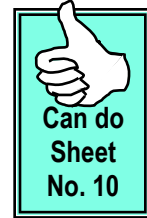


ALTERNATIVE WASTE MANAGEMENT SYSTEMS FOR COUNTRY MEAT PROCESSORS



A Natural Heritage Trust funded project

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A medium- sized country abattoir produces about 2.5 cubic metres of **solid waste** and 3,600 l of **wastewater** per week. In addition about 1.5 cubic metres of bone and scrap are produced in the butcher's shop. Burial pits 3 m wide, 15 m long and 2.5 m deep take only about 3 months to fill, and contaminate land for many years. Wastewater is often pumped to grassland, with little opportunity for reuse.

- **Dry composting** provides country meat processors with an alternative treatment system for putrescible **solids**, requiring minimal land, and improving the potential for **off-site reuse**.
- **Gravel filtration** incorporating **compost worms** screens out the solids in the **wastewater**, and can improve water quality to a standard suitable for **reuse**. In this 'can do' sheet the requirements for and management of these two waste management systems will be outlined.

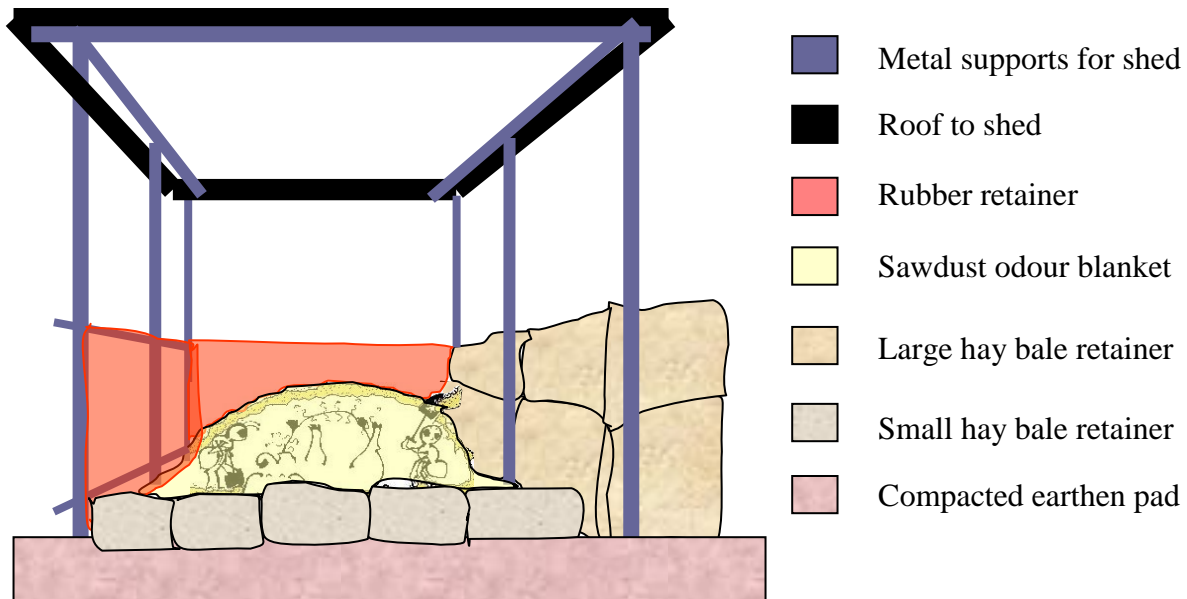


Figure 1: Construction details of one bay of a dry composting shed. The 10 x 16 metres floor area is divided into four bays. Hay bales used initially to contain the dry compost have been replaced by rubber (second-hand conveyor belt) attached to metal bearers. The flexible rubber withstands minor knocks, is waterproof, and takes up much less space than the bales. Small bales retain the leading edge of the dry compost, as the pile is produced. Sawdust is stored in one bay, leaving three for dry composting. Runners, heads, spleens, innards (unwashed), skins, shop bone and fat are placed on a 30cm absorbent layer of sawdust. A hessian cover placed over completed piles minimises dust and deters birds.

WASTEMANAGEMENT SYSTEM 1:

Requirements For And Management Of A Dry Composting Shed

Sawdust (or any other suitable dry, light, small particle material) absorbs any **seepage below** the waste, and absorbs any **odour above** the waste (odour blanket). The specialist insects responsible for the process are not vermin, and are not attracted to the abattoir itself. However the **odour blanket** must be thick enough to deter any houseflies, feral dogs or cats, and other vermin. To remain dry, to provide all-weather access and ease of disposal, a **roofed shed** constructed on a **compacted earthen pad** (refer QDPI Note Earth Pad Preparation Requirements Agdex 440/048) is recommended.

The dimensions of the shed will depend on the weekly output of waste from the abattoir. In the example below, a total of 107 cattle, 89 pigs and 99 sheep were processed over the 8 weeks taken to fill the first bay. The height of the dry compost pile was only about 1 m, restricted by the limited lifting capacity of the three-point linkage platform on the tractor.

Waste description	Number of tubs
innards	119.25
heads and runners	61.75
shop bone	108
Total number of tubs	289
Total volume	32.74 m³

Table 1: Contents of the first dry compost bay at completion. Tubs were transported on a 3-point linkage platform on a tractor. One bay 9 m long by 3 m wide was filled to a depth of about 1 m over an 8 week period.

The abattoir waste was placed on top of about **30cm of sawdust** (or bark chip), and covered with enough sawdust to deter vermin. During dry composting the **total volume** of the waste reduced as microbes and insects used the water (animals are **70% by weight water**). In our trial an estimated 33 m³ of waste was added to one bay, with the final volume (**including sawdust**) only about 27 m³. Therefore the 3-bay capacity of the shed should accommodate about 24 weeks of waste. Delaying **8 to 10 weeks** after the last waste is added before emptying the bay, should ensure that all waste is at the **dry-decay stage** (no fluids, minimal odour). On this basis, there should be sufficient space in the shed to accommodate all the organic waste produced from the abattoir and shop, with a turn-around time per bay of up to 16 weeks after closure of that bay.

Processing The Dry-Decay Remains In The Dry Compost

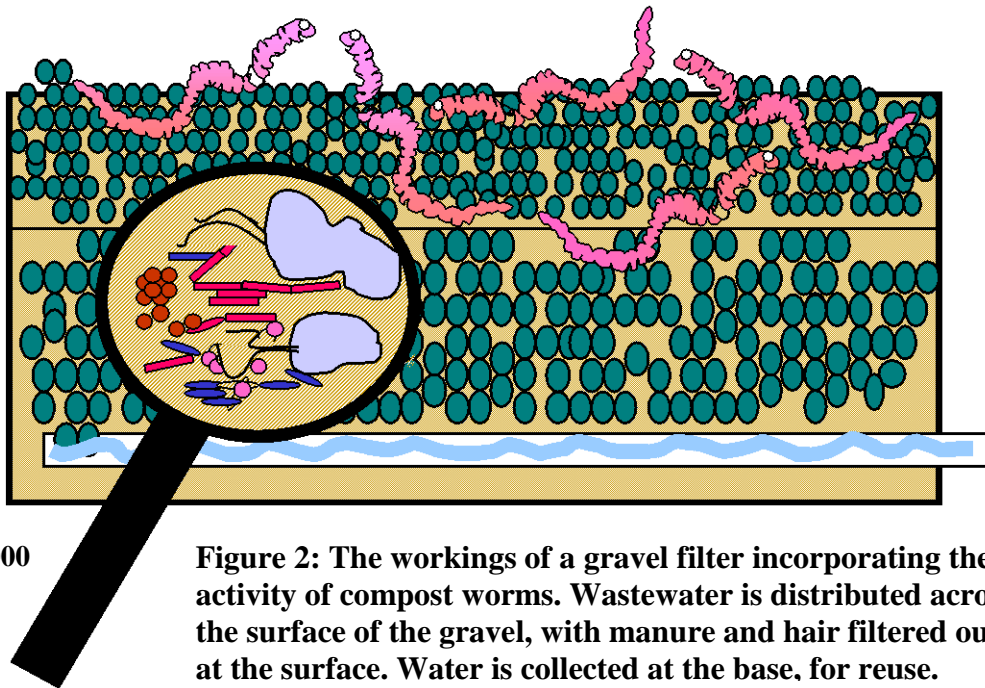
After 8 to 10 weeks of decomposition only bones and skin should remain (**dry-decay stage**), with the specialist insects migrating to the fresher waste piles. The only odour should be dank and organic, associated with blackened clumps of sawdust composted with any seepage. Any uncomposted sawdust can be reused in the other bays. The bone, skin and composted sawdust clumps can be removed from the bay, and transported to a **compacted earthen pad** for conventional **wet composting**. Adding animal manure and wastewater to the dry-decay remnants will **restart** the decomposition process, promoting the activity of **microbes**.

At this stage the bones and skin will be relatively fragile, fracturing further as **microbiological composting** proceeds (refer to 'can do' sheet 4 '**Practical guide to on-farm co-composting**', or MRC Research Report 1/93 '**Recommended techniques for composting meatworks waste**').

Dry composting minimises the survival of any potential **pathogens** present in the decomposing residues. **However wet composting** ensures that any surviving pathogens are adequately **disinfected**, provided the optimal temperature range (45-65⁰C) is generated in the windrow. Alternatively the dry-decay remains can be pulverised as a **mulch** for forestry or other uses, provided direct contact with humans, or with freshly eaten food crops, is minimal.

WASTEMANAGEMENT SYSTEM 2: Gravel Filters And Compost Worms For Wastewater Treatment

Paunch and manure contribute substantially to the nutrient content of wastewater. Therefore the **separation** of paunch and contents for **dry composting**, immediately reduces the nutrient loading of the wastewater. The total phosphorus content of wastewater from a typical abattoir ranges from 80 to 140 mg/L whereas the country meat abattoir wastewater **without paunch** is 5.5 to 27 mg/L. However blood contributes substantially to the total nitrogen content and to the biological reactivity of the wastewater. The Chemical Oxygen Demand (COD) can be as high as 18,000 mg/L if clotted blood is included in the sample. **Gravel filtration** is one low tech. option that can be used not only to filter out and treat the **solids**, but also to further reduce the nutrient loading.



X 1,000
mag.

Figure 2: The workings of a gravel filter incorporating the activity of compost worms. Wastewater is distributed across the surface of the gravel, with manure and hair filtered out at the surface. Water is collected at the base, for reuse.

Provided the volume of water delivered to the gravel filter per unit of time is **low (pulse-dosed)**, a **microbial slime** builds up coating the surface of the gravel. The slime slows the passage of the water through the gravel, giving the **microbes** sufficient time to absorb the nutrients. If a high volume of water hits the gravel filter, this slime may be washed off, actually **increasing** the nutrient loading **above that of the original wastewater**.

- **To work effectively, the sump pump must be modified to deliver short, repeated doses of wastewater to the gravel filter (ideally 2 to 3 minutes duration every 15 minutes or so).**

The addition of **compost worms** to the surface of the gravel filter converts the solids into worms and carbon dioxide. The activity of the worms also improves the action of the gravel filter by enhancing the **turnover** of the **microbial slime** on the surface of the gravel. However there are no low tech. methods available for determining the quality of water in a gravel filter. **Chemical and microbial testing** provides the only objective comparisons.

Determining The Quality Of The Effluent

The specifications for a gravel filter system will depend on the typical wastewater loading of the abattoir, and the intended reuse. By varying combinations of the **size of the gravel** at surface and depth, the **depth and width** of the gravel bed, and the frequency and volume of **pulsed doses of wastewater** the quality of the effluent can be improved. The addition of compost worms is to increase the number of channels through the surface of the filter, and to fragment the mat of organic matter that settles on the surface of the gravel.

The limiting factor of the system will be the ability of the sump pump to deliver short bursts of low-volume wastewater, evenly over the surface of the gravel filter.

Theoretically it is possible to design the gravel filter and pump system to treat the water to **potable water quality**, using ultraviolet light for final disinfection. In practice, the commercial domestic systems that are currently available have been developed on the ‘trial-and-error’ principle, with insufficient information to accurately scale up a version for country meat processors. To-date Agwise and Millmerran Meat Holdings have developed a system that effectively treats the solids, but the performance of the gravel on the water is not as good as we had hoped. To minimise the fouling of pipes, the water leaving the filter should have:-

- Biochemical Oxygen Demand (BOD) and suspended solids of less than 30 mg/L,
- total nitrogen should be less than 15 mg/L and
- total phosphorus less than 5 mg/L.
- Where no direct human contact with the water is anticipated, then the level of thermotolerant coliforms can rise to **not more than 1,000 per 100 mL.**

The performance of the filter after its latest modification has not been tested, but to-date the level of thermotolerant coliforms is greater than 1,000 per 100 mL, and the BOD is above 30 mg/L.

There are no gravel filters specifically designed for country meat processors. Buying ‘off the shelf’ versions developed for domestic dwellings is very risky, and is not recommended. If you want to develop a gravel filter system for your needs, get a copy of the Agwise Case-Study on Millmerran Meat Holdings (available through the QCMPA), to learn about the pitfalls, and the perseverance required .

Acknowledgements

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