ponds to make up			
400	*1570 m^2	1.2 m	the required surface area.			
450	*1660 m^2	1.2 m				
500	*1830 m^2	1.2 m				

Note *: Perhaps divide this dimension into two smaller facultative ponds.
Note 1: Batter slope on interior bank = 2 : 1.
Note 2: Freeboard = 500 mm for all herd sizes.
Note 3: Based on 0.09kg BOD/cow/day

2.4 Pond construction

A resource consent must be applied for from the Taranaki Regional Council prior to commencing any work on the ponds.

Preferably, build the ponds $^2/_3$ above and $^1/_3$ below the ground. Pond and embankment construction involves the following:

1. Stripping topsoil from the pond area and stockpiling it for replacement later.
2. Excavating. Ground conditions should be moist, but not wet, for excavation work.
3. Digging a key trench to a firm base, at least 1m deep and 3m wide, beneath the centre of the embankment. The key trench hinders flow of effluent through the ground by lengthening the seepage path, prevents erosion and offers structural stability to the embankment.
4. Banking up and compacting the soil, while excavating the pond, to form the pond walls, when ponds are built at least partly above the ground. Poor compaction will lead to effluent seepage and erosion of the embankment by wind and rain.
5. Placing layers of suitable graded soil on top of each other to a 200mm depth over the full width.
6. Packing the soil tight using suitable equipment. Fill should be compacted over the entire surface after each 200mm soil layer is added. Use water to aid compaction if the soils are too dry. Best compaction is obtained with heavy rubber-tyred vehicles and rollers. Track vehicles are unsuitable as their weight is spread over a large track surface area.
7. Building the banks with internal batters of 2:1 slope.
8. Building the banks high enough to allow for settling.
9. Building the top bank wide enough to allow for vehicle access for maintenance. Widths of between 3.0m and 4.0m are usual.
10. Building a loose metal platform to provide access and a firm platform for dredging machinery, pond stirrers and vehicle spreaders. This will prevent erosion of the banks and allow for easy access regardless of the prevailing soil conditions.
11. Grading the top bank away from the pond so that stormwater runoff into the pond is prevented.
12. Installing a plastic liner if the soil is less than 10% clay.
13. Sowing grass to cover the embankment to the water's edge to prevent erosion from sun, wind and rain. Phalaris, ryegrass and clover are suitable species.
14. Fencing. A secure perimeter fence is advisable for safety reasons.
15. Using buried PVC pipe, of at least 150mm diameter (preferably use 300mm diameter), for carrying effluent to, and between, ponds. Do not used perforated, ribbed drainage coil. Drains are not acceptable. Pipe the effluent towards the pond centre, 6m from the pond edge. Place the outlet at the opposite side of the pond, 1.5m from the far edge.
16. Including baffles on outlets. This is **very** important. Baffles prevent floating solids from moving between ponds. Make sure all pipes and baffles are fixed and do not float upon changing effluent levels.

3. Management and maintenance

Plan to first use the ponds at the beginning of the milking season to allow bacteria time to build up over the warm summer months.

- Encourage and maintain grass cover on the banks to prevent erosion, but keep Plants short.
- Do not allow trees or shrubs to grow on, or near to, embankments. Tree roots can pierce the embankment causing instability. If trees fall over, or roots die, the embankment will be breached.
- Examine embankments after heavy rain.
- Desludge ponds regularly, as necessary. Never empty out ponds completely or important bacteria will be lost.

3.1 Monitoring the system

The resource consent holder has primary responsibility for monitoring the functioning of the system.

A resource consent that has been issued to allow a discharge to a waterway will usually require that:

- A minimum dilution of 1 part effluent to 100 parts receiving water is maintained at all times.
- An ammonia-N concentration of not more than $0.025gm^{-3}$ is maintained at or beyond the downstream boundary of the mixing zone.
- The filtered carbonaceous BOD_5 concentration does not exceed $2gm^{-3}$.

Any readings above these figures indicate overloading and remedial measures will be necessary. The following visual guides will help identify such a poorly operating pond system:

- Sludge build-up or excessive crusting.
- Bubbling has stopped in the anaerobic pond.
- Discolouration of the receiving waterway.

Where it is suspected that the pond system is operating poorly or the necessary 1:100 dilution cannot be met, consider the options in 'Improving existing effluent treatment systems', above. Also, contact the Taranaki Regional Council.

References

Heatley, P.R., 1996. "Dairying and the Environment Manual: Managing Farm Dairy Effluent". Dairying and the Environment Committee, New Zealand Dairy Research Institute, New Zealand.

Vanderholm, D.H., 1984. "Agricultural Waste Manual". New Zealand Agricultural Engineering Institute Project Report No. 32. NZAEI, Lincoln College, New Zealand.

APPENDIX VIIC

Appendix VIIIC
Good management practices for discharging piggery effluent to land

In the Taranaki region the discharge of piggery effluent on to land is a controlled activity requiring a resource consent. Where there is a failure to comply with conditions outlined in the regional rule regarding discharge of effluent to land then the activity becomes a discretionary activity.

The material presented in this appendix must not be considered as a set of rules that will be applied universally. Each individual situation will be considered by the Taranaki Regional Council on its particular merits and circumstances, with regard for the level of environmental protection that is appropriate in that situation.

When discharging piggery effluent to land, refer also to the Regional Air Quality Plan for Taranaki Appendix II 'Good management practices for intensive pig farming' for guidance. The discharge should comply with the requirements of the Regional Air Quality Plan for Taranaki.

This appendix contains information relating to the discharge of piggery effluent to land. The material is laid out so that information relating to the treatment and discharge system is addressed first, then information relating to site selection is presented.

1. Improving existing effluent treatment systems

For the land application of piggery effluent to be acceptable, economical and practical the volume of effluent needs to be minimal and it should also be applied in such a way that odour and other nuisances are minimised.

1.1 Reducing the volume of effluent requiring treatment

Refer to 'Good management practices for discharging farm dairy effluent to land' as many principles apply.

1.2 Additional Treatments

Since piggery effluent is largely solid in form, provide solid separation, storage, and intermittent land application. Such systems have greater flexibility though at additional cost.

The benefits of solids/liquids separation include pump protection and improved pump performance, decreased loading on storage facilities, production of a liquid that is 'easier to handle', production of a solid by-product that may be useful as a fertiliser, and, if used for irrigation, the liquid will more completely infiltrate the soil.

Composting of the solids may be an option. Refer to 'Good management practices for discharging poultry washwater to land: Improving existing washwater treatment systems'.

2. Effluent collection

Refer to 'Good management practices for discharging farm dairy effluent to land: Effluent collection'.

2.1 Storage Facilities

Have storage facilities capable of holding 2 days worth of piggery effluent and ensure that any overflow is unable to reach surface water.

For calculating storage requirements, Table 1 gives typical solid piggery effluent production values that can be used as a guideline where there is no recorded data from the farm. Water used for washing down and/or drain flushing is also included in this table.

Total effluent volume is calculated from a total pig weight which equates with the number of 50 kg 'pig equivalents' that comprise that weight.

Both the total solid volume and total volume of washwater may be better arrived at through examining the specific property and washdown system employed.

Table 1 Typical piggery effluent production values

Parameter	Pig - meal fed	Pig - whey fed
Animal mass kg	50	50
Raw manure - urine faeces l/day	3.3	10.3
Washdown water l/day	12	12

2.2 System selection

Refer to 'Good management practices for discharging farm dairy effluent to land: Land application system selection'.

Because piggery effluent has a powerful odour, the system used should be designed to operate on as low a pressure and spray trajectory as possible, to keep spray drift and aerosol production to a minimum. This is regardless of whether a spray application system or contractor is used. Aerosol production can be a problem causing an odour nuisance. In addition there is a potential for bacterial drift which is particularly important if spraying is carried out near horticultural crops.

A back-up system should be provided for those times when the weather or soil conditions are unsuitable or equipment breaks down. Sufficient storage or an arrangement with the local septic tank cleaning contractor may be all that is required.

2.3 Soil injection

Injecting effluent from a tanker directly down to the root zone of the Plants is an option which minimises odour, and may become more important in the future.

3. Land application

3.1 Site selection

When choosing a site to apply effluent to land, select a large enough area, where the water table is deep and the soil is free-draining.

Odour is a major consideration when choosing the application site of piggery effluent.

- Proximity to groundwater: do not apply effluent to land within 50m of any wells or bore used for water supply purposes. Piggery effluent can cause a health risk to people and animals.
- Proximity to surface water: do not apply effluent to land within 25m of a surface water body. If effluent accidentally enters a waterway it may decrease the ability of the waterway to sustain life as well as cause a health risk to people and animals. The regional rule for discharge of piggery effluent to land states that no contaminants shall be discharged to surface water. The direct application of effluent into surface water can result in legal action by the Taranaki Regional Council.

- Recommended proximity to dwellings and public roads: not within 150m of any dwelling house and not within 20m of any road. Effluent can cause a nuisance to the public because of its odour and it may attract flies. Refer also to Table 4 of Appendix II of the Regional Air Quality Plan for Taranaki.
- Recommended hygiene guidelines: well away from public places, cropping paddocks and horticultural blocks as disease causing micro-organisms may live in the effluent and can pose a risk to both animal and human health.

3.2 Area required

The area of land required for spray disposal of piggery effluent is determined by:

- Potassium content of the effluent.
- Soil type and the slope of the land (topography). The soil type and slope dictate the maximum rate at which effluent can be applied and the total volume of effluent applied. Refer below 'Application management'.
- The resting period required between each application.

The key determinant with piggery effluent is potassium. Apply up to 100kg/ha of effluent potassium each year. Table 2 gives the area required for various herd sizes.

Table 2 Area required with a loading rate of 100kg K/ha/yr

Combined Pig Weight (kg)	Area Required (ha)
500	0.55
5000	5.50
10000	11.00

A herd of 200 sows weighing 125kg each would require a minimum of 27.5 hectares so as not to exceed a 100kg K/ha/year loading rate.

3.3 Fertiliser Value

The fertiliser value of piggery effluent is significant. Tables 3 and 4 give the nutrient content of wastes from pigs. They are typical nutrient values based on a 50 kg pig equivalent on a daily and annual basis. Note, however, that the fertiliser value of effluent from a single property will vary with feed type. Also, effluent stored in ponds changes in nutrient content.

Table 3 Nutrient value of effluent from a typical 50kg pig

Nutrient	kg/pig/day	kg/pig/year
Nitrogen	0.023	8.40
Phosphorus	0.0075	2.74
Potassium	0.015	5.48

Table 4 Equivalent fertiliser value of effluent from a herd of 5000kg of combined pig weight (e.g. 40 125kg sows)

Nutrient (kg/year)			Solid Fertiliser Equivalent (tonnes/year)
N	P	K	
840			1.8 of Urea
	270		3.0 of Superphosphate
		550	1.1 of Muriate of Potash

3.4 Application management

Avoid generating odour which may become a nuisance to neighbours.

Avoid causing runoff of piggery effluent from the property by not applying effluent to slopes or when it is raining.

Mechanical systems for effluent application should include a back-up system in case of breakdown of the primary system. This may take the form of adequate storage.

Refer to 'Good management practices for discharging farm dairy effluent to land: Application management'.

4. Management and maintenance

4.1 General Tips

Effluent should be screened to remove solids, reduce blockages, and minimise wear and tear. Spray applicators should be flushed after use to reduce blockages.

Where possible, effluent should be spread on bright days when the wind is blowing away from sensitive areas.

Avoid overdosing the land with effluent. If not, the odour will remain much longer and pasture scorching may result.

4.2 Manure applied off-farm

When applying effluent to fertilise a neighbour's property, ensure that the operation and design is subject to a written agreement between all parties involved including the Taranaki Regional Council.

4.3 Monitoring the system

The resource consent holder is primarily responsible for monitoring the functioning of the system.

Refer to 'Good management practices for discharging farm dairy effluent to land: monitoring the system' as principles apply.

Where it is suspected that the land application system is operating poorly, also consider the options in 'Improving existing effluent treatment systems', above and contact the Taranaki Regional Council.

References

Heatley, P.R., 1996. "Dairying and the Environment Manual: Managing Farm Dairy Effluent". Dairying and the Environment Committee, New Zealand Dairy Research Institute, New Zealand.

Vanderholm, D.H., 1984. "Agricultural Waste Manual". New Zealand Agricultural Engineering Institute Project Report No. 32. NZAEI, Lincoln College, New Zealand.

Appendix VIID

Good management practices for discharging poultry washdown water and poultry effluent to land

In the Taranaki region the discharge of poultry washdown water on to land is a controlled activity requiring a resource consent. Where there is a failure to comply with conditions outlined in the regional rule regarding discharge to land then the activity becomes a discretionary activity.

The material presented in this appendix must not be considered as a set of rules that will be applied universally. Each individual situation will be considered by the Taranaki Regional Council on its particular merits and circumstances, with regard for the level of environmental protection that is appropriate in that situation.

When discharging poultry washdown water and poultry effluent to land, refer also to the Regional Air Quality Plan for Taranaki Appendix III 'Good management practices for intensive poultry farming' for guidance.

This appendix contains information relating to the discharge of poultry washdown water and poultry effluent to land. The discharge of poultry washdown water is addressed first, followed by the discharge of poultry effluent. The material is laid out so that information relating to the treatment and discharge system is addressed first, then information relating to site selection is presented.

A. Discharge of poultry washdown water to land

1. Washdown procedures

Washdown water should not normally have detergents, sanitisers or disinfectants added, as these could give rise to contamination of the soil and groundwater. If chemicals are to be used, then only biodegradable products should be considered.

Stock and shed management requires emphasis on the avoidance of damp and poor litter conditions, which will leave a higher level of organic material to be washed out, and therefore a higher contaminant load in the washdown water.

Litter cleaning out should be as complete as possible, with residues and surface dust being blown down and collected along with the litter, prior to washdown. Litter should be removed from the end pad as quickly as possible after cleaning out.

Washdown procedures should follow an accepted practice which minimises any adverse effect of excess water ponding, or the discharge of water with high solid and organic loadings without a collection system in operation.

Washdown water must not be mixed with stormwater for discharge into or near waterways. This is not a permitted activity and can only be done under a specific consent issued by the Taranaki Regional Council.

2. Planned new establishments

The site position and layout should be designed to cater for good drainage and disposal of both stormwater and washdown water in such a manner that washdown water and stormwater contaminated by roof dust cannot reach surface water. Where possible roof fans should not be used in order to reduce the contamination of stormwater.

Site position and layout should include good sized sloping end pads above the relative level of the adjacent ground, with surrounds designed to cater for collection of any solid waste material, and coarse grade road metal at the edges to ease the soakage of water.

A sump collection system may be required if the discharge into or onto land is liable to soak into an area close to a surface waterbody. All discharges of poultry washdown water will be required to obtain a resource consent under Rule 37 of the Plan.

Roof and site stormwater should be able to be disposed of, if necessary, into local surface waterbodies, or into or onto land, provided that the conditions of Rule 23 of the Plan are met.

Interior shed construction should be designed in such a way that there are smooth impervious floors and wall/roof linings, for ease of physical cleaning as well as for effective washing. Equipment and fittings should not have cavities and hard-to-get-areas which would leave organic material in place after physical cleaning, as this will increase the contaminants present in the washdown water.

3. Existing establishments

Existing establishments should follow an upgrading programme to match the requirements outlined above for new establishments as far as practicable, especially for floor and wall surfaces, as well as end pads and ground drainage.

All discharges of poultry washdown water will be required to obtain a resource consent under Rule 37 or 38 of the Plan.

B. Discharge of poultry effluent to land

1. Improving existing effluent treatment systems

For the land application of poultry effluent to be acceptable, economical and practical the effluent should be applied in such a way that odour and other nuisances are minimised.

1.1 Reducing the volume of poultry effluent requiring treatment

Poultry effluent is largely solid in form and the cleaning of poultry is not usually a daily task. Hence, liquid storage is less important than for other animal wastes as collection can be carried out on those days where it is appropriate to immediately apply the effluent to land. However, ensure any collection facility can cope with the total volume of effluent produced on the day of cleaning.

There is very little opportunity to reduce the volume of solid waste that is produced in a effluent situation. However, use manual scrapers and squeegees, and shovel off solids to speed up the cleaning method and minimise the amount of effluent. The build-up of solid manure can then be quickly washed into the sump or carried to a storage area used for composting.

For design purposes, the volume of effluent generated for treatment is best estimated through examining the specific property and effluent system employed.

1.2 Additional Treatments

Direct land application of poultry effluent requires careful Planning and monitoring to avoid environmental degradation.

Solids can be composted. Mechanically separate solids out of poultry effluent, giving a liquid fraction that can be easily pumped, and a solid fraction. Separator types can utilise perforated screens or perforated belts against which effluent is squeezed or screwed. Vibrating screens can separate a liquid fraction. Other separator types use the principle of centrifugation. Regardless, the separated solids are either immediately spread on land or composted and spread on land. The most common application method of dried solids is topdressing with a bulk spreader.

Refer also to paragraph (p) of Appendix III of the Regional Air Quality Plan for Taranaki for further advice on good management practices for the spreading of solids.

Off site removal to commercial processors such as composting/pelleting operations, the nursery industry and market gardens is also an option.

2. Effluent collection

Refer to 'Good management practices for discharging farm dairy effluent to land: Effluent collection'.

Stone or sand trap arrangements are particularly important to hold back feathers, dead birds and other animal litter which may block pumps and pipelines.

Provide for solids separation and composting, and intermittent land application of liquids.

3. System selection

Refer to ‘Good management practices for discharging farm dairy effluent to land: Land application system selection'.

Spray application will require the use of pumps specifically constructed to pump poultry effluent (e.g. feathers). These are available from manufacturers.

Because poultry effluent may have a powerful odour, the system used should be designed to operate on as low a pressure and spray trajectory as possible, to keep spray drift and aerosol production to a minimum. This is regardless of whether a spray application system or contractor is used. Aerosol production can be a problem causing an odour nuisance. In addition there is a potential for bacterial drift which is particularly important if spraying is carried out near horticultural crops.

4. Land application

4.1 Site selection

When choosing a site to apply effluent to land, select a large enough area, where the water table is deep and the soil is free-draining.

- Proximity to groundwater: not within 50m of any well or bore used for water supply purposes. Poultry effluent can cause a health risk to people and animals.
- Proximity to surface water: not within 25m of a surface water body. If effluent accidentally enters a waterway it may decrease the ability of the waterway to sustain life as well as cause a health risk to people and animals. The regional rule for discharge of poultry effluent to land states that no contaminants shall be discharged to surface water. The direct discharge of effluent into surface water can result in legal action by the Taranaki Regional Council.
- Recommended hygiene guidelines: well away from public places, cropping paddocks and horticultural blocks as disease causing micro-organisms may live in the effluent and can pose a risk to both animal and human health.
- Recommended proximity to dwellings and public roads: not within 150m of any dwelling house and not within 20m of any road. Effluent can cause a nuisance to the public because of its odour and it may attract flies.

4.2 Application management

Avoid causing runoff of poultry effluent from the property by not applying washwater to slopes or when it is raining.

Refer to ‘Good management practices for discharging farm dairy effluent to land: Application management’ as general principles apply.

5. Management and maintenance

5.1 General Tips

Where possible, effluent should be spread on bright days when the wind is blowing away from sensitive areas. Avoid overdosing the land with effluent, otherwise the odour will remain much longer.

5.2 Monitoring the system

The resource consent holder is primarily responsible for monitoring the functioning of the system.

Refer to ‘Good management practices for discharging farm dairy effluent to land: Monitoring the system’ as principles apply.

Where it is suspected that the land application system is operating poorly, also consider the options in ‘Improving existing effluent treatment systems’, above and contact the Taranaki Regional Council.

References

Heatley, P.R., 1996. "Dairying and the Environment Manual: Managing Farm Dairy Effluent". Dairying and the Environment Committee, New Zealand Dairy Research Institute, New Zealand.

Vanderholm, D.H., 1984. “Agricultural Waste Manual”. New Zealand Agricultural Engineering Institute Project Report No. 32. NZAEI, Lincoln College, New Zealand.