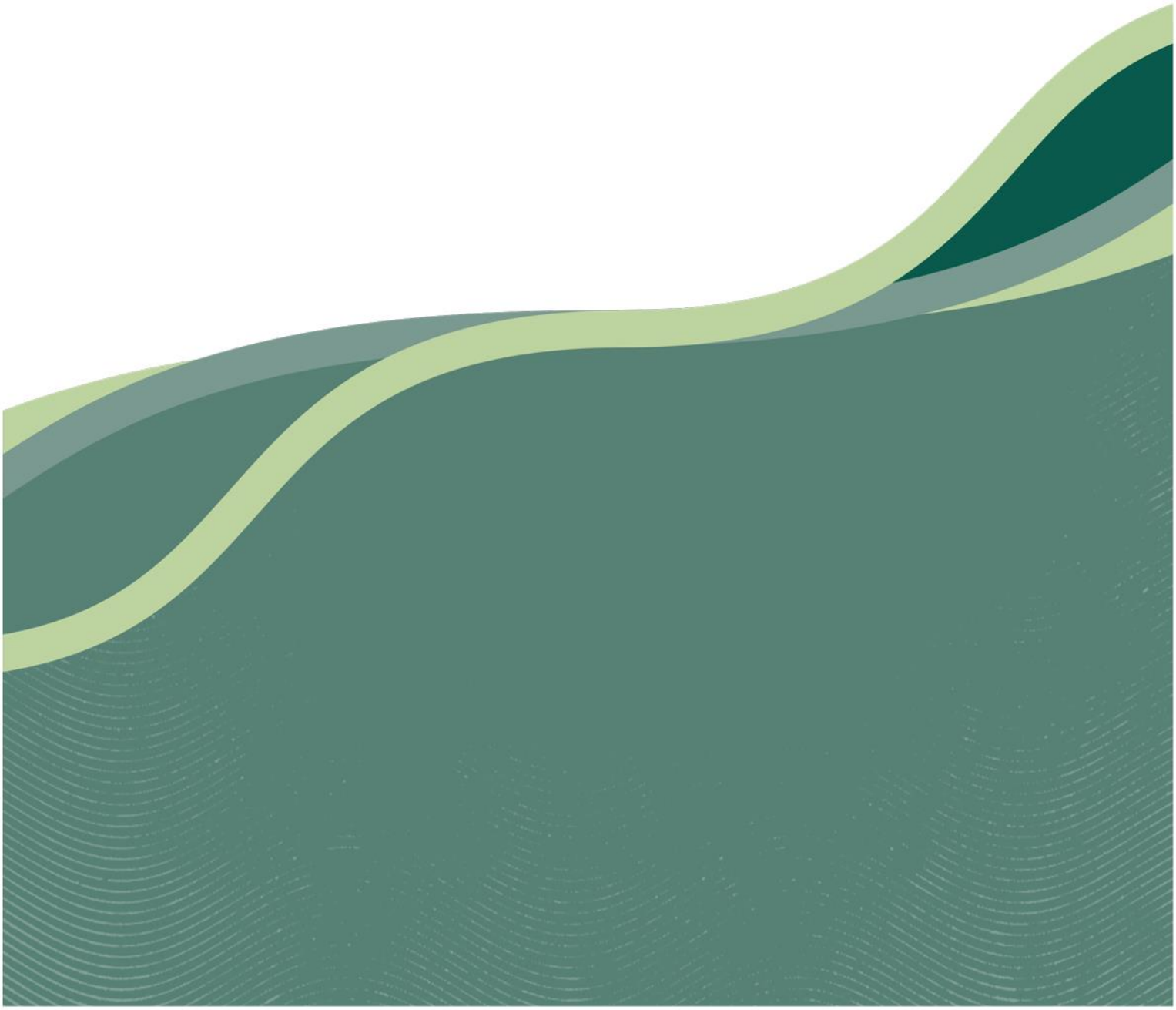
GOVERNMENT OF WESTERN AUSTRALIA

Department of
Primary Industries and Regional Development

Protect
Grow
Innovate

Solid Waste Management Plan

Example 2 – Abattoir



6 March 2024

Summary

An abattoir in Donnybrook slaughters 100 cattle per day, with an average liveweight of 500kg. They operate 5 days a week. This document aims to provide an example solid waste management plan for some of the abattoir's solid waste.

The majority of solid waste produced by the facility (e.g., blood, bone, fat and skin) is sent to a rendering facility offsite. However, the rumen/paunch contents of partially digested feed material and digestive juices will be dried and spread to land onsite.

Environmental Considerations

There is currently high performing pasture grown on the property at an average yield of 10 tonne/ha, and the seasonal groundwater level is a minimum of 5 metres below ground level.

The rumen/paunch is dried and stockpiled in a dedicated area (undercover with a concrete pad) where rainfall runoff or leaching cannot occur.

Nutrient balance

Nutrients IN

Paunch is collected and dried daily to keep the facility clean. The total waste solids are calculated from Patrick et. al's (2004) and Ledward, D (1989) results – this places dehydrated paunch solid production at 0.0097 of total liveweight processed. The generated dehydrated paunch is 126 100 kg/year as shown below:

$$\textbf{Dehydrated Paunch Solids } [\boldsymbol{t}] = \text{Cattle slaughtered [per day]} \times \text{time } [days] \times \text{average weight [kg]} \times \text{waste quantity proportion}$$

$$= 100\ [cattle/day] \times 260[days] \times 500[kg] \times 0.0097$$

$$= 126100\ [kg/year]$$

$$= 126.10\ [t/year]$$

Nutrient Content - The waste nutrient content of dehydrated paunch solids is 1.46% for phosphorus (P) and 2.0% for nitrogen (N) (Patrick et. al (2004)).

Nutrients OUT

Pasture as a crop + Grazing:
High performing pasture is grown producing 10t/ha. The nitrogen and phosphorous content of the pasture are 20kg/t and 3kg/t respectively, as shown in Appendix A. The pasture is grazed by cattle which are later removed from the site. Resultant nutrient offtake from the grazed pasture is only 10% due to the effect of grazing cattle and the manure produced (Maria et al., 2019). This results in 1t/ha of pasture removal[1].

[1] Alternatively, a pasture yield of 8t/ha would result in 0.8t/ha offtake due to grazing

Determination of Spreading Rate

$$\textbf{Phosphorus Spreading Rate } [t/ha] = \frac{crop\ nutrient\ content\ [kg/t] \times crop\ yield\ [t/ha]}{waste\ nutrient\ content\ [\%] \times correction\ factor(10)}$$

$$= \frac{3\ [kg/t] \times 1\ [t/ha]}{1.46\ [\%] \times 10}$$

$$= 0.21\ [t/ha]$$

Nitrogen volatilization in surface spreading methods accounts for around 20% of nitrogen losses.

$$\textbf{Nitrogen fraction remaining} = \frac{(100 - 20)\%}{100} = 0.80$$

$$\textbf{Nitrogen Spreading Rate } [t/ha]$$

$$= \frac{crop\ nutrient\ content\ [kg/t] \times crop\ yield [t/ha]}{waste\ nutrient\ content\ [\%] \times correction\ factor(10) \times Nitrogen\ fraction\ remaining}$$

$$= \frac{20\ [kg/t] \times 1\ [t/ha]}{2\ [\%] \times 10 \times 0.80}$$

$$= 1.25\ [t/ha]$$

The lowest spreading rate is phosphorus, and therefore it is the phosphorous spreading rate that will be employed for determining the minimum area required.

* Correction factor of 10 is required to convert from kilograms to tonnes whilst accounting for the percentage value.

Determination of Minimum Area

The minimum area required is 600ha as calculated below using the lowest spreading rate of phosphorus:

$$Minimum\ Area\ Required\ [ha] = \frac{Dehydrated\ paunch\ solids\ [t]}{spreading\ rate\ [t/ha]}$$

$$= \frac{126.10\ [t]}{0.21\ [t/ha]}$$

$$= 600\ [ha]$$

Conclusion

The spreading rate is 0.21t/ha/year and is based off the limiting factor of phosphorus. The minimum area required to dispose of the solid waste is 600ha. This area is high due to the implications of grazing resulting in minimal nutrient removal from site. If the pasture was mechanically harvested and taken off site the required spreading area would be 60ha.

Table 1 Summary of solid waste generated per year (kg/year), spreading rate (t/ha) and minimum area required (ha).

	Nitrogen	Phosphorus
Spreading rate [t/ha]	1.25	0.21
Minimum area required [ha]	-	600

Records

The following records are to be kept and maintained for each year that solid waste is applied to the property:

- Areas where solid waste has been applied.
- Resultant yield
- Application rates

*Table 2 Log of waste information *maps are not attached as this is an example only.*

Date	Solid waste application area [ha]	Description of solid waste application area	Resultant yield [t/ha]	Application rate [t/ha]
6/7/22	600	See paddock area specified in map attached	1	0.21
6/7/23	600	See paddock area specified in map attached	1	0.21
__/__/23				

Important disclaimer

References

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Appendix A

Table 2. – Nutrient Content of Various Crops. Source – APL, 2018

Crop Nutrient Content (kg/t)			
Crop Type	**Nitrogen**	**Phosphorous**	**Potassium**
Irrigated pasture (cut)	20	3	15
Lucerne hay (cut)	31	3	25
Maize silage	22	3	20
Forage sorghum	22	3	24
Winter cereal hay	20	3	16
Grain barley	19	3	4
Grain wheat	19	4	5
Barley straw	7	0.7	24
Wheat straw	6	0.5	14
Grain triticale	19	4	6
Rice	14	3	4
Grain oats	15	3	4
Grain sorghum	20	3	3
Grain maize	20	3	4
Chickpea	40	4	4
Cowpea	30	4	20
Faba beans	40	4	12
Lupins	45	3	8
Navy beans	40	6	12
Pigeon peas	26	3	9
Canola	33	0.3	12
Cotton	20	4	8