

# WASTEWATER MANAGEMENT GUIDELINES FOR INTENSIVE ANIMAL HUSBANDRY ACTIVITIES

DEPARTMENT OF PRIMARY INDUSTRIES, WATER & ENVIRONMENT

**Regulatory authorities should not permit the point source discharge of pollutants to surface waters from new or existing intensive animal husbandry activities unless there are exceptional circumstances. These cases are to be referred by the regulator to the Board of Environmental Management and Pollution Control for advice.**

## 1. Introduction

The primary purpose of this document is to provide advice to regulators on wastewater management requirements for intensive animal husbandry activities. It also provides some guidance to operators on best practice environmental management in their industry sector.

The Board of Environmental Management and Pollution Control (the Board) is required under the *State Policy on Water Quality Management 1997* (the Policy) to publish emission limit guidelines for a number of common activities which are likely to give rise to point source discharges of pollutants to surface waters. Point source pollution is pollution which is emitted at a discrete, identifiable location, usually via a discharge pipe or outfall, and which can be readily measured.

Emission limit guidelines are primarily intended for the use of local government to assist with planning decisions and with the maintenance of water quality objectives. While the Policy focuses on the receiving environment and prevention of environmental harm, there is recognition, particularly for small to medium scale activities, that 'end of pipe' limits may be the only practical approach to regulation. Setting permit conditions based on the receiving environment would require considerable resources that are often not available, and may only be feasible for larger scale activities.

Intensive animal husbandry activities are nominated in the Policy as a possible point source of pollutant discharge to surface waters. However, consultation with the pig, poultry, beef and dairy cattle sectors indicates that point source discharge of wastewater to waterways is not industry accepted best practice for these intensive farming sectors. Land application of effluent is seen as a viable wastewater management option for intensive animal husbandry operations in Tasmania. Information on best practice environmental management in the intensive livestock sectors from national and international sources supports this view. In general, regulators should set a 'no point source discharge to waterways' requirement for all intensive animal husbandry activities.

## 2. Policy Background

Under the *State Policy on Water Quality Management 1997*, protection of surface water and groundwater quality is achieved by determining the range of existing values and uses for specific bodies of water, which then provide the basis for setting water quality objectives (WQOs). Any number of the protected environmental values (PEVs) listed below can be assigned to a specific water body:

- Protection of aquatic ecosystems (pristine or modified)
- Recreational water quality and aesthetics
- Raw water for drinking water supplies
- Agricultural water uses (irrigation, stock watering)
- Industrial water supply

The nomination of PEVs is a community-based consultative process involving users, stakeholders and other interest groups. The PEVs for regional waterways will be shown in local government planning schemes or equivalent planning instruments. Once PEVs are assigned to a body of water, the Board will determine the water quality guidelines (numerical values for key indicators) to achieve the specific PEVs. The most stringent set of guidelines are the WQOs for that body of water.

Activities that discharge point source pollutants to surface waters are a potential obstacle to the achievement of WQOs for regional waterways. Local councils are responsible through the Resource Management and Planning System for the prevention or control of pollution in surface water and groundwater by activities within their jurisdiction which are not level 2 or level 3 activities (level 1, 2 and 3 activities are defined under the *Environmental Management & Pollution Control Act 1994*). This role may be shared with other authorities in some areas (e.g. national parks, other crown land). Larger scale industrial activities - level 2 activities - such as those in the food-processing, mineral and extractive, and waste disposal sectors are regulated by the Board.

Regulators should set limits (including zero discharge restrictions where appropriate) on the permissible concentrations and/or loads of pollutants discharging from point sources into waterways to ensure that the achievement of WQOs will not be prejudiced.



Tasmania

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### 3. Intensive Animal Husbandry

The term 'intensive animal husbandry' used within this document relates to the confinement of large numbers of animals - pigs, poultry or cattle – within relatively small areas as part of the production process. Other terms often used for this type of activity are 'concentrated animal feeding operations', 'feedlots' or 'intensive livestock operations'. A general definition for an intensive animal husbandry operation is any concentrated, confined animal growing operation for meat, milk or egg production located in pens or houses wherein the animals are provided with externally sourced feed. Definitions are also sometimes expressed in terms of exceeding a threshold of animal units per unit area.

As the focus of the guidelines is to prevent point source pollution to waterways from all structures housing livestock for some period on an intensive basis (i.e. excluding extensive or free range production), the regulator has some discretion in determining what constitutes an intensive animal husbandry unit. Regulators should consider issues such as the period of confinement and livestock numbers when assessing pollution potential. A categorisation system used by the state government in the past provides the following practical definitions of intensive animal husbandry in different sectors:

#### **Pig industry**

- Extensive system: pigs are kept in paddocks with natural shelter or temporary or movable shedding. Generally there is rotation of paddocks and no requirement for handling of effluent or solid waste.
- Semi-intensive: all stock are housed for part of the time, or some stock such as dry sows are run outside in paddocks.
- Intensive: all stock are housed and all services are brought to the animals.

#### **Poultry industry**

- Free range systems: birds have access to paddocks or runs, and housing is either of a permanent fixed nature or of movable sheds.
- Semi-intensive: a housing system in which the birds have access to a confined area.
- Intensive: a system of poultry keeping in which the birds are totally confined to the house. All services are brought to the stock.
- Controlled environment: intensive conditions for poultry where the operator has complete control of heat, light and air supply. All services are brought to the stock.

#### **Beef industry**

- Free range: natural grazing only with or without conserved fodder being brought to the animals.
- Feedlots: an area in which cattle are restricted in pens or enclosures for the purpose of intensive feeding. Services are brought to the animals. Includes areas in which such cattle are handled, loaded & unloaded, including any area adjacent to such pens or enclosure; where the animal wastes from the feedlot are accumulated or treated pending removal or disposal; or in which facilities for feeding such cattle are maintained and the feed for such cattle is stored, handled and prepared.

### **Dairy industry**

Although pastures are largely grazed directly in Tasmania, dairy cows can be found in two intensive situations:

- during milking (2 periods per day of about 2 hours)
- when winter yard feeding or housing is practised.

### 4. Environmental Impacts

Manure is the primary source of pollution from intensive animal husbandry activities. Nutrients (particularly nitrogen and phosphorus), organic matter, solids, pathogens, and odorous/volatile compounds are the primary pollutants derived from animal waste. Manure is also a source of salts and trace elements, and to a lesser extent, antibiotics, pesticides, and hormones. The particular composition of manure will depend on the particular species (cattle, pigs or poultry), the animal's size, maturity, and health, as well as the constituents of the animal feed. The environmental effects will relate to the scale and type of operation and the wastewater management practices in place.

- Nitrogen and phosphorus in manure can have significant negative impacts on waterway health. Excessive levels of nutrients in lakes or slow-moving waters can increase their biological productivity (eutrophication). This may cause a deterioration in water quality with algal blooms, less dissolved oxygen and increased turbidity.
- Manure also consists of bio-degradable organic compounds that are broken down in aquatic ecosystems by bacteria and other micro-organisms. This process consumes dissolved oxygen, reducing the amount of available oxygen for aquatic animals. The microbial decomposition of animal waste in the absence of oxygen can also produce gases such as methane, carbon dioxide and hydrogen sulfide.
- The manure itself and other elements mixed with it - spilled feed, bedding and litter materials, hair, feathers (and corpses) – result in elevated levels of solids when discharged to waterways. These decrease the clarity of the water, physically hindering the functioning of aquatic plants and animals and providing a protective environment for pathogens.
- Countless micro-organisms, including bacteria, viruses, protozoa, and parasites are found in livestock manure and may pollute surface waters. Many of these are associated with risks to human and animal health.
- Disinfectants such as chlorine may be added to animal wastes if used during cleaning activities or wastewater treatment and may be harmful if discharged to the aquatic environment.

There are also other factors to consider, particularly when dealing with very large concentrations of animals.

- Undigested feed that passes through animals can result in manure with significant concentrations of sodium and potassium and other soluble salts. This can contribute to deterioration in soil structure, reduced permeability, reduced crop yields and contaminated groundwater. In fresh waters, changes in salinity can displace resident aquatic species and degrade drinking water quality.
- Manure also contains trace elements such as arsenic and cadmium which can be of environmental concern in elevated concentrations. Unrestricted application of manures and discharge to waterways may result in high cumulative metal loading rates with potential impacts on human health and the environment.

- While antibiotics can be used to treat illness and to a lesser extent as feed additives to promote growth or to improve feed conversion efficiency, they are not widely used in Tasmania. However, overseas experience indicates that where antibiotic use is widespread, there are concerns that strains of antibiotic resistant pathogens are emerging in the receiving aquatic environment.
- Pesticides and hormones may also be constituents of animal wastes. Pesticides are applied to livestock to suppress flies and other pests, while hormones have been used by most livestock sectors to increase productivity. In Tasmania the use of growth promotant hormones is limited due to market requirements, the expense of these hormones or outright banning as in the cattle industry. Both of these types of pollutants have been linked with reduced fertility, mutations, and death in aquatic fauna.

## 5. How Do Pollutants Reach Surface Waters?

Pollutants from animal waste can reach surface water by several mechanisms.

- Point source wastewater and stormwater discharges from intensive animal husbandry facilities via a pipe or outfall.
- Surface discharges where the pollutant travels overland or through drainage lines to a nearby stream, river, or lake. These can occur as the result of
  - spills (eg pond overflows; wash outs from floodwaters when ponds are sited on floodplains; malfunctions such as pump failures; manure irrigation gun malfunctions; and pipes or retaining walls breaking);
  - dry-weather discharges (deliberate discharges from siphoning ponds to reduce the volume in overfull ponds);
  - surface runoff of contaminated stormwater from housing facilities;
  - direct contact between confined animals and surface waters; or
  - surface runoff from the inappropriate application of effluent to land.
- The pollutant may also reach surface waters via another environmental medium such as leaching to groundwater or volatilisation to air.

## 6. Waste Management Hierarchy

The Policy requires that pollutant discharges to the environment should be reduced to the maximum extent that is reasonable and practical having regard to best practice environmental management, and in accordance with the following hierarchy of waste management, arranged in decreasing order of desirability:

1. waste avoidance;
2. recycling/reclamation;
3. waste re-use;
4. waste treatment to reduce potentially degrading impacts;
5. waste disposal.

Consultation with the pig, poultry, beef and dairy cattle sectors indicates that recycling and reuse of effluent is both an effective and feasible effluent management strategy for these intensive farming activities. Disposal of animal waste

to waterways via a point source discharge is not considered industry accepted best practice and will only be approved in exceptional circumstances.

For intensive animal husbandry activities wishing to discharge effluent to waterways, the managers of the activity must first clearly demonstrate to the satisfaction of the Board that all reasonable and practical pollutant reduction measures have been implemented and that alternative methods of disposal - on-site re-use or irrigation - are not practical or would result in a higher net environmental risk, considering the effluent quality to be discharged.

## 7. Waste Management Practices

Each industry sector employs its own range of animal husbandry techniques with an appreciation of what is considered to be best practice environmental management in the sector. Animal waste should be viewed as a valuable resource rather than as a potential pollutant. Effective effluent management systems utilise this resource while minimising the associated environmental and public health risks. Regulators and operators should ensure that appropriate best practice environmental management techniques are adopted.

### *Pigs*

Intensive piggeries house and rear pigs for slaughter and most are farrow (birth on-site) to finish operations. Typically housing structures are long sheds which allow separation of stock age groups. Pen size and stocking density will vary with the age of the pigs. While feed may be continuously available or regulated, water is usually freely available from troughs or nipples. Generally sheds are designed so that pig excreta is flushed into channels beneath slatted floors. This waste is then collected in a central treatment system. The quantity and strength of waste water, which determine treatment and disposal requirements, will vary with diet and the amount of food, drinking water and wash down water in the waste collection channel.

Two departmental documents - *The Tasmanian Pig Industry: An Environmental Status Survey* (Brennan 1990) and *Environmental Guidelines for Piggeries* (Brennan & Howett 1990) - provide useful information on the management of piggeries to minimise environmental impacts. While the regulatory framework has since changed, much of the information relating to wastewater management is still applicable. A more recent resource is the 1995 ARMCANZ document *Effluent management guidelines for intensive piggeries*.

The operation of the piggery, including effluent reuse, must be controlled so as to prevent contaminated runoff leaving the property. Key factors for minimising the environmental impacts of effluent from intensive piggeries include:

- Appropriate site selection that avoids the need for costly environmental protection measures and preserves community amenity.
- Efficient use of water throughout the piggery.
- Separating uncontaminated stormwater from piggery effluent. Clean stormwater must be kept away from areas where it may be contaminated and directed to the stormwater drainage system. Contaminated stormwater should be directed to effluent collection tanks or ponds.
- Areas where accidental spills may occur should be bunded and effluent directed to storage and treatment areas.

- Separation of solid and liquid components of the waste stream.
- Effective effluent containment and storage with storage and treatment tanks and lagoons designed to cope with excess volumes of effluent when climatic conditions prevent irrigation. Design and integrity of storages should ensure minimal leakage to groundwater and no pollution of surface water through overflow. Consideration should also be given to evaporative capacity and de-sludging requirements.
- Utilising appropriate treatment systems whether they be physical (coarse screening, sedimentation, dissolved air flotation or centrifuging), chemical (enhancement of coagulation or flocculation), or biological (anaerobic, aerated or facultative lagoons).
- Have in place effective procedures to respond to all emergencies and contingencies.
- Sustainable application of effluent to land giving consideration to aspects such as groundwater protection, soil structure, land contamination, salinity and eutrophication of surface waters - refer to *Effluent management guidelines for intensive piggeries* (ARMCANZ 1995); *Effluent at Work* (Kruger, Taylor & Ferrier, 1995) and *Environmental Guidelines for the use of Recycled Water in Tasmania* (DPIWE Working Draft in Progress).
- To avoid surface run-off, effluent should not be applied to land that is immediately adjacent to waterways, is subject to flooding, has waterlogged or saline soils, slopes with little ground cover, is rocky or has highly erodible or very impermeable soils.
- There must be no point source discharge of piggery effluent to surface waters other than in exceptional circumstances as approved by the Board.
- Minimise the potential for contamination of groundwater or run-off to surface water from stockpile areas. Aspects to consider include
  - adequate cover for manure stockpiled in the open
  - stormwater drainage away from stockpile
  - adequate buffer distances to waterways or drainage lines
  - avoiding flood-prone or waterlogged areas
  - prevent seepage through porous soils
- Sustainable application of manure to land should take into account issues such as groundwater protection, maintaining soil structure, avoiding land contamination, and preventing eutrophication of surface waters (see *Environmental Guidelines for the use of Recycled Water in Tasmania* DPIWE).
- There must be no point source discharge of poultry effluent to surface waters other than in exceptional circumstances as approved by the Board.

### **Beef Cattle**

The major on-site activities associated with feedlots are receipt of young steers; receipt of feedstock; preparation and distribution of feedstock; animal husbandry; maintaining feedlot surfaces and the drainage and liquid waste disposal systems; loading stock for transfer; stockpiling of manure for drying and off-site sale; and collection, storage and disposal of liquid animal waste by spray irrigation. Wastes from beef operations include manure, bedding and contaminated runoff. The 1992 CSIRO report *National Guidelines for Beef Cattle Feedlots in Australia* provides a broad framework of generally acceptable principles for feedlot establishment and operation in order to avoid environmental degradation.

On-site strategies for wastewater management should include:

- Separation of uncontaminated stormwater and waste water. Clean stormwater must be kept away from areas where it may be contaminated and directed to the stormwater drainage system. Contaminated stormwater should be collected in lagoons, aerated and irrigated without any off-site runoff.
- Appropriate grade and surface type for pens.
- Adequate collection ditches and drainage channels.
- Effective sedimentation/retention basins.
- Effluent holding ponds of adequate capacity.
- A comprehensive irrigation strategy covering factors such as buffer distances, irrigation areas, loading rates, limits on application times and spray drift control. The best time to determine this is prior to site development, when assessing site suitability.
- There must be no point source discharge of effluent from cattle feedlots to surface waters other than in exceptional circumstances as approved by the Board.

### **Dairy Cattle**

Periodic (twice daily) confinement of dairy cows, whether in the holding area prior to milking or in the milking shed itself, produces substantial loads of animal waste. This waste stream generally includes manure, urine, gravel, sand, soil, waste feed, milk spillage, detergent and disinfectant residues, and possibly minor amounts of veterinary chemicals. A trend towards fewer dairy farms and increased herd sizes suggests greater potential for environmental pollution.

### **Poultry**

There are two common types of poultry confinement facilities—those that are used to raise broilers for meat and those that are used to house layers. A minimal number of operators may also be involved in the activity of hatching, breeding or growing of chickens. The majority of water usage in poultry sector is for drinking and for the cleaning and disinfection of housing facilities. Egg production operations tend to produce less wash down-water due to the widespread use of caging systems rather than the floor based production used by the broiler industry. Stockpiling of manure and litter (prior to sale or use as fertiliser) from broiler sheds may require some precautions to minimise the risk of surface and groundwater pollution.

Smaller volumes of liquid effluent generated by poultry operations (compared to other intensive animal husbandry operations) tend to reduce the risk of waterway pollution and the complexity of pollution prevention measures. Two documents published by the Department - *The Tasmanian Poultry Industry: An Environmental Status Survey* (Brennan 1989) and *Environmental Guidelines for Poultry Producers* (Brennan & Howett 1990) - provide useful information on the management within the poultry sector to minimise environmental impacts. While the regulatory framework has since changed, much of the information relating to waste management is still applicable.

Key factors for minimising the environmental impacts of effluent from intensive poultry operations include:

- Prevent entry of stormwater and drinking water spillage into manure collection areas.

To prevent the unacceptable degradation of water, land and environmental quality, dairy operators must effectively manage effluent generated by dairy shed operations. One valuable management resource is the 1999 ARMCANZ document *Effluent management guidelines for dairy sheds*. Several codes of practice developed by the Tasmanian dairy industry - *Managing Dairy Farm Effluent in Tasmania: Code of Practice 1997* and *Code of Practice for Farm Dairy Premises, Tasmania 1998* – and the pamphlet *Managing Effluent on Dairy Farms*, also provide practical guidance on effluent management. A certified assessor contracted by the Tasmanian Dairy Industry Authority inspects dairy farm premises to determine the level of compliance with the *Code of Practice for Farm Dairy Premises, Tasmania 1998*. The local publications indicate a well documented and well accepted industry view that there should be no point source discharge of dairy effluent from intensive use areas to surface waters. DPIWE libraries and some local councils (all with dairy farmers in their municipality) have the 1996 NZDEC document *Dairying and the Environment – Managing Farm Dairy Effluent* available for reference.

Dairy operations, including effluent reuse, must be managed so as to prevent contaminated runoff leaving the property. Key areas for wastewater control include:

- Appropriate site selection for new dairy sheds considering factors such as neighbouring land use, local drainage patterns and waterways, groundwater characteristics, soil types, land area available for irrigation, pollution risks, measures needed to preserve community amenity and agreed environmental values.
- Separation of uncontaminated stormwater and dairy shed effluent to reduce capacity requirements of ponds.
- Separate solid component from effluent using solids traps between dairy yard and pump sump.
- Areas where accidental spills of milk, effluent or chemicals may occur should be adequately contained to direct spillage to storage and treatment areas.
- Undertake hazard analysis to look at likely effects of a failure in the effluent management system. Have in place effective procedures to respond to all emergencies and contingencies.
- The performance of the dairy effluent management system should be continually monitored.
- Subject to animal and human health and dairy hygiene requirements, minimise water use and recycle where appropriate.
- Utilise appropriate treatment systems whether they be physical (coarse screening and sediment traps), chemical (enhancement settlement or suitability for land application), or biological (anaerobic or aerated ponds).
- Effective effluent containment and storage with storage and treatment tanks and lagoons designed to cope with excess volumes of effluent when climatic conditions prevent irrigation. Design and integrity of storages should ensure minimal leakage to groundwater and no pollution of surface water through run-off.
- Appropriate application of effluent to land giving consideration to aspects such as groundwater protection, climate, soil structure, land contamination, salinity and eutrophication of surface waters. Useful reference documents include *Effluent management guidelines for dairy sheds*, *Managing Dairy Farm Effluent in Tasmania: Code of Practice 1997*; *Environmental Guidelines for the use of Recycled Water in Tasmania* and *Reclaimed Water on Dairy*

*Farms – General Information and Requirements for Users* (produced by the former Victorian Dairy Industry Authority - now Dairy Food Safety Victoria).

- Runoff from intensive use areas must be prevented from entering both surface and groundwater. Changes to yard, laneway and stock race design may prevent water pollution problems.
- There must be no point source discharge of dairy effluent to surface waters other than in exceptional circumstances as approved by the Board.

## 8. Re-use of Treated Wastewater

### *Irrigation to land*

Land irrigation with effluent is the appropriate re-use process where site characteristics allow. Generally some form of effluent treatment will be required before land application, however, it may be possible to irrigate without prior treatment in areas where the risk of water pollution is low. The discharge of effluent to surface waters will not be permitted unless it is demonstrated to the Board that land irrigation is not practical, or would involve a higher net environmental impact or public health risk.

While industry specific guides to land application are cited above, the general principles governing this “beneficial re-use” approach are described in the draft DPIWE document *Environmental Guidelines for the use of Recycled Water in Tasmania*. Presently available as a working draft, this document is to be released in 2001 (to replace the 1994 DELM publication *Guidelines for Reuse of Wastewater in Tasmania*). It is intended as a reference for determining environmental objectives and management of all major aspects of wastewater reuse systems in Tasmania. These guidelines provide irrigation design, discharge and operating specifications for the use of wastewater in any effluent reuse scheme or activity.

Recycling of wastewater should be managed to achieve the following environmental and health performance objectives:

1. control of recycling operations so as not to pollute ground or surface waters;
2. use of organic matter, nutrients, salt and wastewater for sustainable operations; and
3. management of wastewater so as not to cause any interference with community health or amenity.

The recycling guidelines detail those factors to consider when evaluating the viability of the irrigation program. These include:

- the volume and constituents of effluent discharged;
- site water balance – i.e. soil type, local drainage, proposed plants/crops, evaporation and annual rainfall;
- capacity for nutrient uptake by soils and plants;
- potential salinity hazards;
- storage requirements during periods where rainfall meets plant needs;
- stormwater management to prevent overland flow of nutrients;
- public health requirements;
- buffer distances sufficient to ensure activity separated from residential areas (consider future expansion);
- buffer distances to mitigate impacts on nearby terrestrial and aquatic environments.

This approach necessitates constant and complete recycling of nutrients by crop harvesting or grazing by animals to avoid accumulation in the soil and the risk of run-off. Monitoring programs are needed to ensure that long-term irrigation re-use does not affect soil and ground water quality. To ensure that remedial action can be taken early, the following monitoring is recommended – flow (influent and effluent), waste quality (influent and effluent), soil and groundwater.

#### **On-site re-use**

Suitably treated wastewater may also be considered for use to irrigate golf courses, gardens and parks; dust suppression on roads; emergency fire fighting or for washing down stock holding yards.

### **9. Departmental Contact**

These guidelines are also on the DPIWE website - <http://www.dpiwe.tas.gov.au/env/environment.html>. Further information may be obtained by contacting:

**Environmental Policy Section  
Environment, Planning and Scientific Services Division  
Department of Primary Industries, Water and Environment.  
GPO Box 44, HOBART. TAS. 7001.**

### **10. References**

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