Robertson Farm Assured Meat

Robertson

November 2015

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ROBERTSON FARM ASSURED MEAT

PLANNED COMPOSTING PLANT FOR THE RESPONSIBLE DISPOSAL OF ABATTOIR BY-PRODUCTS THROUGH COMPOSTING PROCESS INTO A PRODUCT FOR BENEFICIAL USE

1. Objectives

The overlaying objective of the planned composting facility is to manage 'by-products' that form as a result of the slaughtering processes within the abattoir, in a responsible and sustainable manner in order for the abattoir to have minimal effect on the surrounding environments that could possibly be effected in a negative manner through these 'by-products'. The objective is also to create a product from these 'by-products' which is re-usable in a beneficial and responsible manner.

2. Type of 'by-products'

- Manure (Minimal from abattoir, mainly from feedlot on the same property)
- Blood
- 'Pensmis'
- Rejected Carcasses (minimal)
- 'Derms'

3. Current Disposal of Abattoir 'by-products'

The 'by-products' as mentioned are currently disposed of as follow:

- Manure: Sold and collected by farmer that utilizes the manure for composting on their own farm
- Blood: Removed by the Local Municipality
- 'Pensmis': Removed by the Local Municipality
- Rejected carcasses
- 'Derms'

4. Future disposal

The future removal of the abattoir 'by-products' will be done by the abattoir themselves. The 'by-products' will be gathered on the abattoir property in the industrial area of the town of Robertson, as it is currently done. The 'by-products' will then be transported on a daily basis to the composting facility which is 15 km outside of Robertson, on route between Robertson and Worcester (refer to google map on pg.)
Here the 'by-products' will be stored and composted according to the composting process as is set out by a registered agriculturist. This will ensure that the manner in which the compost is made is done in the correct way in order to minimalise any negative impacts, the best product is produced and that the product is utilised on the same property in a responsible way. In the instance that the volumes that are composted increases the compost will be sold to neighbouring farmers, etc.

5. Composting facility

5.1 Site Details

The Composting facility will be situated on the farm, Middelburg that is situated 18 km outside of the town of Robertson, off the R 62 towards Worcester.

The co-ordinates for the farm is S33 43 49.3 E019 44 33.5 and the maximum area available for the composting facility is 2.5 Ha. However, about 1 ha is needed for the processing of about 10 ton raw material per day.

The site is more than 100 m away from any water resources, and the slight slope from the feeding lot and the composting facility that will collect any run-off water into a collection dam is in an opposite slope direction from the water resource.

The slope of the site is less than 3%.

There is easy access to the farm via a dirt road with the composting facility and feeding lot situated adjacent to the road on the farm. There are no nearby residential areas. There is only a single farmhouse across the road, situated about 1 km from the barrier fence of the farm.

5.2 Soil study

5.2.1 Soil classification

AVS conducted a soil study to establish the type of soils underlying the area that is to be used for the composting facility and the feeding lot. The main purpose is to establish any physical barriers within the soil profile, the soil texture and soil structure. As these soil characteristics will provide an indication of the way the drainage system for the composting facility and feeding lot will have to be implemented. The correct implementation of drainage will ensure that the infiltration of run-off water from the composting facility and feeding lot into the underlying soils does not occur.

The chemical analysis of the soils was also analysed and studied to determine the agricultural potential of the soils. We wanted to ensure that soils with good agricultural potential were not used for the composting facility and feeding lot, but rather soils with poor potential.

Three profile pits were examined. The slope of the composting and feeding lot area is less than 5%.

The profile pits were dug about 200 cm deep.

Table 5-1: Position of the soil samples taken (WGS 84 format) – indicated on google image 1 (below)

Description	Latitude/Longitude	Altitude (HASL)
Soil 1	S33 43 49.3 E019 44 33.5	297 m
Soil 2	S33 43 49.2 E019 44 32.1	298 m
Soil 4	S33 43 53.0 E019 44 34.7	296 m
Soil 5	S33 43 54.0 E019 44 32.5	290 m

Google Image 1: Soil profile positions as indicated on the google earth image

Soil 1 and Soil 4 were described as Brandvlei soils, i.e. a 15 cm deep Orthic A horizon that overlies a 15-90 cm deep Soft Carbonate horizon. Soil 2 and Soil 5 were described as Shorlands soils, i.e. a 15 cm deep Orthic A horizon that overlies a 15-40 cm deep Red Structured B horizon. The total profile depth was 200 cm for all the soils. The soils 1 - 4 have more than 25% clay in the B-horizon.

Photo 1: Soil 1 and 4

Photo 2: Soil 2 and 5

5.2.2 Soil Analysis

The soils were sampled for chemical analyses at various depths as specified in the tables below. Bemlab conducted the chemical analyses summarised in Tables 5-2 to 5-5. Soil analysis from the Bemlab attached.

Table 5-2: Soil 1 (Feeding lot area – planned)

Soil depth (cm)	Soil texture	pH (KCl)	Resistance (ohm)	Vol. % stone	P (Olsen) (mg/kg)	P (Bray II) (mg/kg)	K (mg/kg)	Exchangeable Cations (cmol/kg)			
								Na	K	Ca	Mg
0 - 15	Clay	7.2	110	1	9	27	187	2.66	0.48	6.10	2.04
15 - 90	Clay	7.8	60	1	1	14	184	5.57	0.47	15.03	5.44

Soil depth (cm)	Micro-elements (mg/kg)				Fe mg/kg	Carbon (%)	Soluble S mg/kg
	Cu	Zn	Mn	B			
0 - 15	2.4	2.7	282.2	0.93	60	0.89	64.93
15 – 90	0.8	0.4	83.0	2.27	8	0.27	891.41

Table 5-3: Soil 2 – (Feeding lot area – planned)

Soil depth (cm)	Soil texture	pH (KCl)	Resistance (ohm)	Vol. % stone	P (Olsen) (mg/kg)	P (Bray II) (mg/kg)	K (mg/kg)	Exchangeable Cations (cmol/kg)			
								Na	K	Ca	Mg
0 – 15	Clay	7.2	580	1	9	35	144	0.54	0.37	6.97	2.54
15 – 40	Clay	5.2	160	1	-	5	79	2.02	0.20	4.00	5.52
40 - 90	Clay	4.0	90	1	-	3	42	3.44	0.11	1.76	3.75

Soil depth (cm)	Micro-elements (mg/kg)				Fe mg/kg	Carbon (%)	Soluble S mg/kg
	Cu	Zn	Mn	B			
0 – 15	2.5	**3.0**	308.3	0.60	63	1.01	19.92
15 – 40	1.1	1.2	80.7	0.53	450	1.05	75.06
40 - 90	0.6	**0.8**	7.9	0.30	31	0.25	176.30

Table 5-4: Soil 4 – (Composting area – planned)

Soil depth (cm)	Soil texture	pH (KCl)	Resistance (ohm)	Vol. % stone	P (Olsen) (mg/kg)	P (Bray II) (mg/kg)	K (mg/kg)	Exchangeable Cations (cmol/kg)			
								Na	K	Ca	Mg
0 - 30	Clay	7.9	1120	1	7	17	364	0.37	0.93	14.67	2.71
30 - 60	Clay	7.3	460	1	2	7	201	0.61	0.52	6.00	3.47
60 - 90	Clay	7.8	80	1	3	11	242	1.94	0.62	4.49	6.43

Soil depth (cm)	Micro-elements (mg/kg)				Fe mg/kg	Carbon (%)	Soluble S mg/kg
	Cu	Zn	Mn	B			
0 - 30	2.1	1.0	45.7	0.56	13	0.84	17.28
30 – 60	3.3	0.7	**257.3**	0.77	46	0.49	29.90
60 - 90	1.7	0.4	**205.1**	1.02	40	0.38	151.62

Table 5-5: Soil 5 – (Composting area – planned)

Soil depth (cm)	Soil texture	pH (KCl)	Resistance (ohm)	Vol. % stone	P (Olsen) (mg/kg)	P (Bray II) (mg/kg)	K (mg/kg)	Exchangeable Cations (cmol/kg)			
								Na	K	Ca	Mg
0 - 15	Clay	5.7	100	1	-	20	65	3.10	0.17	2.12	3.52
15 - 50	Clay	3.8	70	1	-	9	73	5.35	0.19	1.67	4.71
50 - 90	Clay	5.4	60	1	-	14	39	5.55	0.10	1.55	5.82

Soil depth (cm)	Micro-elements (mg/kg)				Fe mg/kg	Carbon (%)	Soluble S mg/kg
	Cu	Zn	Mn	B			
0 - 15	1.6	3.5	165.3	0.64	85	0.86	97.56
15 - 50	2.5	1.1	**9.3**	0.37	461	0.59	258.59
50 - 90	1.3	0.3	**318.5**	0.54	56	0.43	440.01

5.2.3 Results and discussions

All the soils have a very high clay content (>25%), thus restricting the movement of water through the profile. Leaching of nutrients and salts from the soil into the groundwater will not easily occur. The high salinity in the soils, coupled with the high clay content, will lead to crusting on the surface restricting water infiltration and increasing run-off.

Soil pH:

The pH of the soils vary greatly over the relatively small area from being alkaline in profiles 1 & 4 to acidic in profiles 2 & 5.

Resistance:

In most of the samples the resistance is <350 ohms, which is used as a threshold norm. Soils with vales below 350ohms are considered to contain salt concentrations that will severely restrict plant growth.

Phosphorus (P):

The analyses show that P concentrations are relatively low in the samples.

Potassium (K):

Soil K concentrations of K follow the same pattern as that of pH. K values are high in samples from profiles 1 & 4 and low in the samples from 2 & 5. However, the K saturation % of the CEC never exceeds 5%. This is an indication of the high level of the total concentration of the cations (salt) in the soil. The other cations mainly responsible for this high concentrations are Ca, Mg and Na.

Calcium (Ca):

Calcium is very high in the Brandvlei profiles (1, 4) where free lime is present in the soil. High Ca concentrations such as these will impede the uptake of other nutrients. In the Shortlands profiles the Ca is low to the extent that lime has to be added if crops were to be grown successfully. Big chemical variations such as these over short distances is very problematic for farmers as it is nearly impossible to get uniform crop growth.

Magnesium (Mg):

In some samples the Mg concentration is higher than that of Ca. This is very problematic as plants require much more Ca than Mg for optimal growth. To achieve this, Ca (lime) has to be added and the Mg must be leached from the soil profile. As pointed out before, leaching of Mg or any other salts will be very difficult due to the high clay content.

Sodium (Na):

It is generally accepted that at Na levels > 10% of the CEC, the salinity in the soil will start to restrict root growth of agricultural crops. With the exception of 3 of the samples, the analyses show Na concentrations of much higher saturation percentages. Leaching Na from the soil presents the same problems as discussed for Mg.

Trace Elements (Zn, Cu, Mn, B):

With the exception of Mn, the analyses show that all the trace elements are deficient.

5.2.4 Recommendation – Soil and drainage

The soil classification and analyses show that the area is not suited for intensive agriculture. Even farming with extensive crops e.g. pastures is unlikely to be successful. The main reason for this is the high salt content of the soils, and the inability to leach the salts from the profile.

Leaching/reclamation of soils can only be done if enough water is available and when there is good drainage, so that the leached salts can be removed from the profile.
The rainfall is low (277 mm/yr) and no water for irrigation is available. Furthermore will the high clay content prevent salts from leaching out of the profile.

Leaching of salts from a profile must be a controlled exercise, to prevent the contamination of the groundwater and of lower lying soils in the landscape.

Compaction of the topsoil as required for the proposed activities would further reduce the likelihood of salts leaching from the profile to contaminate the groundwater.

The run-off from the terrain must be managed and collected in order to prevent possible pollution of lower lying areas.

The compaction will also prevent the nutrients and salts from the manure and urine to penetrate the soil and contaminate the groundwater.

The run-off can be collected in a dam to be constructed at the lowest point on the terrain. From here the water can be recycled and used to wet the composting heaps.

This set of conditions makes the area suitable for the proposed actions.

5.3 Facilities needed and area needed for each facility

The facilities that will be needed for composting are listed in the table below. The primary facilities needed in order to process compost that will only be used on the premises or be sold as bulk to farmers are indicated with an *.The area indicated per facility is calculated for a facility that can process under up to 10 Ton of compost annually, which is the minimum space that will be needed. Should there in future be a need to accommodate additional tonnage of compost to be processed refer to the last column in the table below for the required area needed for a facility that can compost up to 20 tons of compost annually.

Table 5-7: Facilities, surface types required and area needed

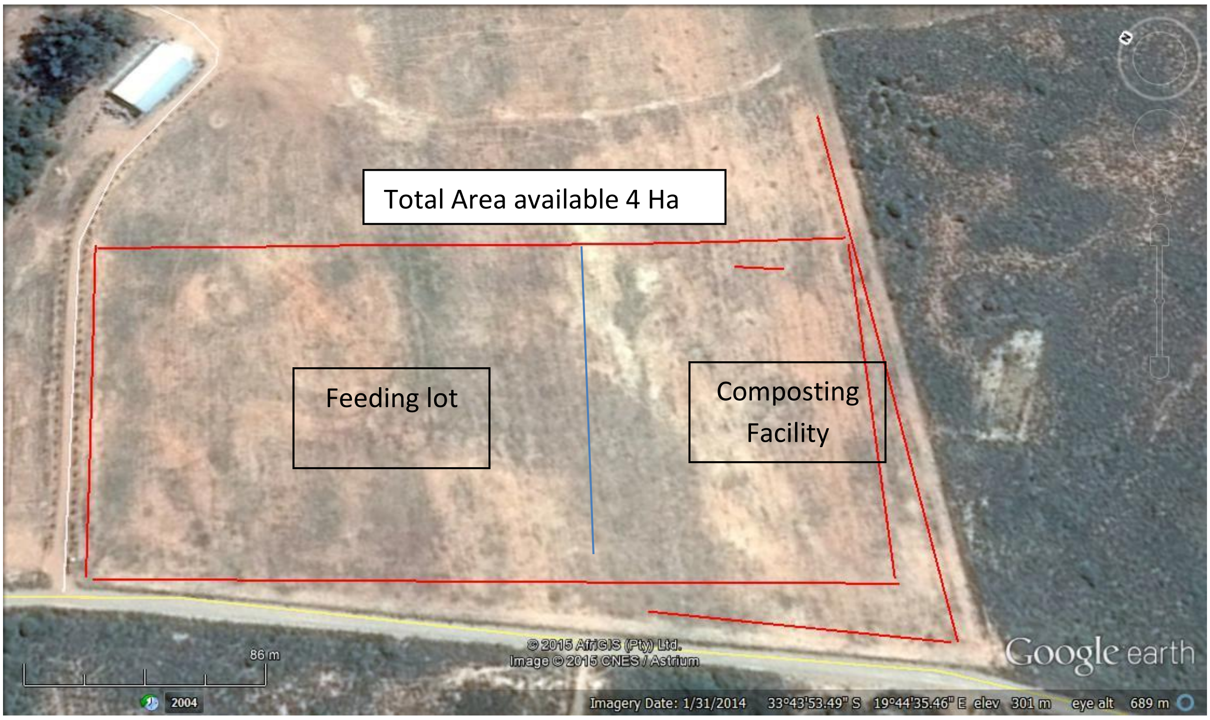
Facility	Surface type	Area needed (m^2) (up to 10 Ton)	Area needed (m^2) (up to 20 Ton)
<u>Collection area:</u> Manure* Wood chips* (bulking agent)	Hardened; impenetrable for water	450	900
Green waste collection area (should this be needed)	Soil surface	400 Vary according to amount of greenwaste collected	800 Vary according to amount of greenwaste collected
Chipper area	Hardened surface	12	12
Mixing area for raw materials*	Concrete slab	400	800
Composting wind-rows 25 m row lengths *	Hardened surface	620	1 240
Roofed and Enclosed Storage and sifting area (sifting and packaging)	Concrete	400	800
Offices (enclosed)	Concrete	16	16
Sump – drainage water* (Min Size 6 000 m^3)	Lined/tank	1 600 (calculated on dam depth of 4 m) (calculated for 2 ha)	1 600 (calculated on dam depth of 4 m) (calculated for 2 ha)
Total area needed (excludes open spaces for vehicle movement, etc)	-	3 098	6 196

The area that is available in total for both the feeding lot and the composting facility is about 4 Ha as indicated and the estimated area available for the composting facility is about 2 Ha as indicated on the below google Image 2. Therefore there is sufficient space for the composting facility with enough free space for vehicle movement, etc.

<u>Water and power points:</u>

Please note on the site layout where the water points need to be positioned. The first water point needed is nearby the compost rows and the mixing area. The other water point will be needed at an office point, along with a power point. The power point will be needed for the sifting process as well as in the office.

Google Image 2: Size of composting and feeding lot area available



The size of the collection dam was calculated based on long-term rainfall data for the area. Rainfall annually averages 277mm. Over 2 Ha this amounts to a total volume of 5 540 m^3 per year, rounded 6 000 m^3 (0.277 x 100 x 100 x 2), thus 6 000 000 litres of water. Therefore the collection dam will be able to collect all rainfall over the 2Ha that will drain towards the collection dam. The water can then be re-used on the compost rows.

5.4 Site Layout

Google Image 3: Scaled layout of the composting facility on google earth photo (1 m: 0.8 mm).

5.5 Drainage recommendations

It is recommended that one drainage system must be constructed in order to function simultaneously for the feeding lot and the composting facility.

The system will consist of a central drainage drain that will allow water flow towards the collection drain that is to be installed. The waste water will gravitate from the various surfaces of the feeding lot and the composting facility into the central drain from where it will flow at an angle towards the collection dam. The collection drain is situated closest to the dirt road as is indicated on Google Image 3, pg. 10.

Both the angle of the feeding lot and the composting facility must be angled in such a way that any run-off water is gravitated towards the central drainage canal that will run through the middle of the two facilities, thus ending in the central collection dam.

The drainage canal will have to be compacted but there is no need for a plastic or concrete lining of the drainage canal. The collection dam will be lined with plastic, concrete or any other suitable barrier as the water will be stored for intervals that could lead to water penetration into the underlying soils.

The water collected in the collection dam (this includes run-off water as well as rainwater) will be pumped to be re-used on the composting rows in order to save large amounts of water. The size of the collection dam is estimated based on long-term rainfall for the area. Rainfall annually is 277 mm and over an area of 2 Ha the recommended size for the collection dam is 6 000m^3.

6 Raw Materials

The raw materials needed are mainly sourced from the adjacent feeding lot and the abattoir, situated in the town of Robertson.

6.1 Type and volume of raw materials available annually

Table 6-1: Available raw material types and volumes

Raw materials available (volumes based on 2014/2015 outputs)						
	ton/year	ton/month	ton/day	m^3/year	m^3/month	m^3/day
Manure	450.00	37.50	1.50	900.00	75.00	3.00
“Pensmis”	1800.00	150.00	6.00	1800.00	150.00	6.00
Blood	225.00	18.75	0.75	225.00	18.75	0.75
Totals	**2475.00**	**206.25**	**8.25**	**2925.00**	**243.75**	**9.75**

Pensmis – 1 ton = 1m^3, as it is mainly water
Blood: Every 1 000L of blood provides 150 kg of dried blood product

The volume of raw material available from the abattoir and feeding lot totals 8.25 ton per year. This is under the 10 ton per year minimum that is allowed before registration is required, with the requirement that the product (compost) must be utilised on the same premises.

6.2 Type and volume of raw materials needed annually

In order to ensure a potentially profitable composting facility a minimum of 10 000m^3 compost must be produced annually. During the composting process about 30% of volume is lost in the form of moisture.

Thus, a minimum of 12 000m^3 of raw material is needed annually. This result in raw material required per day estimated at 40m^3.

The raw material that will be received from the abattoir and feeding lot totals 9.75 m^3 per day. A bulking agent such as woodchips will be needed and be essential to ensure that higher volume of compost can be produced. Refer to Table 6.2 for mixing recommendations.

6.3 Suggested raw material ratio's and procedures for mixing

In accordance to the volume of raw material that is available the ration of raw materials to be mixed for a composted product is suggested in the below table (Table

Table 6-2: Raw material ratio's for composting mix

Compost volumes, mixing and processing	
Raw Material	Volume available and utilised (m^3)/day
Manure, 'pensmis' and blood	9.75
Woodchips (bulking agent)	30.00
Mixture:	Mix volumes as indicated above

The resulting volume of the mixture as indicated in Table 6.2 will result in a final volume of 30m^3. After the composting process, that involves 30% loss in moisture from the raw material, there will be a final volume of 20m^3 of composted product produced per day.

With 20m^3 of composted product produced daily we estimate the production of 100m^3 of compost per week and roughly 4 800m^3 per year to be produced. Thus, a further 5 600m^3 of composted product must be produced in order to make it a profitable stand-alone business. But since the main goal of the compost facility is to process and re-use abattoir 'by-products' this is not essential. The cost that has been going into paying sub-contractors to remove the 'by-products' will be used to establish and run the composting facility.

We recommend the following steps in processing of the raw material:

- Collect all manure on the hardened surface in a heap indicated for collection area
- Buy in woodchips and store on collection area next to the manure heap
- Make up the mixture of about 10m^3 of manure and 30m^3 of woodchips on the concrete mixing area. Leave the mixture open and not heaped.
- Wet the mixture overnight till 80% wet
- The daily delivery of 'pensmis' and blood from the abattoir must be placed directly on the spread out mixture of manure and woodchips. This will ensure that the excess water from the blood is dried quickly and will minimise the stence.
- Shortly after adding the 'pensmis' and blood place the mixture in a heap in the first row.
- Row specifications: 2m wide and 1.5 m High. Every meter of compost is thus 3m^3. The rows should not be longer than 20 meters. It is for practical reasons the easiest length of rows. There is also a 3 m space needed between rows, in order for machinery to turn.
- After 6-8 weeks the compost should be ready for use.

The composted product can be used directly on pastures, etc. Or can be sifted and bagged to sell commercially.

7 Machinery and other tools needed

List of machinery needed: Immediate and future

Machinery needed immediately:

- Compost turner (various sizes available, buy according to need)
- Front loader
- Spades
- Tractor (Look at kW must have crawler gear)
- Pipes and sprinklers for wetting
- Fencing around the facility

Machinery and facilities needed in future:

- "Rolsif''
- Heatsealer to seal bags
- Hopper and conveyors
- Covered and enclosed barn for sifting and bagging
- Office and staff facilities

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Addendum A

Environmental Management Plan

An Environmental management plan will be compiled to address any environmental issues that may occur. This report will be added as an addendum at a later stage.

Addendum B

Soil analysis

Addendum B

Soil Classification Report

Compiled by ReSalt