Manage a Feedlot

Handout 12

Waste and Manure Management System

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Different Systems for Managing Waste And Manure In A Feedlot

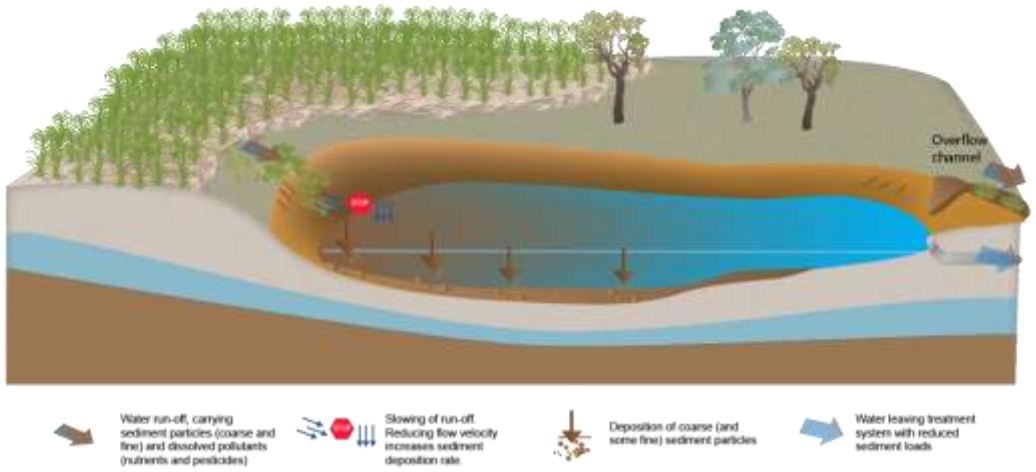
Drains

General design features for feedlot drains include

- drains must be lined with material of sufficiently low permeability to minimise the potential for leaching of contaminants into the soil or underground water resources.
- they must have sufficient flow capacity to avoid overtopping.
- they must be free flowing to avoid excessive sediment build up. They must be maintained in a clean weed free condition.
- they must have sufficient bed gradient to effectively convey suspended sediments to the sedimentation system without excessive scouring of the drain bed. Flow velocities will be affected by the drain cross section profile, dimensions, slope and drain bed material. Maximum permissible flow velocities to prevent scouring will depend on the drain bed material.
- they should be topped with a durable all-weather surface to permit access by cleaning equipment.

Drains require regular maintenance to remove weeds and repair erosion and scouring after rainfall events, and require cleaning to remove sediments which have been deposited from run-off. For ease of operation drains should have relatively flat beds and side batters.

Sedimentation Systems



The purpose of a sedimentation system is to remove as much as is practical of the entrained solids in feedlot runoff. The system should be designed and managed to

- minimise the solids passing from the sedimentation system into the storage lagoon. The advantages of this are the reduction in sludge build-up in the storage lagoon and the reduced

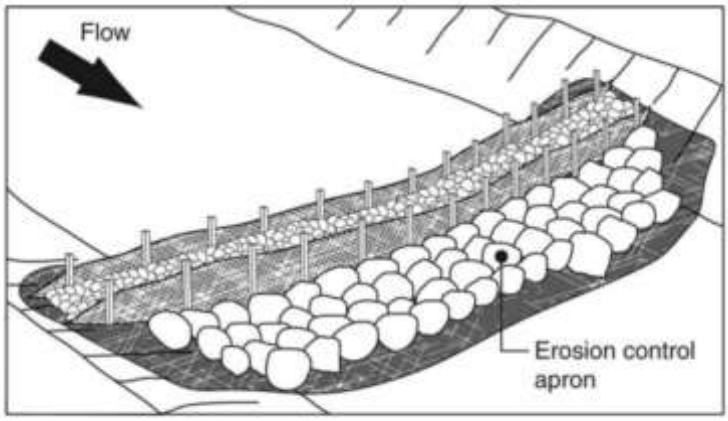
need to de-sludge the lagoon, and the reduced biological loading of the storage lagoon which reduces the intensity and duration of odour emissions.

- promote free drainage with minimal clogging of the sedimentation weir
- promote the rapid drying of the deposited material. Rapid drying reduces the intensity and duration of odour emissions
- prevent leakage of effluent into the soils or groundwater. The system must be constructed on low permeability soils, or sealed with suitable clay or a synthetic liner
- allow easy and cost-effective removal of the deposited material.

Three types of sedimentation systems are very suitable for cattle feedlots:

Basin	Wide and shallow with maximum depth less than 1 metre. Sedimentation weir controls discharge into the storage lagoon Free draining with shallow slope (approximately 0.1%) to sedimentation weir. Compacted gravel base to allow mechanical removal of dried sediments.	2 - 3	2.5
Terrace	Wide shallow waterway with slope 0.1 - 0.5%. Sedimentation weir controls discharge into storage lagoon or next terrace 2 - 3 terraces may be constructed in series Free draining with slope to sedimentation weir. Compacted gravel base to allow mechanical removal of dried sediments.	8 - 10	1
Pond	An excavated hole with depth greater than 1 metre. Does not drain completely after rainfall Solids settle to form a sludge layer which must be removed at intervals of 1 - 5 years Pond usually needs to be pumped out to allow de-sludging	2 - 3	6

Sedimentation Control Weir



Sediment weir with downstream rock splash pad

The function of the sedimentation control weir is to slow the flow of the effluent in the sedimentation system to the critical velocity to allow entrained solids to settle, and also enable the liquid to drain from the sediments deposited on the upstream side. During the process the weir regulates the depth of the ponding within the sedimentation system and the rate of discharge into the storage lagoon.

Sedimentation weirs should be designed to safely discharge design storm events up to the 50-year ARI design storm without overtopping the earthen bank. A minimum freeboard of 900 mm should be provided between the top of the weir and the top of the embankment. Suitable types of weirs are

- the horizontal drop board type - consisting of one, and occasionally two rows of removable drop boards installed within a concrete channel through the bank of the sedimentation system. The boards are wedged apart to facilitate drainage, and the gaps can be progressively widened to hasten drainage from the sediments. The boards can be completely removed to assist cleaning.
- the vertical timber type - consisting of timber boards mounted vertically within a concrete channel through the bank of the sedimentation system. The gaps between the boards cannot be adjusted, and generally the structure cannot be removed to allow access for cleaning.
- the adjustable vertical slot throttle weir - consisting of two steel plates installed across the sedimentation terrace on the upstream side of a short concrete masonry wall. The gap can be adjusted to facilitate drainage, and the plates can be completely removed to allow access for cleaning.

To prevent scouring of the inlet into the storage lagoon energy dissipation structures or a concrete slipway should be installed between the sedimentation weir and the storage lagoon.

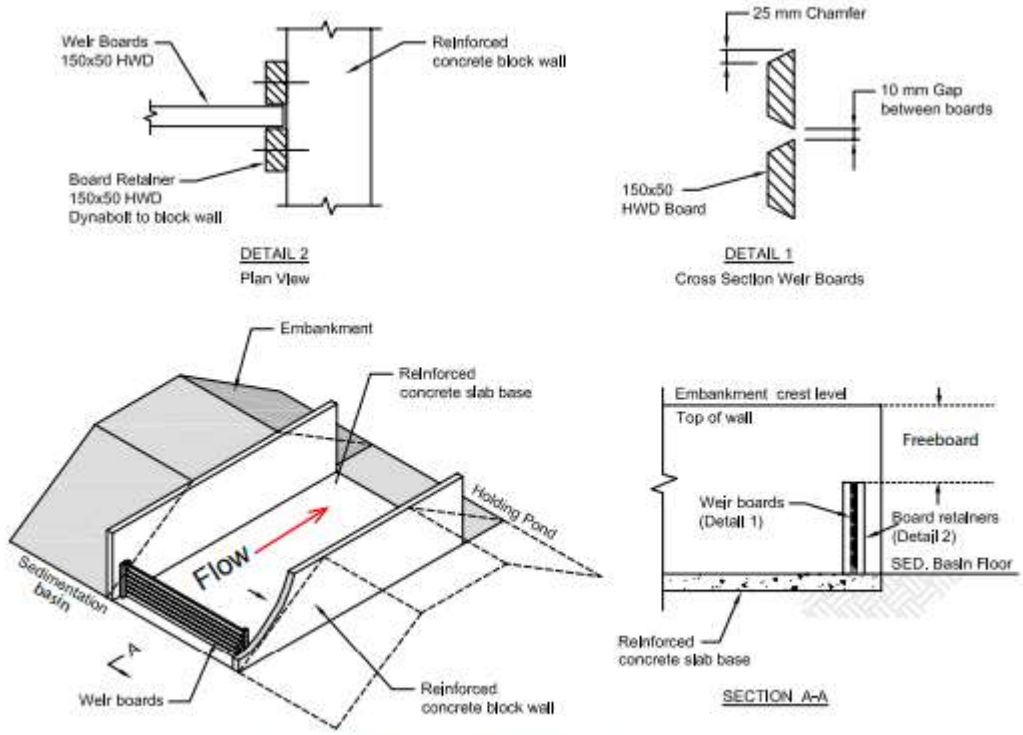


Figure 1. Typical horizontal timber drop-board weir

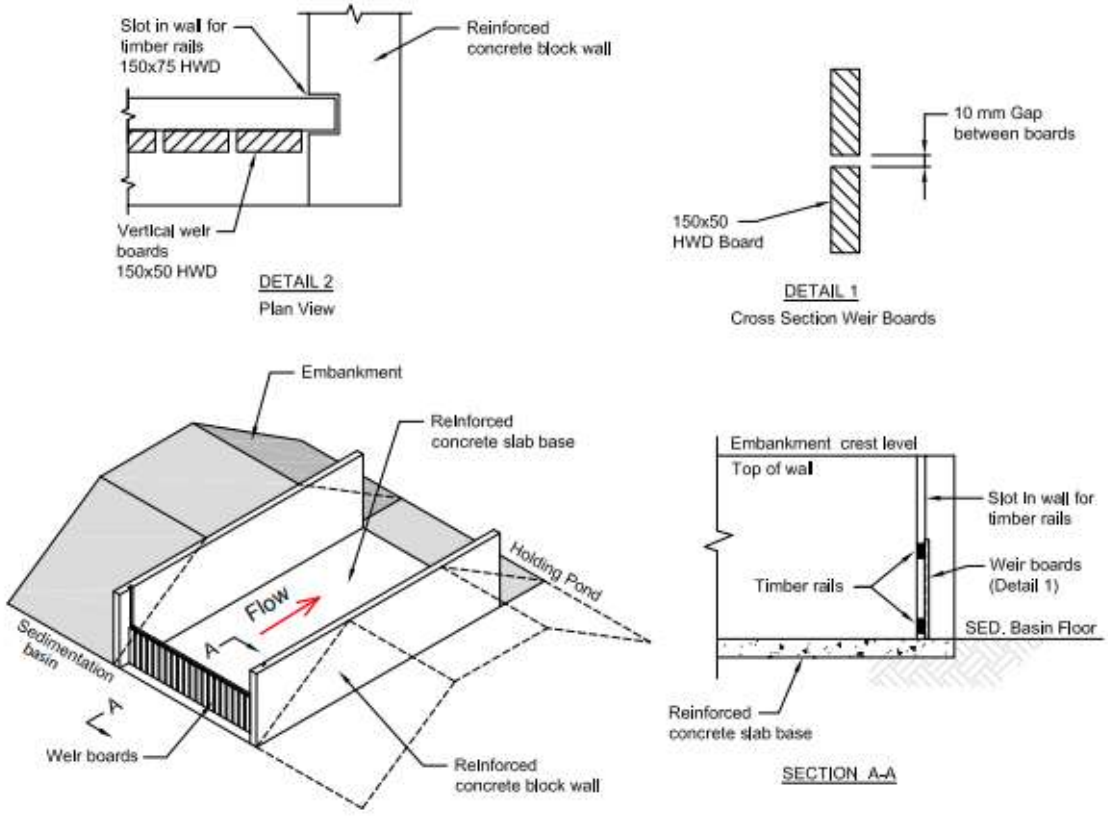


Figure 2. Typical vertical timber weir

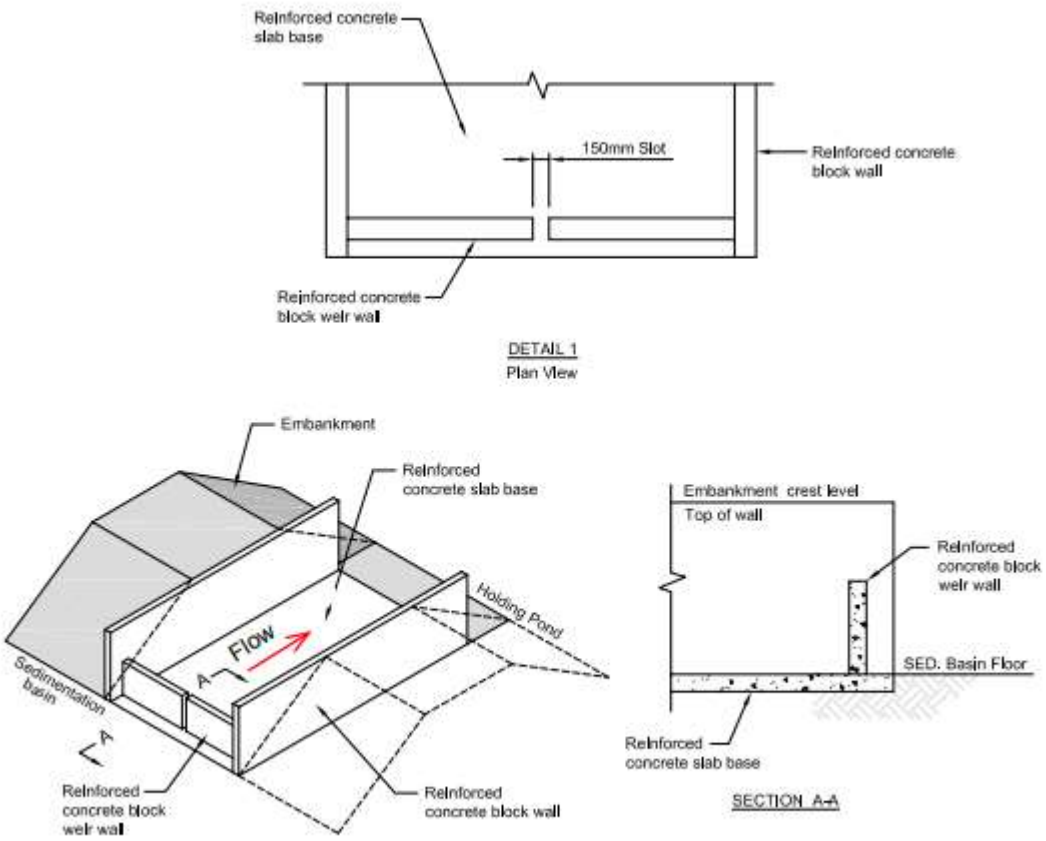
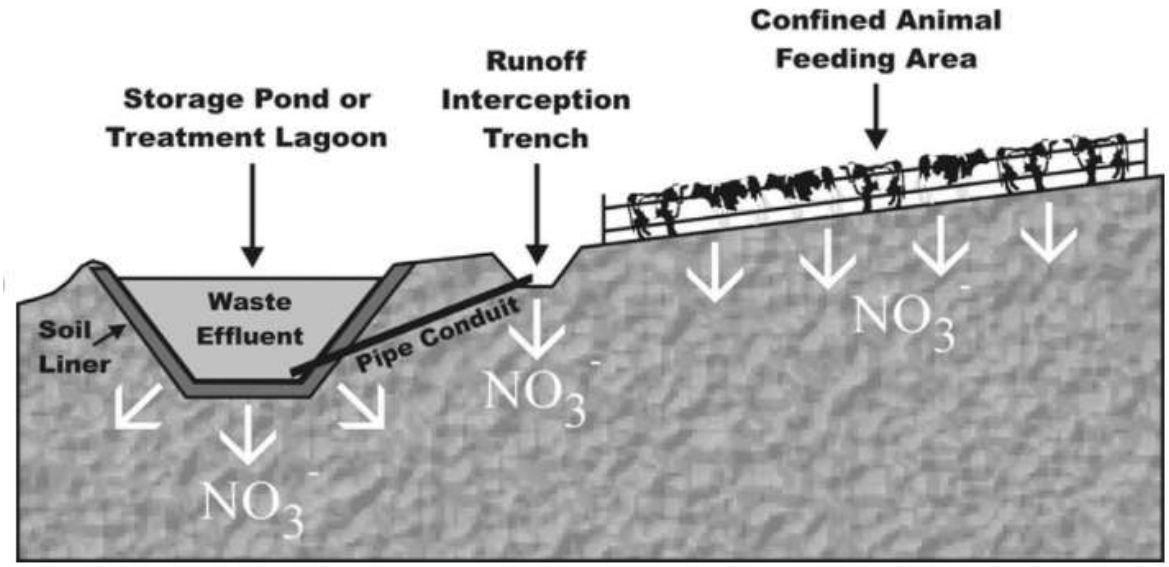


Figure 3. Typical single vertical slot throttle weir

Storage Lagoon

The runoff (effluent) from cattle feedlots is generally high in nutrients, salts and organic matter. This effluent can contaminate surface and underground water resources and soils if it is allowed to flow out of the feedlot in an uncontrolled manner, or is irrigated onto agricultural land which is not capable of assimilating the water and nutrients. The effluent needs to be stored until it can be utilised safely. In water pollution sensitive areas, the water protection agency may insist on a greater storage capacity in order to reduce the risk of lagoon overflows.



Schematic of a feedlot or dairy facility showing locations where nitrate (NO 3-) can be released into the subsurface.

For protection of the earthen structure, the storage lagoon should have a spillway designed for safely passing a design storm with an average recurrence interval of 50 years at non- scouring velocity. In addition, a 900mm freeboard above the spillway will adequately protect the embankment from over-topping during extreme rainfall events and from wave erosion on windy days.

Despite the pre-treatment of settling the suspended solids, the runoff will contain a considerable number of organic compounds when entering the storage lagoon. Where practical, the water depth in the storage lagoon should be kept shallow (less than 1.5 metres) to minimise anaerobic breakdown of the wastewater which causes offensive odours.

Evaporation Systems

Evaporation systems must be capable of containing the runoff from the feedlot controlled drainage area for a 96-percentile wet year. They should only be considered where the annual evaporation exceeds annual rainfall by a large margin and sustainable spreading on land is not feasible - for example in the dry pastoral districts where it is not possible to reliably grow crops and improved pastures.

Evaporation systems are not the preferred option. Evaporation concentrates the nutrients and salts in the stored effluent which makes the consequences of overtopping or lagoon failure more serious, and the concentrated sludge is more difficult to dispose of. The sludge may be mixed with stockpiled pen manure at a rate which permits safe use on agricultural land, or it may be composted with manure or other organic materials. However, depending on the concentration of salts, sustainable utilisation of the sludge on agricultural land may not be feasible. In this situation the most likely disposal option may be disposal into properly engineered land-fill.

Solid Waste Management

Manure should be regularly collected and removed from the pens. Regular cleaning under fences and around feed and water troughs is important in reducing fly breeding sites, odour production and dust potential.

Pens should be cleaned and maintained in accordance with the conditions of planning approval or licensing. Pen cleaning operations should remove all accumulated manure down to the pen surface.

Mounding of manure to provide dry laying areas for the animals is not recommended. Mounds interfere with the pen drainage and create wet spots which promotes pen floor breakdown and increased odour production on the up-hill sides of the mounds. Where permanent gravel or earth mounds are employed within pens they should be of a design and alignment which does not interfere with the cleaning operations and the drainage of water from the pens.

Effluent and Manure Utilization

The objective of feedlot waste utilization is to employ crops, pastures and soils to effectively utilise or assimilate the nutrients, salts, organic matter and water in the wastes in a sustainable manner. The essential features of a sustainable waste utilization system are

- nutrients are not leached below the active root zone of the crop or pasture. This prevents contamination of groundwater resources.
- dissolved or suspended contaminants are not transported from utilisation areas to watercourses. This prevents contamination of surface water resources.

- effluent and manure are not applied excessively. This prevents the degradation of the chemical and physical properties of the soil which lead to nutrient overloading, salinization, sodicity, acidification, erosion, poor infiltration and waterlogging.
- the productivity of the land used for waste utilisation is enhanced
- neighbouring landholders are not subjected to odour and dust nuisance because of poorly timed and managed waste application practices.