

Oxidation pond treatment system

An oxidation pond system consists of two types of pond, an anaerobic pond and an aerobic pond. Certain farms may also require a third type of treatment (tertiary treatment), in the form of a constructed wetland or drain.

Anaerobic pond

The anaerobic pond is the first pond in the treatment system. By definition, the anaerobic pond is devoid of oxygen. This encourages the growth of anaerobic bacteria, which break down the solid content of the effluent.

Solids settle in the anaerobic pond, removing much of the nutrients from the effluent. To operate well, the pond needs to be deep (4 metres (m) or more) with a relatively small surface area. This helps maintain a low oxygen content and high temperature, which will help the survival of the anaerobic bacteria. Anaerobic ponds operate best at a temperature of at least 20.5°C.

The discharge from the anaerobic pond is devoid of oxygen, and is only partially treated. It is toxic to most aquatic life, and must pass through an aerobic pond before the effluent can be discharged to water.



Aerobic pond(s)

The aerobic pond is the last pond in the system. By definition, it contains oxygen, allowing the growth of aerobic bacteria which further break down the wastes. In addition, this pond allows some further settling of suspended solids. The ultraviolet light from the sun also reduces disease-causing organisms.

Surface area is the most important consideration as sun and wind are essential for the efficient operation of an aerobic pond. Oxygen availability is often a limiting factor in the rate of decomposition, hence an aerobic pond should be constructed in an exposed position. Pond depths should not be greater than 1.2 m for overall efficiency.

The efficiency of the aerobic pond reduces as size increases. Farms milking over 250 cows should split the aerobic pond into two or more ponds of equal dimensions.



Tertiary treatment

Depending on the site, tertiary treatment may be required in the form of a wetland or weedy drain. This type of treatment is useful for removing primarily nitrogen from the effluent. An additional information booklet is available detailing tertiary treatment.



Design of the pond system

Position of the pond system

Officers of the Council must be consulted before an oxidation pond system is constructed, to ensure that the site will comply with Council requirements.

To comply with the Council's regulations the system will need to be positioned more than 150 m from a dwelling. It is also recommended to keep the system over 45 m from the farm dairy and over 20 m from the farm and road boundary. Additional rules from the district council and/or your dairy company may apply.

When deciding where to put the ponds, you will need to consider where you want the ponds to discharge to. If the ponds are to discharge to water¹, that water will need to be able to dilute the treated effluent by 100:1 at the point of discharge, at all times. That is, for every litre of effluent that is discharged, there needs to be 100 litres of flow in the waterbody. A resource consent will be granted only when this dilution is available (in special circumstances, in consultation with the Council, the requirement may be reconsidered).

Other factors that need to be considered:

- Soils and parent materials at the site must be impermeable to pond waters as the waste solution can contaminate groundwater if seepage occurs. Ponds can be constructed in free-draining gravels, but water sealing materials, such as clay or butyl rubber sheeting, would be required.
- The aerobic pond(s) should be sited in an open area to take advantage of the sun and wind, which assist the efficient operation of the aerobic pond and thus improve the quality of the discharge.
- The stormwater catchment needs to be kept to a minimum to increase the retention time of the ponds.
- Rainwater run-off from the roofs of buildings should be directed away from the effluent system.
- Terrain needs to allow for a straight run of pipelines. Also tractors and desludging vehicles need to be able to access both ponds.
- 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.

Pond size

The following tables give the appropriate pond sizes for the respective number of cows milked. Required pond dimensions have been based on data collected by Ministry of Agriculture and Fisheries, Ministry of Works and

Development, and the Taranaki Regional Council scientific staff, in association with other groups including Federated Farmers. The size of each pond depends on the loading being applied to the system, ie the amount of effluent entering the ponds. This has been calculated at 68 litres/cow/day, and includes water used to wash the yard down. Flood wash systems use varying amounts of water and need to be dealt with separately. Please contact the Council if you have, or are intending on installing, a floodwash system.

The figure above does not include stormwater or run-off and effluent from feedpads. Consequently, if stormwater is entering the ponds, the pond system will need to be larger. This is also the case if there is an inflow of natural water, such as a spring. If effluent from a feedpad is entering the ponds, the design will need to be approximately 33% bigger. It is recommended that a stormwater diversion be installed to divert clean rainwater away from the ponds and feedpad when is not in use.

In addition:

- The length to width ratio should be 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 24 m - within 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 0.5 m freeboard in the design.
- In some situations it may be practical to construct two anaerobic ponds.

Pond construction requires the skills of an experienced operator with the correct type of machinery to complete the job satisfactorily. The main points that should be considered when embarking on this project are outlined in the next section.

Stormwater diversion

It is unnecessary to direct stormwater through the oxidation pond system. A stormwater diversion can be installed to ensure that any clean water that runs off the yard is diverted away from the ponds. Diverting the stormwater to a low point in the surrounding paddock will avoid the direct discharge of effluent to water should the system fail. In addition, the diversion should ideally be positioned prior to the sandtrap, to avoid contaminants from the sandtrap fouling the clean stormwater. Alternatively, an overflow pipe from a sump can be used to take stormwater, but it must be free of effluent before it can overflow. Ideally, the overflow pipe should also be directed to a low point in the surrounding paddock.

¹The discharge of contaminants or water to water in the Hangatahua (Stony) River catchment is prohibited (rule 6 of the Regional Fresh Water Plan for Taranaki).

Recommended anaerobic pond size

ANAEROBIC

Cow numbers	Required volume (m ³)	Depth (m)	Surface area (m ²)	Top bank size (m)	Pond floor size (m)
100	525	4.5	300	18 x 21	0 x 3
150	615	4.5	380	20 x 23	2 x 5
200	810	4.5	470	20 x 28	2 x 10
250	1000	4.5	540	20 x 33	2 x 15
300	1200	4.5	650	20 x 38	2 x 20
350	1390	4.5	740	20 x 43	2 x 25
400	1580	4.5	770	24 x 37	6 x 19
450	1770	4.5	840	24 x 40	6 x 22
500	1970	4.5	920	24 x 44	6 x 26
550	2400	4.5	1144	26 x 44	8 x 26
600	2800	4.5	1242	27 x 46	9 x 28
650	3000	4.5	1288	28 x 46	10 x 28
700	3200	4.5	1380	30 x 46	12 x 28
750	3400	4.5	1457	31 x 47	13 x 29

Batter slope on interior bank = 2:1
 Freeboard of 0.5 m is included in the depth
 Based on 0.09kg BOD/cow/day

Recommended aerobic pond size

AEROBIC

Cow numbers	Required surface area (m ²)	Depth (m)	Volume (m ³)	Top bank size (m)	Pond floor size (m)
100	370	1.7	340	20 x 23	13 x 16
150	560	1.7	540	20 x 33	13 x 26
200	740	1.7	720	24 x 35	17 x 28
250	*920	1.7			
300	*1100	1.7			
350	*1280	1.7			
400	*1570	1.7			
450	*1660	1.7			
500	*1830	1.7			
550	*2020	1.7			
600	*2200	1.7			
650	*2390	1.7			
700	*2570	1.7			
750	*2750	1.7			

Build an appropriate combination of two or more ponds to make up the required surface area

* Divide this dimension into two smaller aerobic (facultative ponds)
 Batter slope on interior bank = 2:1
 Freeboard of 0.5 m is included in the depth
 Based on 0.09kg BOD/cow/day

Note: Pond measurements can be altered to suit terrain where necessary, but the volumes (anaerobic) and surface area (aerobic) must remain within the guidelines.