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Organic Waste Management Strategy

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EXECUTIVE SUMMARY

This report presents the findings of an abattoir compost market study.

The objective of this study is to gain an understanding of the current and future markets for abattoir compost products, so as to be able to provide advice about which market areas offer the greatest potential, and to identify the potential for adoption of composting strategies at abattoirs throughout Australia.

The study area covers the whole of Australia; however, is limited to the regions surrounding existing abattoirs, so as to take account of transport economics.

Information for the study has been gained from:

- Australian and overseas literature regarding compost practice and marketing.
- A survey of the waste management practices of Australian abattoirs.
- Abattoir compost production trials.
- Discussions with relevant business and organisations. The Victorian State Chemistry Laboratory provided a detailed assessment of the major soils and horticultural industries near Victoria's abattoirs.

Abattoir compost is produced through the composting of: paunch, screened solids, and animal manures; and can include organic filter material which is used to treat abattoir effluent. The organic filter is described by Organic Recyclers and Meinhardt in the Organic Waste Management Strategy - Progress Report Nos. 1&2.

The abattoir compost trials and previous studies demonstrated that high quality compost products can be produced from abattoir compost. The products identified with the most potential were: soil enhancers, growing media, and organic fertiliser.

Approximately 17.6 million m^3/year of compost could potentially be produced from Australia's abattoirs.

The potential market for abattoir compost can be divided into the following market segments: Urban, Horticultural, and Agricultural markets. The Urban and Horticultural markets are likely to the most economically viable; however in order to market all the compost that could potentially be produced, the Agricultural and other markets will need to be tackled.

The resale of abattoir compost offers a new source of revenue to the meat processing industry. The economic benefit of composting abattoir waste is maximised when implemented as part of an overall waste management strategy enabling financial savings gained by avoiding current waste management expenditure. Dependant on current site specific operations, it is anticipated that abattoir composting will be financially viable when employed as part of a total strategy.

A SWOT analysis was conducted for the composting of abattoir wastes. The following is a summary of the results:

Strengths

- No solid wastes to dispose of
- Cost savings compared to other treatment/disposal methods.
- Environmentally friendly, long term solutions.

- Production of a valuable product

Weaknesses:

- Composting requires a skilled operator, and appropriate plant.
- A site and appropriate infrastructure is required for the composting operation.
- A market needs to be developed for the finished compost product.
- A quality control system is required to ensure compost product consistency.
- Existing abattoirs have alternative treatment infrastructure in place.

Opportunities

At new abattoirs and abattoirs which are upgrading their waste treatment systems, composting operations can easily be established.

There is a wide variety of markets for compost products. These markets are generally underdeveloped but are growing rapidly.

Threats

Other organic and inorganic products are already well established in the market.

There is also the danger of unscrupulous operations marketing inferior compost products, and damaging the image of the industry as a whole.

Before abattoirs establish full scale composting facilities an individual marketing plan should be produced.

The marketing plan should identify:

- the main markets within a reasonable time distance of the abattoir say up to 50 kilometres;
- estimate the quantities and quality of compost that can be produced;
- match the estimated production within the main potential markets, to ensure that the abattoir can meet the needs of the local available markets;
- source supplies of bulking materials for producing the compost;
- determine the market size, and the likely prices which may be paid for compost;
- identify competing products .

The composting of abattoir wastes has great potential, particularly, as part of an overall Organic Waste Management Strategy.

The MRC can play a useful role in supporting composting; through information dissemination, and further research into critical aspects, particularly in compost application to land.

1. INTRODUCTION

1.1 BACKGROUND

Over recent years the generation, treatment and disposal of waste products from manufacturing industries has become a major environmental issue.

Abattoirs produce solid wastes (such as paunch material and animal manures which are organic in nature) and high strength organic wastewater from the meat production process and cleaning down operations.

Government Authorities are constantly reviewing their environmental management policies and increasing controls. Water authorities are moving towards a user-pays principle; as such, the cost of industrial waste discharges to urban sewerage schemes is likely to increase significantly. The need to develop appropriate waste minimisation strategies and cost-effective systems for removal of nutrients from wastewater cannot be over emphasised.

For this reason, the Western District Meat Packing Co., (WDMP) partially funded by the Meat Research Corporation, has embarked upon developing an Organic Waste Management Strategy. This project is intended to identify Organic Waste Strategies that can be implemented nationally, to assist abattoirs throughout Australia.

The WDMP Organic Waste Management Strategy consists of solid waste composting trials, liquid waste filtration trials using compostable organic matter, and a compost market study. This report describes the results of the market study.

The market study provides an essential part of the strategy, as the on-going success of composting as a waste management strategy is fully dependent on the availability of appropriate product markets.

1.2 STUDY OBJECTIVES

The objective of this study is to gain an understanding of the current and future markets for abattoir compost products, so as to be able to provide advice about which market areas offer the greatest potential, and to identify the potential for adoption of composting strategies at abattoirs throughout Australia.

The study area covers the whole of Australia; however, is limited to the regions surrounding existing abattoirs, so as to take account of transport economics.

1.3 STUDY APPROACH

The study has been undertaken by Organic Recyclers in association with Meinhardt (Vic) Pty Ltd. The State Chemistry Laboratory (SCL), which is part of the Victorian Department of Agriculture and Minerals, Victoria was consulted to provide specialist input in relation to major soil types and horticultural industries near Victorian abattoirs.

Given the complexity of major soil types adjacent to abattoirs throughout Australia, the study is limited to a broad identification of major soil types and both agricultural and horticultural industries nationally. Detailed evaluation of Victorian major soil types and agricultural/horticultural industries has been undertaken as a specific model.

The study consisted of the following tasks.

- Desk Research
- Abattoir Waste Survey
- Product Production Trials
- Market Identification

- Market Assessment

These tasks are described below.

Desk Research

Information regarding the Australian market was obtained by a literature review of relevant conference papers, reports and journals.

Abattoir Waste Survey

To gain an understanding of the potential quantities of compost and its likely composition, a detailed survey of current waste management practices of abattoirs throughout Australia was conducted.

The survey was conducted by fax and each abattoir was asked questions related to their capacity, solid waste management, liquid waste management, and potential markets in their own geographical areas. The survey results are provided in Appendix C.

Compost Production Trials

Composting trials were conducted of the solid waste materials comprising; paunch, save-all, screened solids and animal manures. Wastewater filtration trials were also conducted using an organic filter medium, which was incorporated into composting trials.

These trials provided data on the compost composition, which in turn was used to identify the range of products which could be produced, plus, information on production costs. The detailed results of the composting and wastewater filtration trials are provided in Western District Meat Packing Co., Organic Waste Management Study, Progress Reports No. 1 & 2. (Organic Recyclers and Meinhardt, 1995 & 1995A.)

Market Identification

A market survey was conducted, of relevant businesses and organisations. These groups included councils, nurserys, landscape gardeners, Institute of Horticulture, and the Victorian Department of Agriculture - State Chemistry Laboratory.

SCL provided a detailed assessment of the suitability of different soil types for receiving composted material around Victorian abattoirs. Nutrient status, organic matter content, structural limitations, and other factors were taken into account.

SCL also identified agricultural enterprises which were likely to use organic materials at a competitive cost.

The suggested application rates of composted material was examined regarding concentrations of nutrients, salinity and toxins.

The SCL assessment provides a detailed evaluation of potential Victorian agricultural and horticultural market demands based on major soil types around Victorian abattoirs. The SCL Victorian assessment was undertaken as a detailed model for national application.

Market Assessment

The status of the market for abattoir compost was evaluated utilising the information obtained from the above tasks.

2. COMPOST PRODUCTS

The term composting means different things to different people. The definition of compost adopted for the Organic Waste Management Strategy has been taken from Haug (1993) which states *"Composting is the biological decomposition and stabilisation of organic substrates, under conditions that allow development of thermophilic temperatures as a result of biologically produced heat, to produce a final product that is stable, free of pathogens and plant seeds, and can be beneficially applied to land".* The thermophilic temperature range is 40 - 70 degrees celsius.

A variety of compost products can be produced depending on the quality and composition of materials composted, and the method of composting used. The main compost products that are produced are:

- soil enhancers
- growing media
- organic fertilisers

Soil enhancers are used to improve soil structure, increase soil organic matter, and increase water holding capacity. There are no nutrient requirements for these functions.

Growing media are materials in which plants are grown; for example, potting mixes. Growing media require certain physical characteristics associated with structure and wettability, plus nutrients and other chemical constituents.

Soil fertility is the ability of a soil to supply nutrients and water. Fertilisers are products containing nutrients in a form readily available to plants; therefore, the proper addition of fertiliser to soil will increase soil fertility.

Recent research in Western Australia identified that there are currently a wide range of mulch and compost type products on the market. Whilst most producers of such products had a clear understanding of the technical difference between composts and mulches, the research indicated that the market itself did not make a clear definition between the two, for many applications of these types of products. Instead, there appears to be a continuum from mulches to composts to organic fertilisers and there is a range of products available which make up this continuum.

This is illustrated below in Figure 2.1.

FIGURE 2.1 - TYPES OF PRODUCTS CURRENTLY AVAILABLE ON THE MARKET

Pure Mulches			Composts		Organic Fertilisers
twigs bark, woodchips, pine needles etc →	addition of sawdust →	addition of peat →	addition of composted green waste →	addition of animal manures →	addition of treated sewerage sludge

demand for soil conditioning

low ⟶ high

Source: SPI (1992)

Note: These definitions are based only on market place perceptions.

As Figure 2.1 illustrates, the addition of such materials as sawdust, peat and composted green waste increases for products which have greater soil conditioning properties.

Whilst these are all well known facts, it is interesting to note that a number of products currently sold on the market as composts only have ingredients such as sawdust or peat added to them, and have not been truly composted in a technical sense.

Because these products are subject to some composting (given that they spend a considerable period of time in a stockpile before reaching their final application), much of the industry considers it appropriate, and acceptable therefore, to market these products as a compost.

2.1 STANDARDS

There is currently a lack of regulatory standards in regard to compost. The only standard for general compost at present is the Waste Management Association of Australia, draft Interim Best Practice Procedures for Organic Recycling Plants and Recycled Organic Quality, which is a voluntary standard, although Standards Australia are due to release a draft standard on compost quality soon.

The WMAA document specifies an acceptable marketable quality for recycled organic products in terms of ensuring human and environmental safety in the market place. It does not set organic product criteria which will ensure plant growth and soil health standards consistent with manufacturer's claims.

WMAA (1995) provides a list of the maximum acceptable limits for contaminants which is presented in Table 2.1. The WMAA contaminants acceptance levels are derived from the NSW EPA Draft Interim Code of Practice for Use and Disposal of Biosolids Products relating to Unrestricted Use or Grade A category. The NSW EPA Draft Interim Code establishes five grade categories (Grades A to E) based on contaminant levels. Whilst the NSW EPA Draft Interim Code identifies Grades A to C as acceptable for agricultural land application, WMAA states that Grade A product or lower levels must be achieved by all organic recycled products offered for public sale. A complete copy of the WMAA document is provided in Appendix A.

TABLE 2.1 - CONTAMINANT ACCEPTANCE LEVELS (WMAA, 1995)

Contaminant	Grade A Acceptance mg/kg*
Arsenic	20
Cadmium	3
Chromium	100
Copper	100
Lead	150
Mercury	1
Nickel	60
Selenium	5
Zinc	200
Aldrin	0.02
Dieldrin	0.02
Chlordane	0.02
Heptachlor	0.02
HCB	0.02
Lindane	0.02
BHC	0.03
PCB's	0.03

* Note: Grade A refers to the NSW EPA (1994) unrestricted use category. Values based on dry weight of contaminant/dry weight of solids.

WMAA (1995), also sets criteria for organic matter content, moisture content, foreign matter, vegetable and seed propagules, and pathogen reduction.

Other relevant standards include:

- NSW EPA, draft "Interim Code of Practice for Use and Disposal of Biosolids Products", 1994.
- Australian Standard AS 3743-1993, "Potting Mixes"
- Agricultural and Veterinary Chemicals (Fertilisers) Regulations 1995 - Victoria
- VIC EPA, Off-site Disposal of Contaminated Soil, 1991

The NSW EPA code has been written in regard to biosolids which they define as being "the particulate matter, mainly organic, removed during sewerage treatment (previously referred to as sewerage sludge)". It is not supposed to apply to general compost. However, this document is widely used in the compost industry, the WMAA document and the proposed Standards Australia document use many of the criteria contained in it.

The potting mix standard, AS 3743-1993, specifies the: physical, chemical, biological, and labelling requirements for potting mixes packaged for retail sale. Potting mixes of both regular and premium quality are covered. Requirements are also included for mixes labelled as suitable for African violets, bulbs, hanging baskets, seedlings, orchids, acid-loving plants and plants that are sensitive to phosphorous. AS 3743-1993 is a voluntary standard, which relatively few companies adhere to.

The soon to be proclamated Victorian Agricultural and Veterinary Chemicals (Fertilisers) Regulations 1995 prescribes composition and labelling standards for fertilisers, including organic fertilisers. This document only applies in Victoria, although each state has its own fertiliser regulations.

The Victorian EPA bulletin Off-site Disposal of Contaminated Soil defines the concentrations of contaminants acceptable in clean fill.

2.2 DESIRED CHARACTERISTICS

In order to be successfully marketed, compost must have a composition and appearance which meets the needs and perceptions of the end user.

The aim of any commercial composter should be to produce a good product of consistent quality.

Ultimately the operator should strive to produce a product of consistent;

- moisture content
- pH levels
- colour
- practice size

Customers like to think they are always getting the same product. If the compost's physical characteristics differ between batches, customers may become afraid of receiving inferior product, even if the chemical characteristics are consistent between batches.

A consistent particle size of composted material should also be a major aim of compost plant operators. Not only should particle size be consistent within a batch but it should be consistent between independent batches also. This process is ultimately controlled by screening. The screening process has been noted to not only grade the product to a consistent size but also break up or remove clumps of amendment material such as wet sawdust and partially composted product.

Many international composters have found that the demand for their product is strongly colour dependent. In many instances, it has been found that a greater market share has been acquired when the product has been made blacker or darker. This may be due to consumers relating a darker coloured compost to one of enhanced quality characteristics.

The compost must be completely sterilised (fully composted), free of viruses, pathogens and phitophera, and seeds. It should have a neutral pH level eg. 6.5 to 7.

If changes are anticipated with the product characteristics then the primary users should be informed. By alerting customers of potential changes customer confidence will not risk being weakened through lack of communication.

Availability has been identified as an important factor in selling compost. User groups require the availability of consistent products throughout the growing season.

3. ABATTOIR COMPOST

3.1 PROPERTIES

Abattoir compost is produced through the composting of; paunch, screened solids, and animal manures; and can include the organic filter material which is used to treat the site effluent. The organic filter and composting methods are described in the Organic Waste Management Strategy developed by Organic Recyclers and Meinhardt in Progress Report No.1 and Progress Report No.2. An abattoir compost was produced by combining the abattoir solid waste with a bulking agent then windrow composting these materials. Some liquid wastes; for example, paunch washdown can also be incorporated into the compost. An efficient composting operation will require the addition of water to maintain optimum moisture conditions. Abattoir waste water can be used for this purpose. Figure 3.1 shows a stockpile of abattoir compost ready for sale. The typical composition of abattoir compost is given below in Table 3.1.

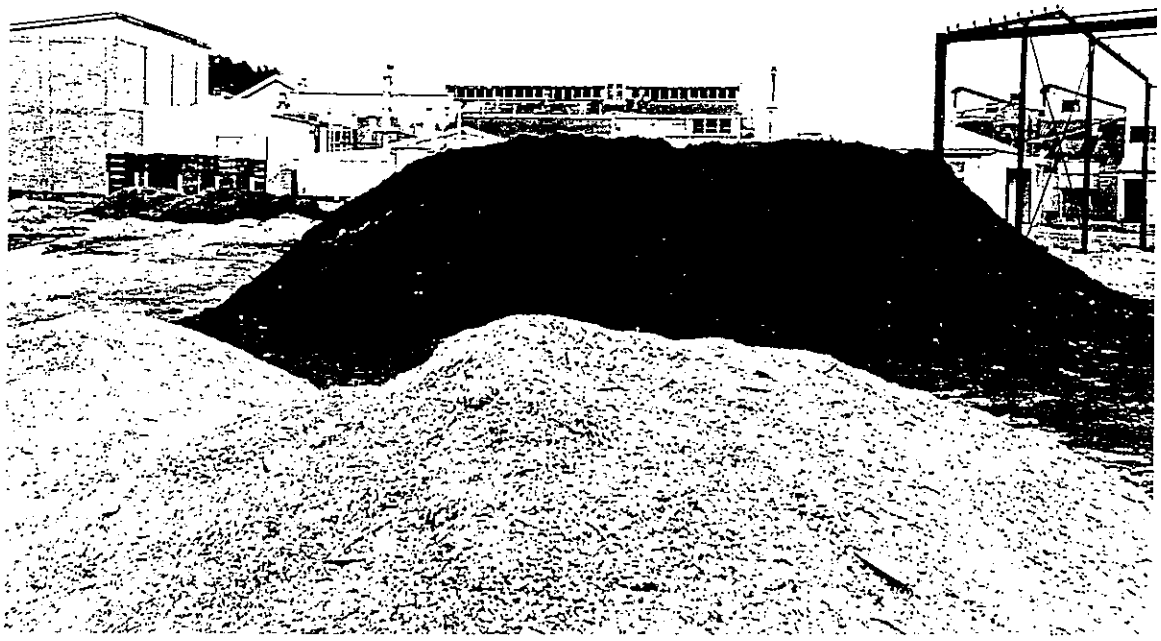


Figure 3.1 - Abattoir Compost Ready For Sale

TABLE 3.1 - SOIL ENHANCEMENT AND FERTILISER PROPERTIES

PARAMETER	UNIT	ABATTOIR[1] COMPOST	MINIMUM[2,3] LEVEL REQUIRED
Nutrients			
Nitrogen	%	0.52-0.73	0.5
Phosphorous	%	0.09-0.30	0.5
Potassium	%	0.15-0.31	0.5
Calcium	%	0.82	0.5
Magnesium	%	1.55	0.5
Sulphur	%	<0.002	0.5
Micronutrients			
Iron	%	0.99-2.4	0.01
Manganese	%	0.037-0.040	0.01
Copper	%	0.0015-0.0017	0.005
Zinc	%	0.018-0.024	0.005
Boron	%	0.0013	0.005
Molybdenum	%	<0.001	0.001
Cobalt	%	<0.0005	0.001
Soil Enhancement Parameters			
pH	-	7.2	5.3-6.5
EC	dS/m	1.15	$\leq$ 2.2
Water Holding Capacity	%	54.5	$\geq$ 40
Air Filled Porosity	%	24.7	$\geq$ 13
Loss on Ignition	%	45.0-53.0	-

1. Organic Recyclers
2. Dept of Agriculture (1995)
3. AS 3743-1993, "Potting Mixes"

The nutrient levels of abattoir compost are relatively low, compared to say farmyard manure (2% N, 1.7% K, and 0.4% P) (Cooke, 1986, p.95). However, the nitrogen content is sufficient to meet the Victorian Government fertiliser requirements (0.5% N) as indicated in Table 3.1. The nitrogen is derived entirely from unmineralised animal and vegetable materials; and as such, the abattoir compost product can be sold as an organic nitrogen fertiliser.

For plants, many metals are essential micronutrients. The levels of manganese, iron and zinc in the compost are in sufficient concentrations to be useful to plants and meet the Victorian Dept. of Agriculture (1995) requirements. Therefore, the compost product may be sold as containing these micronutrients.

The tests used for pH, EC, Water Holding Capacity and Air Filled Porosity use methods employed for the analysis of potting media. The Australian Standard for Potting Mixes (AS3743 - 1993) indicates that "Regular Potting Mixes" should have a pH between 5.3 and 6.5, an EC less than 2.2 dS/m, Water Holding Capacity greater than 40 % and Air Filled Porosity greater than 13%. By this standard therefore, only pH does not meet the criteria.

The potting mix standard requires a slightly acidic pH. The close to neutral compost pH test result of 7.2 indicates a mature compost. Compost with a pH less than 7.2 may be deemed unmatured and as a result may contain untreated pathogenic agents and parasites. The neutral pH result is a desired result.

Table 3.2 summarises the properties of the abattoir compost from an environment protection point of view. The values provided are the sum of averages plus 2 times the standard deviation (Av +2SD), this is in accordance with the NSW EPA (1994) Code of Practice.

TABLE 3.2 - ENVIRONMENTAL PROTECTION REQUIREMENTS

PARAMETER	UNIT	ABATTOIR[1] COMPOST (Av +2 SD)	GRADE A [2,3]	GRADE B [3]
Arsenic	mg/kg	<5	20	20
Cadmium	mg/kg	0.7	3	11
Chromium	mg/kg	69	100	500
Copper	mg/kg	19	100	750
Lead	mg/kg	16	150	150
Mercury	mg/kg	<0.1	1	9
Nickel	mg/kg	108	60	145
Selenium	mg/kg	<0.5	5	14
Zinc	mg/kg	260	200	1400
Aldrin	mg/kg	< 0.01	0.02	0.2
Dieldrin	mg/kg	< 0.01	0.02	0.2
Chlordane	mg/kg	< 0.01	0.02	0.2
Heptachlor	mg/kg	< 0.01	0.02	0.2
HCB	mg/kg	< 0.01	0.02	0.2
Lindane	mg/kg	< 0.01	0.02	0.2
BHC	mg/kg	< 0.01	0.03[2] (0.02)[3]	0.2
PCB's	mg/kg	< 0.01	0.03[3] (0.30)[3]	0.3
		(Averages)		
Salmonellae Organisms	Organisms/50g	Nil	Nil	
Faecal Coliforms	MPN	49	<100	
Loss on Ignition	%	45.0 - 53.0	>25	
Moisture Content	%	43.1 - 44.0	<45	
Foreign Matter	%	4.8	5	
Vegetable or Seed Propagules	Seedlings per 4 litres	Nil	2	

Source:
1. Organic Recyclers
2. WMAA (1995)
3. NSW EPA (1994)

Table 3.2 indicates that the abattoir compost generally meets Grade A contaminant acceptance levels, except for Zinc and Nickel, which are at Grade B levels. Compost which has Grade B levels of contaminants is classified as "Restricted Use 1" which means that it is suitable for agricultural, and landscaping uses but not for home lawns and gardens.

This is likely to be a local problem and refinements in the composting technique employed and an examination of potential sources of contaminants should reduce contaminant levels to meet Grade A requirements.

3.2 POTENTIAL COMPOST QUANTITIES

During trials at the WDMP abattoir in Colac, approximately 1200 sheep and 100 cattle were processed each day, the waste from these operations produced about 35-40 m^3/week of compost. The cattle processing produced a far greater volume of waste per animal than the sheep. It is estimated that about 16-18 m^3/week of compost was produced per 1,000 cattle processed and 4.5-5.2 m^3/week of compost was produced per 1,000 sheep processed. Table 3.3 summarises the number of livestock slaughtered in Australia in the year 1993-1994, and provides estimates of potential compost quantities.

The potential compost quantities were calculated assuming that all abattoir waste was composted, and compost was produced at the following rates:

- 17 m^3/week/1,000 animals (Bulls, Bullocks, Steers, Cows and Heiffers)
- 8.5 m^3/week/1,000 animals (Calves and Pigs)
- 5 m^3/week/1,000 animals (Sheep and Lambs)

TABLE 3.3 - NUMBERS OF LIVESTOCK SLAUGHTERED ('000's)

	NSW	VIC	QLD	SA	WA	TAS	AUST
Bulls, Bullocks and Steers[a]	1,008.5	772.0	1,700.5	199.0	271.2	101.8	4,070.0
Cows and Heiffers[a]	979.4	622.0	1,081.4	201.4	167.6	85.2	3220.1
Calves[a]	221.4	583.4	148.7	8.8	4.4	23.2	991.6
Sheep	6,006.9	3,975.9	856.6	3,078.3	2,952.2	526.1	17,641.0
Lambs	3,991.7	5,600.8	669.6	2,363.8	1,553.2	437.8	14,967.2
Pigs	1,490.9	1,188.5	1,207.9	562.1	550.4	95.8	5190.2
Potential Compost Quantities ('000) (m^3)	5,129	4,505	3,456	2,021	1,805	469	17,608

Source: ABS (1995)

Note: While livestock slaughtered in the Northern Territory and the Australian Capital Territory are not separately listed they are included in the Australian totals.

There are some seasonal variations in the number of animals slaughtered, particularly with calves.

Based on the numbers of livestock slaughtered each year, it is estimated that 17.6 million m^3 of compost could potentially be produced from the nation's abattoirs.

3.3 OPERATIONAL REQUIREMENTS

The development approval process for composting is regulated by state planning legislations. For example, in Victoria the EPAV (1994) require a Works Approval for facilities which treat waste by composting, which are designed to produce more than 10 tonnes per day of compost. An EPAV license is not required for the composting; however, abattoirs themselves require an EPAV license.

An important component of an EPAV Works Approval is the minimum buffer distance required. The EPAV (1990) require a buffer distance of 500 metres from a composting operation to residentially zoned land. Abattoirs also require a 500 metre buffer to residentially zoned land.

A planning permit may also be required.

Two states, NSW and Victoria, are currently developing specific siting criteria for composting operations. It is expected that draft versions will be available for comment in late 1995.

For an abattoir the size of WDMP abattoir in Colac, which processes about 1,200 sheep and 100 cattle per day, an area of about 1 hectare would be ideal for composting operation.

4. EXISTING AND POTENTIAL MARKETS

4.1 SALES VOLUMES

There are currently no statistics kept of the compost sales volumes in Australia. One recent study (Trennell, 1995) estimated that between 150,000 and 200,000 cubic metres of compost is commercially processed each year for the Victorian Market. Another study (GHD,1994) estimated that the current green organic usage within Metropolitan Melbourne and Greater Geelong was 350,000m^3, per annum; however the bulk of this was mulch products rather than compost. The GHD (1994) study predicts that in the year 2000 the green organic usage will be 710,000 m^3, this represents an increase of over 100% in five years.

In Perth it was estimated that 280,000 tonnes of green products including mulch are consumed annually (SPI, 1992).

According to Kevin Banner of Organic Recyclers about 1,800 m^3/year of compost is sold in the City of Warrnambool. Which has a population of about 23,000 people. This equates to sales of 0.078m^3/capita/year for urban users. Although Organic Recyclers believe there is potential for additional sales.

As large scale commercial composting is still in its infancy in Australia, the potential sales volumes are much higher than the current sales volumes. Although, the Strategic Planning Institute study in Perth (SPI, 1992) estimated that 70% of the total potential consumption for mulches and composts would be in substitution of products already on the market and approximately 30% would take up currently unused consumption capacity.

4.2 POTENTIAL AUSTRALIAN MARKETS

While this study concentrates on Australian markets for compost, it is worth noting that there is also the potential for export markets. Middle Eastern countries in particular have expressed an interest in importing organic materials.

Highly populated areas and regions with intensive horticultural industries offer the greatest potential for compost sales. By the correlation of existing abattoirs with population centres, and surrounding agricultural zones, suitable areas were identified as having the greatest potential markets.

From information provided by the Australian Meat and Livestock Corporation of Accredited Abattoirs, a locality plan of Australia's abattoirs was produced. Individual abattoirs are listed in Appendix A. As transport costs are a major component of the selling price it was arbitrarily nominated that product would be transported no more than 50 km. Figures 4.1 - 4.6 depict each accredited abattoir with a 50 km radius, zoning all the potential markets within.

In order to identify potential markets, the demand was broken down into the following components: Urban, Horticultural, and Agricultural markets

4.2.1 Urban Markets

The urban market is assumed to consist of those users associated with highly populated areas, major towns. The prices paid by urban markets are high relative to Agricultural markets; however, individual customers are likely to only buy small quantities of compost at a time. The main user groups include:

- Private Gardeners;
- Retailers of Nursery Products;
- Landscaping and Garden Design Businesses;

- Sand, Soil and Gravel Suppliers and Garden Supply Businesses;
- Local Government;
- State/Federal Government Departments such as Department of Transport, Department of Housing and the Department of Lands;
- Private & Public Leisure Organisations and Developers such as Housing Estates, Commercial Centres, Golf Clubs, Bowling Clubs, etc.

The retailers of potting mixtures and allied products include retail nurseries, supermarkets, hardware stores and garden supply businesses. Whilst some retailers such as certain supermarket chains and retail nursery co-operatives have supplies of packaged potting mixtures and allied products under their own brand name, most retailers sell these products under the brand name of the supplier.

Wholesale nurseries and commercial growers either formulate and produce their own growing mixtures or purchase their requirements from a local supplier of commercial growing mixtures. The majority of the wholesale nurseries and commercial growers now buy in their growing media requirements.

Urban landscapers in Australia predominantly use the phosphorous sensitive plants of the Proteaceae family and Australian natives. The Colac abattoir compost has low phosphorous levels and so may be suitable for landscaping applications.

Growth trials should be conducted to prove that the compost does not inhibit the growth of these plants.

A Working Party on Composting in 1987 estimated that the market for organic fertiliser in Sydney was in the order of 577,000 cubic metres per year. This was broken down into the markets shown in Table 4.1. This market is currently met by products such as manure and composted agricultural wastes. If the horticultural segments are removed the potential urban market for compost was 410,000m^3. Around the time of this survey Sydney had a population of 3,364,858 (ABS, 1986 Celsius). Using these figures the potential consumption per person was 0.12m^3/year. The average market price for this compost was about \$20/m^3.

Table 4.1 - Consumption and Cost of Commercial Compost in Sydney, 1987

Market	*Consumption m^3 per year*	*Av. Price Delivered \$ per m^3*
Nurseries (Retail and Wholesale)	170,000	15
Cut Flowers (Greenhouse)	65,000	n.s
Landscape Contractors	77,600	23
Market Gardeners	50,000	8
Mushroom Growers	15,000	8
Turf Growers	30,000	30
Golf Courses (Private)	9,335	15
Councils	23,100	17
Government Bodies	105,897	21-32
Others	31,068	11-21
Total	577,000	

n.s. Not Specified

Source: IC, 1991

Generally, the population base will determine the ultimate volume of sales. In order to generate adequate customer demand to facilitate a full scale composting

operation, it was arbitrarily decided that a population centre of at least 10,000 people would be required. On this basis, a total of 104 population centres were identified using ABS 1986 census data. By correlation of 10,000+ population centres and 50km radius zones around all the abattoirs, areas with strong potential markets were indicated. A list of abattoir/ town correlations is listed in Appendix B.

4.2.2 Horticultural Markets

Horticulture industries which offer the greatest potential for using compost products are:

- turf growers
- commercial vegetable growers
- cut flower producers

Other potential horticultural markets are orchard and vineyard mulching.

Fertiliser

Different agricultural land uses require fertilisers of different compositions, while similar crops in different regions of the country also require fertilisers of different compositions. The fertiliser composition required is dependent upon:

- crop type
- soil type (location)
- climate

The same is also true for soil enhancers although to a lesser extent.

Organic fertilisers including compost need to be applied at greater rates than manufactured fertilisers, if trying to match equivalent nutrient content. An example, using Colac Abattoir compost (Section 3.1) for growing vegetables is shown in Table 4.2. The abattoir compost has an N:P:K ratio of about 5:2:3.

TABLE 4.2 - EQUIVALENT FERTILISER VALUE

Product	kg/ha nitrogen applied	kg/ha phosphorous applied	kg/ha potassium applied
1t/ha complete NPK 5, 2 & 1	48	57	59
1 t/ha Poultry Manure (NPK 5:3:2)	25	15	10
1 t/ha Colac Abattoir Compost	5.2	2.2	3.3

Note that, to apply equivalent rates of N to the manufactured fertiliser, the poultry manure needs to be applied at approximately double the rate and the Abattoir Compost at nine times the rate. Even then, P and K application for the Abattoir compost are considerably less than the manufactured fertiliser. Remembering that these equivalents are drawn up on the basis of total nutrient, not available nutrient. Organic sources of nutrients will generally be a much slower source of available nutrients and perhaps too slow to provide for the rapid growth stages of crops. On the other hand, slow release can be of benefit, particularly in situations where leaching (eg. deep sands) of the more readily soluble nutrients (N, S and K) is rapid and extreme. In many cases, composts and manures should be seen as supplementary sources of nutrition, rather than the primary source of nutrition, except in the specialised area of 'organic farming'.

Soil Amelioration

Rates of organic compost applied to agricultural land, normally range between 2.5 to 10 t/ha. The lower level is probably the minimum required in most situations to enable some soil response (eg. improved structure) to occur. The upper level generally relates to a maximum practical amount that can be applied and cultivated into the soil in one dressing. Repeated applications on either an annual basis or after each crop may also be carried out. SCL produced a guide for the application of compost in horticultural soils near Victorian Abattoirs, this is summarised in Table 4.3. This is strictly a guide only as individual situations (farms/paddocks/crops) are likely to require a variety of treatments and not necessarily the one indicated here. A detailed report on the major soils and horticultural industries near Victorian abattoirs was produced by SCL and forms Appendix D of this report..

TABLE 4.3 SOIL AMELIORATION APPLICATION RATES

Region	Soil Condition	Compost Rate, t/ha	
		Orchard/Vineyard	Vegetable
Swan Hill	sandy surface (Gc1)	2.5-5	2.5-7.5
Goulburn Valley	hardset (Dr2)	2.5-7.5	5-10
North East	hardset (Dr2/Dy3)	2.5-5	2.5-7.5
Ararat	hardset (Dr2/Dy3)	2.5-5	na
Daylesford	friable (Dr4/Gn3/Db1)	0-2.5	0-5
	hardset (Dr2/Dy3)	2.5-5	na
Hamilton	n/a	na	na
Portland	deep sandy (Uc1)	na	5-7.5
Warrnambool	friable (Um6/Gn2)	na	0-2.5
Colac	friable (Um6/Gn2)	na	0-2.5
	sandy surface (Dy3)	na	2.5-7.5
West/North Melbourne	hardset (Dr2)	na	5-10
	sandy surface (Dy3)	na	2.5-7.5
East/South Melbourne	friable (Gn4/Gn3)	0-2.5	0-5
	hardset (Dy3)	2.5-5	2.5-7.5
	deep sandy (Uc2)	2.5-5	5-7.5
	peaty (Uf5/Uf6)	na	0
West/South Gippsland	friable (Gn4)	na	0-5
	deep sandy (Uc2)	na	5-7.5

na = not applicable as these enterprises are not common for the region.
( ) = Major soil profile, which is explained in detail in Background Paper B.

Note that the rates suggested for orchards and vineyards are lower than those for vegetables because it is assumed that in most cases, minimal, if any, incorporation of the compost will occur. In some situations (eg. southern, high rainfall, vineyards) rates may need to be kept low to restrict N inputs, as high nitrogen can cause excessive vigour and loss of yield of fruit quality. Where new orchard or vineyard plantings are proposed or where inter-row cropping takes place, compost rates may be similar to those suggested for vegetables.

Frequency of application to vegetable situations will depend on a number of factors, including; intensity of cropping, number of pre-planting cultivations, rate of compost breakdown, crop type and soil type. Sandy soils should show benefits to compost at lower rates than those required by heavier, hardset soils. Sandy soils are also less buffered against change (pH, salinity, heavy metal accumulation, nutrient leaching) than heavier soils, and for this reason, less frequent and/or lower rates of application may be necessary in some situations. To better determine appropriate rates and frequency of Abattoir Compost application to horticultural land, properly replicated trial work would be required over the range of soils and situations encountered. This would also involve monitoring of chemical and physical characteristics of the soils on these sites and the yields and quality of produce.

As an example, the required application rate for a vegetable farm in the Colac region on a Dy3 type soil (hard mottled yellow) with a sandy surface is 2.5-7.5 t/ha. The abattoir compost has a density of about 0.6 t/m^3; therefore 4.2-12.5m^3/ha of compost would be required for soil amelioration. At \$10/m^3 for bulk compost this works out to be \$42-\$125/Ha (or \$17-\$51/acre) per dressing. This dressing would also provide about 30% - 90% of the soil's nitrogen fertiliser needs.

4.2.3 Agricultural and other Markets.

At present, the use of compost products by broad acre enterprises such as cropping and grazing is generally not viable, due to the expense of transport and spreading over large paddocks. This is not to say farmers aren't interested in using compost products. The application of compost to soils at rates of between 2.5 to 10 t/ha can significantly increase the sustainable stocking levels of land, improve the soil water holding properties and can reduce erosion.

As agricultural land is often in the immediate vicinity of many abattoirs, transport costs may be minimal.

Forestry (or Silvaculture) is another potential market. Compost can be applied to land before seedlings are planted, then can be used as a mulch after planting.

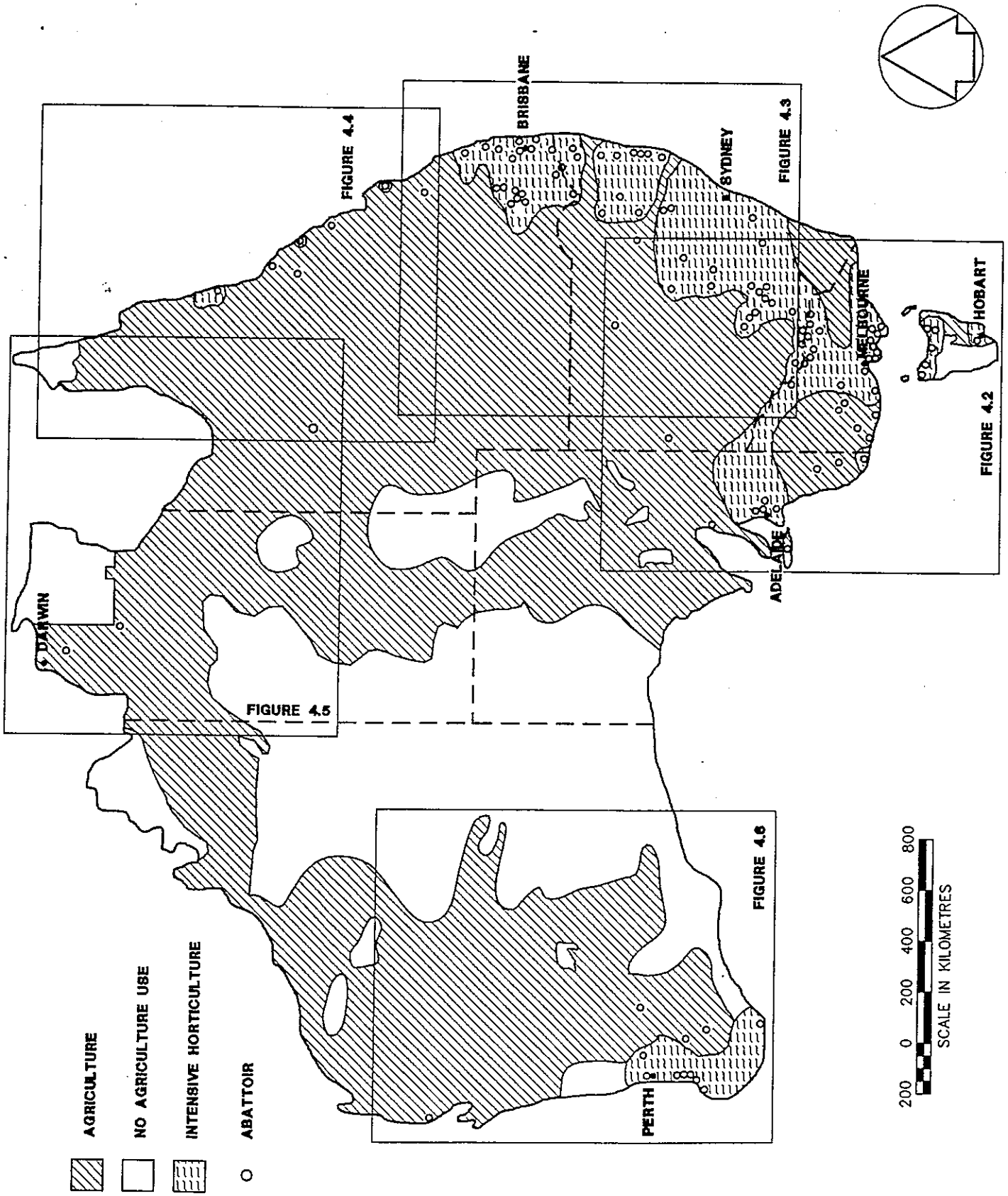
Soil rehabilitation is another potential use, but is at the low value end of the market. Compost can be successfully used for mine site reclamation. Mine soil from open cut mines can be high in sulphur which is oxidised be bacteria, to sulphate, rendering the area very acids. Application of any form of compost prevents this acidification process. Compost can also be used to help treated soil salinity problems.

Low grade compost can also be used as a part of the final landfill cover.

According to a US study, (Tyler,1993), the agricultural market has by far the greatest potential. The relative proportions of each market segment in terms of quantities is:

- Urban 1%
- Horticulture 3%
- Forestry 11%
- Agriculture 85%

The Australian market for compost is likely to be similar to the US market.



KEY PLAN

FIGURE 4.1

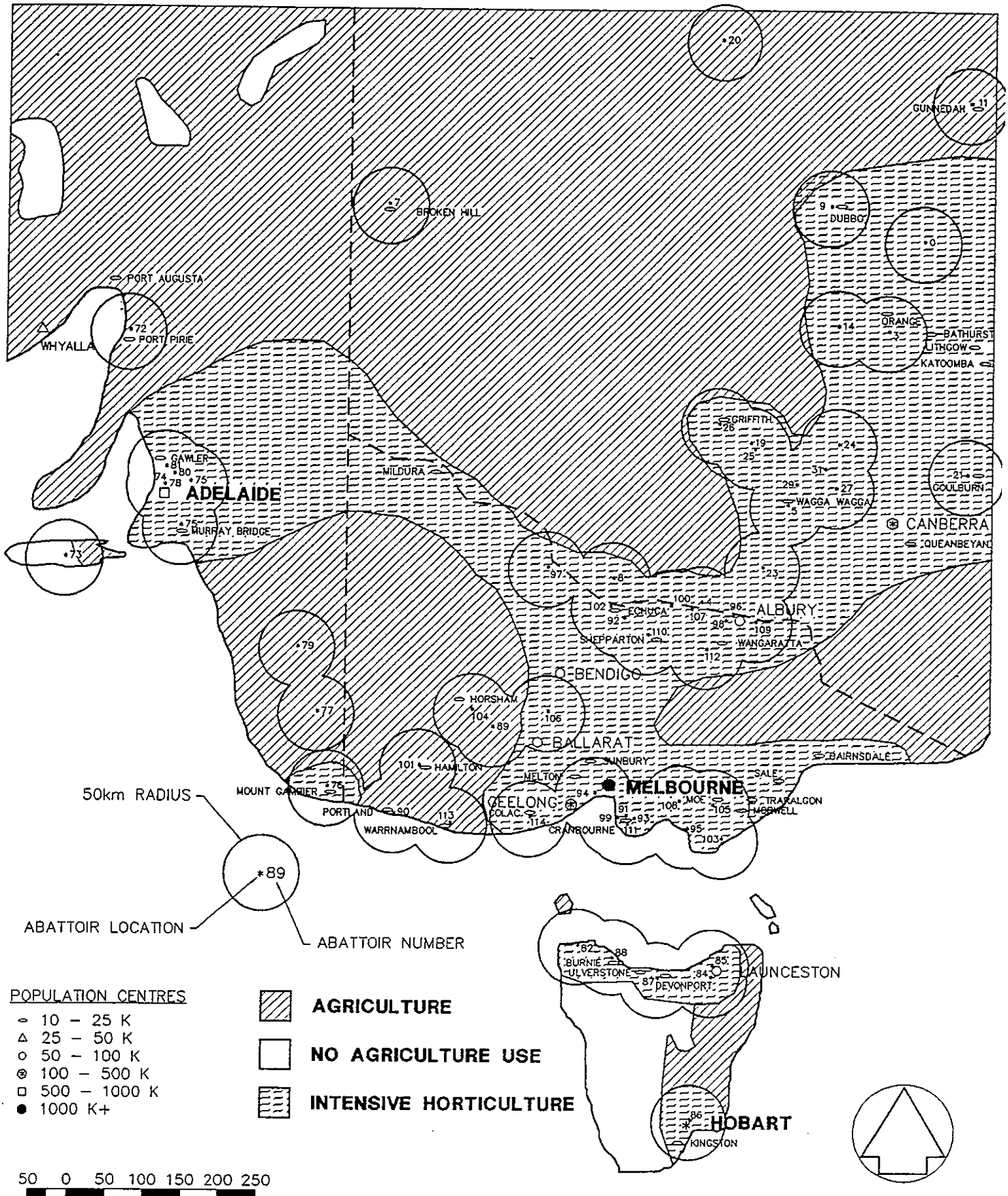

ADELAIDE
WHYALLA
PORT AUGUSTA
PORT PIRIE
BROKEN HILL
MILDURA
GAWLER
MURRAY BRIDGE
GUNNEDAH
DUBBO
ORANGE
BATHURST
LITHGOW
KATOOMBA
GRIFFITH
WAGGA WAGGA
GOULBURN
CANBERRA
QUEANBEYAN
ALBURY
ECHUCA
SHEPPARTON
WANGARATTA
BENDIGO
HORSHAM
BALLARAT
HAMILTON
SUNBURY
MELTON
BAIRNSDALE
SALE
MELBOURNE
GEELONG
COLAC
MOE
TRARALGON
MORWELL
CRANBOURNE
MOUNT GAMBIER
PORTLAND
WARRNAMBOOL
50km RADIUS
*89
ABATTOIR LOCATION
ABATTOIR NUMBER
BURNIE
ULVERSTONE
DEVONPORT
LAUNCESTON
HOBART
KINGSTON
POPULATION CENTRES
10 – 25 K
25 – 50 K
50 – 100 K
100 – 500 K
500 – 1000 K
1000 K+
AGRICULTURE
NO AGRICULTURE USE
INTENSIVE HORTICULTURE
50 0 50 100 150 200 250
SCALE IN KILOMETRES

FIGURE 4.2

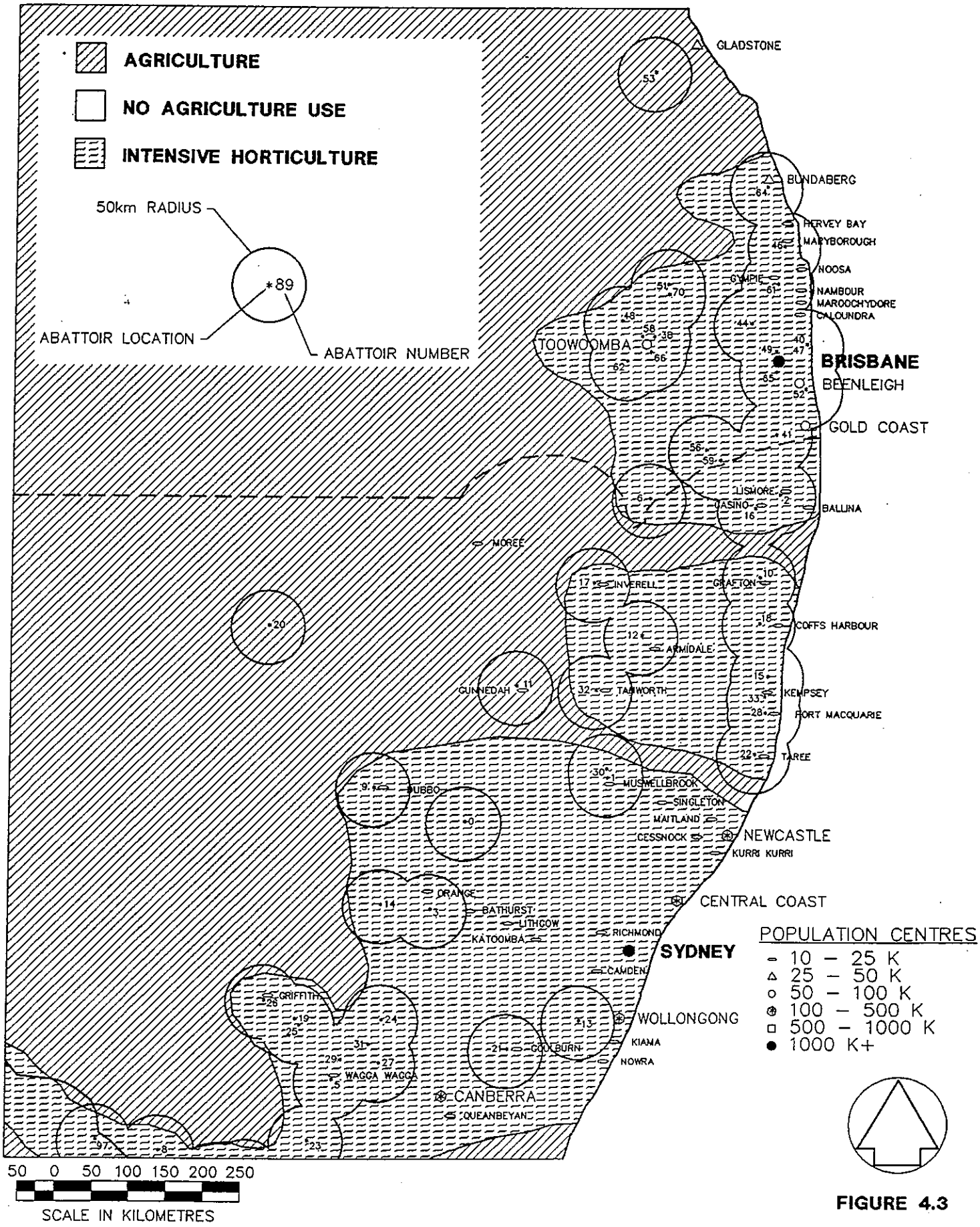

AGRICULTURE
NO AGRICULTURE USE
INTENSIVE HORTICULTURE
50km RADIUS
*89
ABATTOIR LOCATION
ABATTOIR NUMBER
GLADSTONE
BUNDABERG
HERVEY BAY
MARYBOROUGH
NOOSA
GYMPIE
NAMBOUR
MAROOCHYDORE
CALOUNDRA
TOOWOOMBA
BRISBANE
BEENLEIGH
GOLD COAST
LISMORE
CASINO
BALLINA
MOREE
INVERELL
GRAFTON
COFFS HARBOUR
ARMIDALE
GUNNEDAH
TAMWORTH
KEMPSEY
PORT MACQUARIE
TAREE
DUBBO
MUSWELLBROOK
SINGLETON
MAITLAND
CESSNOCK
NEWCASTLE
KURRI KURRI
CENTRAL COAST
ORANGE
BATHURST
LITHGOW
KATOOMBA
RICHMOND
SYDNEY
CAMDEN
GRIFFITH
WOLLONGONG
KIAMA
NOWRA
GOULBURN
WAGGA WAGGA
CANBERRA
QUEANBEYAN
POPULATION CENTRES
10 – 25 K
25 – 50 K
50 – 100 K
100 – 500 K
500 – 1000 K
1000 K+
50 0 50 100 150 200 250
SCALE IN KILOMETRES

FIGURE 4.3

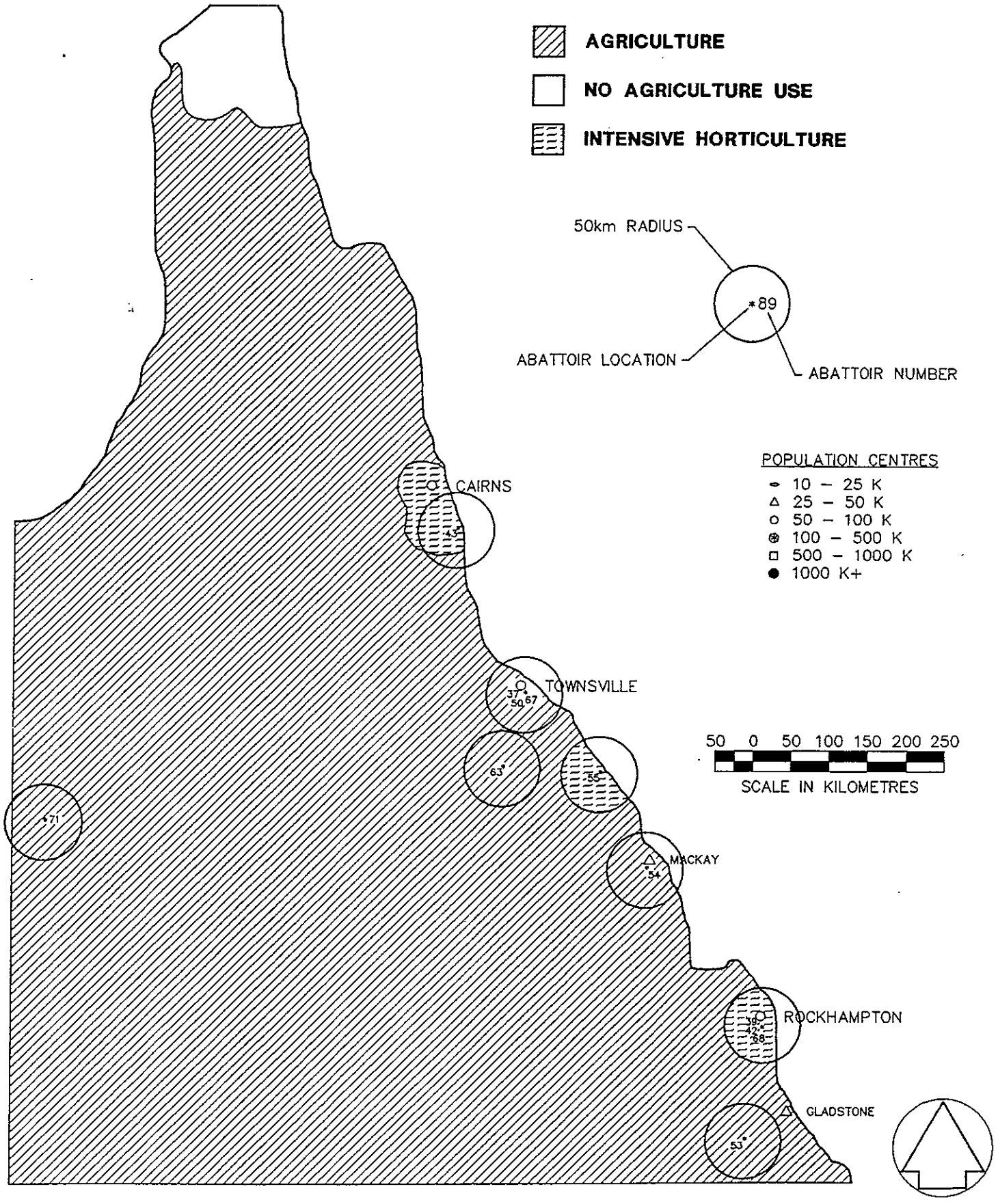

AGRICULTURE
NO AGRICULTURE USE
INTENSIVE HORTICULTURE
50km RADIUS
89
ABATTOIR LOCATION
ABATTOIR NUMBER
POPULATION CENTRES
10 – 25 K
25 – 50 K
50 – 100 K
100 – 500 K
500 – 1000 K
1000 K+
CAIRNS
TOWNSVILLE
MACKAY
ROCKHAMPTON
GLADSTONE
50 0 50 100 150 200 250
SCALE IN KILOMETRES

FIGURE 4.4

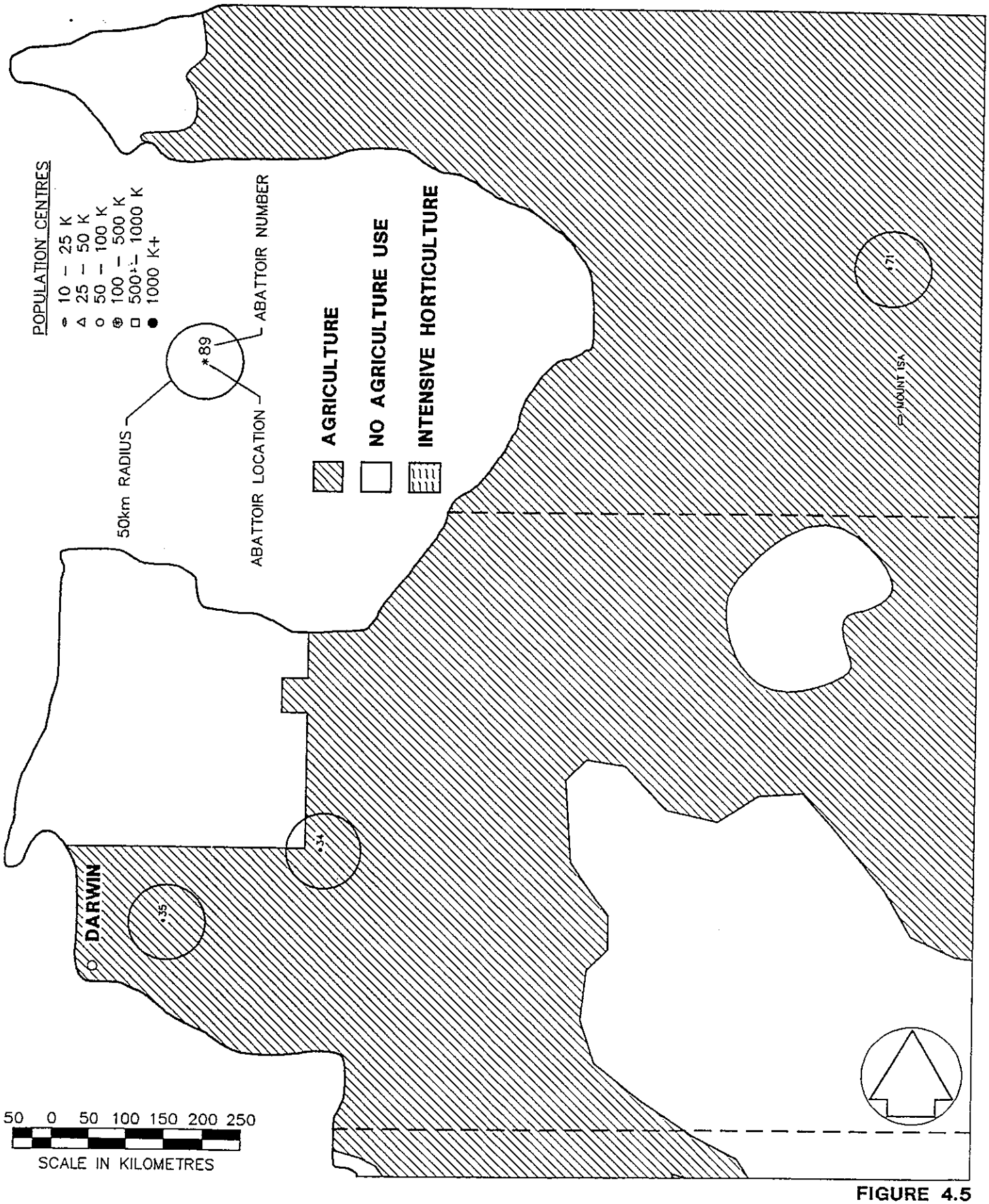

POPULATION CENTRES
10 – 25 K
25 – 50 K
50 – 100 K
100 – 500 K
500+ – 1000 K
1000 K+
ABATTOIR NUMBER
*89
50km RADIUS
ABATTOIR LOCATION
AGRICULTURE
NO AGRICULTURE USE
INTENSIVE HORTICULTURE
MOUNT ISA
DARWIN
50 0 50 100 150 200 250
SCALE IN KILOMETRES

FIGURE 4.5

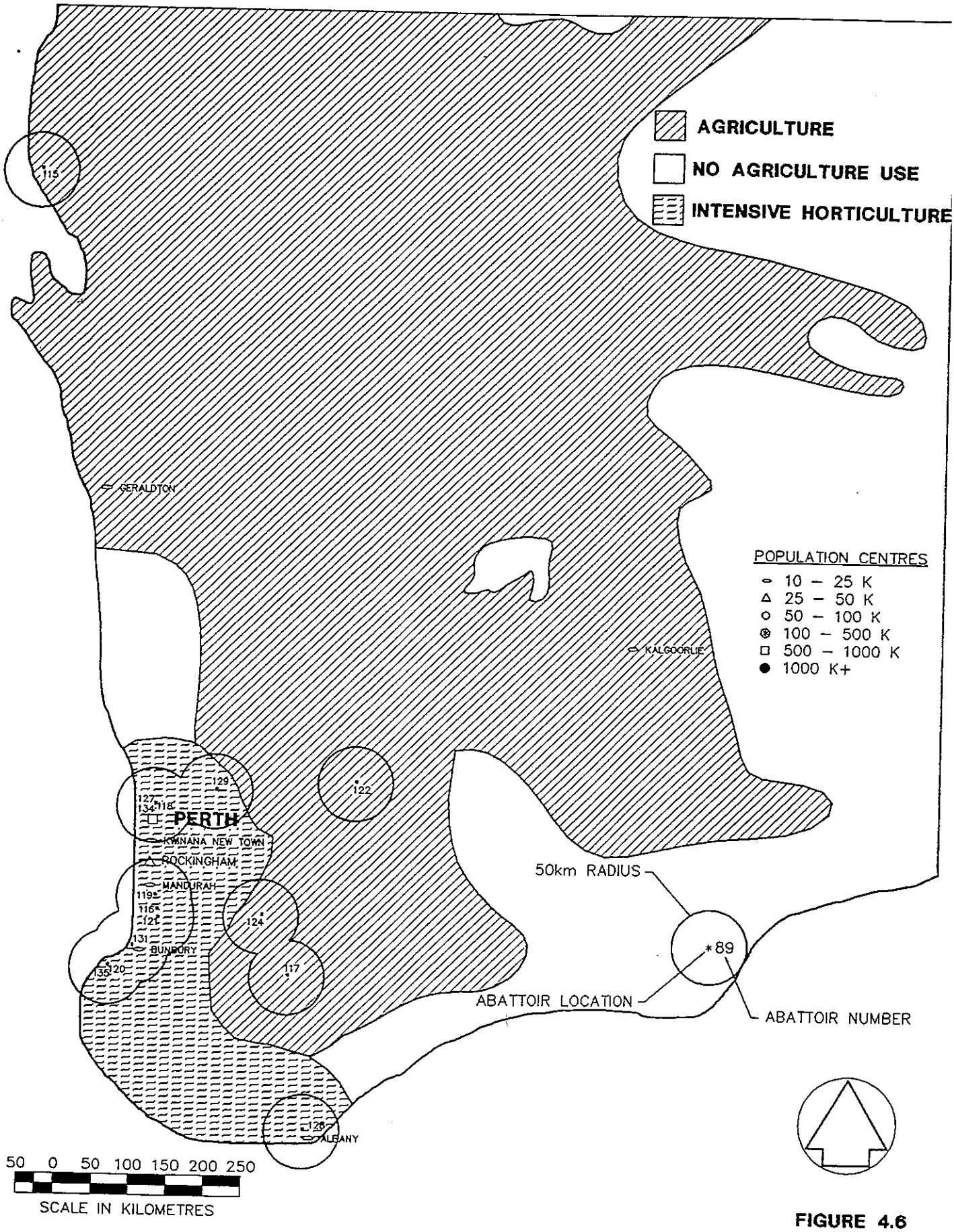

AGRICULTURE
NO AGRICULTURE USE
INTENSIVE HORTICULTURE
GERALDTON
KALGOORLIE
PERTH
KWINANA NEW TOWN
ROCKINGHAM
MANDURAH
BUNBURY
ALBANY
115
129
127
134
118
122
119
116
121
124
131
120
35
117
126
POPULATION CENTRES
10 – 25 K
25 – 50 K
50 – 100 K
100 – 500 K
500 – 1000 K
1000 K+
50km RADIUS
*89
ABATTOIR LOCATION
ABATTOIR NUMBER
50 0 50 100 150 200 250
SCALE IN KILOMETRES

FIGURE 4.6

4.3 MARKET PRICES

The cost of the final compost product is constituted by:

- materials costs
- production costs
- transportation costs

Materials Costs

Where waste is used as the raw material for producing compost, the cost of materials will be low. It is likely that the composter may in fact be paid to accept the waste materials. The cost of any additional amendments required for the composting operation can be significant if no appropriate sources are located in the immediate vicinity. Bulking agents, for example, wood chips, can cost between 0 - $\$10/m^3$.

Production Costs

The cost of production is determined by the degree of refinement the final material must have in order to be acceptable to the potential user. Ultimately, the cost of production is dependent on the sophistication of the process. Production costs range from about \$10 - $\$25/m^3$.

Transportation Costs

The cost of transport will be directly proportional to the distance separating the processing plant and the potential market. For this reason, it is necessary to locate composting facilities as close as possible to the potential market. For a $40m^3$ load of compost, transport costs are likely to be around \$1.50 to \$3.00/km. Therefore, for a 50km trip the cost will be \$1.88 to $\$3.75/m^3$.

Current Market Prices

The market price paid for compost will vary according to:

- the products it can substitute (eg. fertiliser)
- availability of supply
- the end user and application of product
- product quality

The range of current market prices including transportation for various products is given in Table 4.4. These prices will vary considerably around Australia depending on quality and location. Many councils give away mulch for free to their residents.

Table 4.4 - Compost and Soil Enhancement Product Prices

Product	Price $/m³
Mulch[2]	$ 0 - 20
Top Soil[3]	$ 25
Packaged Potting Mix[3]	$ 100 -150
Special Blend Potting Mix[3]	$ 55
Packaged Growing Media[3]	$ 90 - 100
Bulk Growing Media[3]	$ 35 - 60
Bulk Abattoir Compost[1]	$ 5 - 12
Packaged Compost[2]	$ 160 - 180

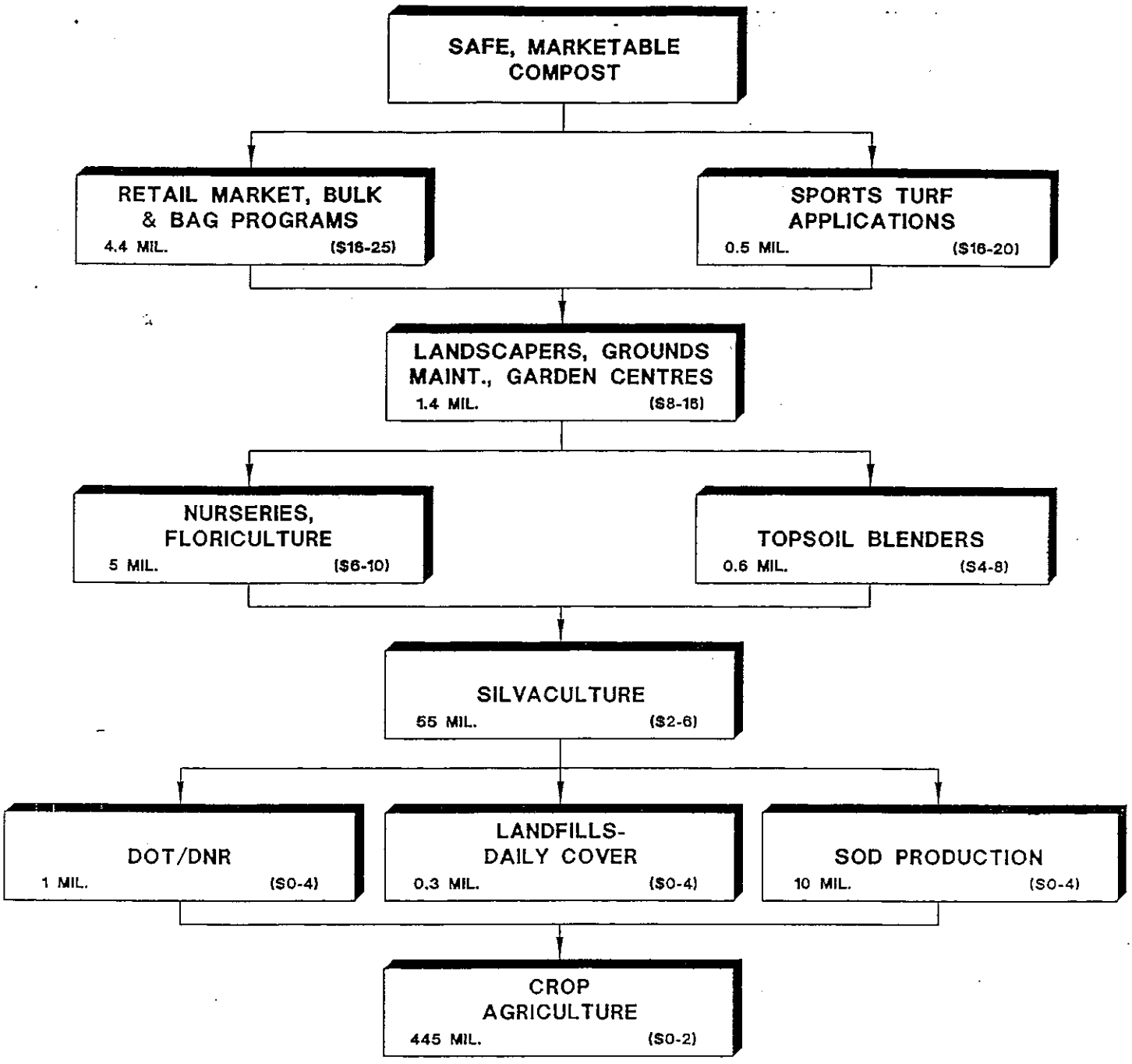
Source:
1. Organic Recyclers (not including transport)
2. SPI (1992)
3. GHD (1994)

The demand for, and price paid for compost varies with different market groups. Effectively marketed compost will find its way to the highest dollar markets. Excess compost will go to the next highest paying market and so on. A survey conducted in 1991 in the USA (Tyler, 1993) provides a good example of this process, and is illustrated in Figure 4.7.

Ironically, the highest dollar markets also have correspondingly low total market potential in size. It appears that these two measurements (ie. product price and total volume potential) are somewhat inversely related.

The market price for bulk abattoir compost is about $5 - $12/m³ compared to the total cost of about $10 - $34/m³.

It is clear that in most instances the market price for compost products is less than cost of producing and selling compost. For the production of compost to be worthwhile, the costing structure needs to take into account the money saved on solid and liquid waste disposal achieved by diverting these wastes to compost.



- NUMBERS ON THE BOTTOM RIGHT-HAND SIDE OF EACH BOX REPRESENT ESTIMATES OF MAXIMUM AND MINIMUM PRICES ($US) BUYERS ARE WILLING TO PAY FOR EACH PRODUCT PER CUBIC YARD EXCLUDING TRANSPORTATION. NUMBERS ON THE LEFT INDICATE THE TOTAL U.S. MARKET SIZE IN TONS. (SOURCE - TYLER, 1993)

COMPOST MARKETING HIERARCHY
FIGURE 4.7

4.4 VICTORIAN MARKET

A detailed evaluation was made of the Victorian market for abattoir compost, to serve as a model for national application.

The Victorian State Chemisty Laboratory provided a detailed report on major soils and horticultural industries near Victorian abattoirs. This report is enclosed as Appendix D.

The demand for abattoir compost; plus, an indication of the value of these products is provided in Table 4.5.

In producing this table the, following assumptions were made:

- Urban Demand was based on population centres of greater than 10,000 people. A demand of 0.12m^3/person/year was adopted.
- The compost price for urban use was \$20/m^3 and for horticultural use \$10/m^3.
- The horticultural demand was based on application rates provided in Table 4.3 and the areas currently used for horticulture from Appendix D. The density of compost was assumed to be 330kg/m^3.
- The quantitative demands for Agricultural and other markets are very difficult to determine, and are likely to be very site specific and are therefore not included. As a consequence of not including an Agricultural demand, the total demand figures are likely to be conservative.

Table 4.5 - Abattoir Compost Demand - Victoria

		Urban		Horticulture		Agriculture		TOTAL	
Region	Abattoirs in Region	Demand	Estimated	Demand	Estimated	Demand	Estimated	Demand	Estimated
	Ref. No.	m^3/year	Value ($)	m^3/year	Value ($)	m^3/year	Value ($)	m^3/year	Value ($)
Swan Hill	97	0	$0	15000	$146,000			15000	$146,000
Goulburn Valley	92,100, 102,110	5000	$97,000	52000	$518,000			57000	$615,000
North East	96,98, 107,109, 112	9000	$183,000	7000	$75,000			17000	$258,000
Ararat	89,104	1000	$29,000	3000	$32,000			5000	$61,000
Daylesford	106	8000	$153,000	28000	$282,000			36000	$435,000
Hamilton	101	1000	$24,000	0	$0			1000	$24,000
Portland	90	1000	$26,000	3000	$27,000			4000	$53,000
Warrnambool	113	3000	$54,000	3000	$35,000			6000	$89,000
Colac	114	1000	$25,000	8000	$82,000			9000	$107,000
West and North of Melbourne[1]	94	322000	$6,444,000	75000	$752,000			397000	$7,196,000
East and South of Melbourne[1]	91,93,99, 111	319000	$6,383,000	53000	$529,000			372000	$6,912,000
West and South Gippsland	95,103, 105,108	4000	$83,000	32000	$320,000			36000	$403,000

Note 1: The urban demand of the region, West and North of Melbourne; and the region, East and South Melbourne overlap.

The total urban and horticultural demand in the vicinity of Victoria's abattoirs is about 637,000 m^3/year. The potential supply of abattoir compost in Victoria is 4,505,000 m^3/year (Table 3.3). Clearly the potential supply of compost is greater than the Urban and Horticultural market segments alone. If the Urban and Horticultural markets account for 4% of the total market, as discussed in Section 4.2.3, the total potential market for compost in Victoria including Agricultural and other markets, could be almost 16 million m^3/year.

5. MARKET EVALUATION

The following is a SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis for the composting of abattoir wastes. The SWOT analysis addresses:

- Expected Growth of Market Demand
- Potential Market Threats
- Products Currently Available to Compost Substitution

5.1 STRENGTHS

The beauty of composting abattoir waste is that an undesirable waste product is transformed into a valuable commodity using simple and cost effective technology. In summary the main strengths of composting abattoir waste are:

i) No solid wastes or residues to dispose of.

ii) Many abattoirs are located close to horticultural and urban markets.

iii) Many regions where abattoirs are located are remote from major soil enhancer and fertiliser producers. In these areas there is an untapped demand for these products at reasonable prices.

iv) It is a long term sustainable development.

v) Raw materials are either free or cheap.

vi) Favourable publicity and reputation for implementing "environmentally friendly" methods.

vii) The composting operation can easily handle wastes from other industries and the community. A composting operation could be run as a joint venture with local government or other industries eg, Nursery's.

viii) Additional income and/or direct operational cost savings can be achieved through the sale of compost.

ix) The composting operation can be conducted off site.

x) Low infrastructure costs.

xi) Prevents waste from being landfilled, which is in line with Local, State and Federal Government policies.

xii) Composting and sale of the product maybe more cost effective than other solid waste management options.

xiii) Composting can have considerably less impact on the environment than most other solid waste management alternatives.

xiv) A biological stable compost does not generate offensive odours and can be stored without nuisance.

xv) Unlike many fresh organic wastes, mature compost does not contain or produce phytotoxic substances (compounds that inhibit plant growth and seed germination).

xvi) The heat generated during the composting process promotes moisture

removal, making the product easier, and therefore less costly, to handle than the raw material.

xvii) The heat generated during composting destroys pathogens and most common weed seeds.

xviii) Plant nutrients in the organic material become more concentrated as the readily biodegradable carbon compounds are removed and the waste volume is reduced.

xix) The structure and appearance of the organic material is improved, making it more easily spread on crop-land or more attractive for marketing as a soil conditioner or potting mix base for home gardeners and commercial plant nurseries.

xx) The waste stream is consistent, enabling production of a consistent product.

5.2 WEAKNESSES

There are relatively few weaknesses to composting abattoir wastes, these are:

i) Composting requires a skilled operator, and appropriate plant.

ii) A site and appropriate infrastructure is required for the composting operation.

iii) A market needs to be developed for the finished compost product.

iv) A quality control system is required to ensure compost product consistency.

v) Existing abattoirs have alternative treatment infrastructure in place.

5.3 OPPORTUNITIES

Urban

The consumers of growing media and allied products can be broadly classified under the consumers of packaged growing media (potting mixtures, etc.) and allied products (mainly home gardeners) and the consumers of bulk growing media and allied products (growers of ornamental plants, landscapers, government bodies, etc.). The expectations of consumers of both packaged and bulk growing media and allied products are changing.

As recently as ten years ago, most growers of ornamental plants had no choice but to make their own growing mixtures. This was because there were no commercial suppliers of growing mixtures that were of a sufficient quality and consistency. Indeed, this situation still exists in a number of areas in several states in Australia.

Growers now realise that the formulation of growing mixtures for ornamental plants in containers requires particular levels of expertise and knowledge of suitable ingredients if one is to grow containerised plants of consistent quality and performance. Consequently, growers are now prepared to pay for the delivery of professionally formulated growing mixtures where the opportunity exists.

Home gardeners, on the other hand, are generally still unaware of what to expect or demand when purchasing packaged potting mixtures. Most home gardeners now understand that plants grown in containers require a potting mix rather than just using garden soil, however, there is no compulsory requirements that a producer of packaged potting mixtures must comply with in order to sell a mixture material as a

potting mix, (AS 3743 -1993, Potting Mixes does not require mandatory compliance).

Consequently, there exists in the market an extremely diverse range of packaged potting mixtures and the home gardener has virtually no assistance in comparing one potting mix to another when purchasing. In 1990, an Australian Standard on packaged potting mixes was published by the Standards Association of Australia. Whilst this publication is a welcome step in the right direction, it is a voluntary standard and producers of packaged potting mixes are not required to comply with the standard. Currently there exists only a handful of producers of packaged potting mixes who have applied for and been granted the use of the Standards Australia "premium" trademark on their range of packaged potting mixes.

A major market exists for the use of composts in the manufacture of top soil products for landscaping. Composted and treated sewerage sludges are already used extensively in the manufacture of topsoil products.

There are also major opportunities for the use of compost in sports turf applications and landscaping.

In many cases compost is cheaper than alternative products; for instance, peat and natural topsoils.

Horticulture

The horticulture Industry provides tremendous opportunities for abattoir composts. Numerous studies have show compost to be very beneficial to plant growth; by improving structure, providing nutrients and suppressing diseases.

Compost can be used in the cut flower industry (Horticulture), in vegetable production, and to a lesser extent for fruit and vineyard mulching.

Agriculture and Other Opportunities

The Agriculture market is potentially the biggest, however, it is also represents the low value end of the market.

Another opportunity for compost is for land rehabilitation, for instance on old minesites, completed landfills and salt effected land.

Foresting is another area of some potential; particularly before the seedlings are planted.

5.4 THREATS

The greatest threat to the sale of compost in all market sectors is the potential for unscrupulous operations to enter the market with inferior compost products, and damaging the reputation of the industry as a whole. It is for this reason that the move towards regulating the industry should be encouraged.

Other organic wastes and product; for instance, peat moss, chicken manures and green waste mulches are already widely used and may be difficult to displace in some markets.

Inorganic products like lime and mineral based fertilisers are widely used and generally are easier to apply than compost in larger scale applications.

Local government and Wastewater Treatment authorities are likely to produce large amounts of Compost in the future which could saturate some markets.

6. COMPETING IN THE MARKET PLACE

6.1 COMPOST MARKETING STRATEGY

Viewing a composting facility as a manufacturing plant brings to light critical components of a successful operation. Like any manufacturing operation, there is a need for consistency in product quality, which is dependent on the incoming raw materials and the production process. Satisfying customer needs translates to consistent quality, a competitive price and on-time delivery. Balancing supply and demand is crucial, as is on-time delivery.

The regional markets will not appear over night and it may take some time for supply and demand to balance out.

The ideal situation is for the production of compost to stay slightly ahead of sales, creating a "just in time" inventory. This will minimise the land required for stockpiling the compost.

A supply shortage can occur due to overdevelopment of the market. This may arise when many markets are developed at once instead of emphasising one or two main ones. The initial response from several of these market sectors could leave an abattoir temporarily "sold out". Balancing diversity in market development and maximizing profits from each niche separately is the fine art of marketing compost.

Another factor to consider is the relationship between product price, and the timeline for introduction and acceptance. The various phases can be classified as: Testing, Education, Market Development, Product Development, and Sales Strategy (or T.E.M.P.S.). Before aggressive marketing can begin, potential customers need to be confident about product quality and its uses. Full-scale market development takes place following that outreach.

An individual marketing plan needs to be prepared for each abattoir on a case by case basis. Although if several abattoirs are located in close proximity to each other there would be benefits in having a coordinated approach.

Discussions should be held with other regional organic waste producers, especially local government, to look into the benefits of a coordinated approach. One composting site may be able to process and market all the organic waste materials from the region.

The marketing plan should identify:

- the main markets within a reasonable time distance of the abattoir say up to 50 kilometres.
- estimate the quantities and quality of compost that can be produced
- match the estimated production with the main potential markets, to ensure that the abattoir can meet the needs of the local available markets
- source supplies of bulking materials for producing the compost
- determine the market size, and the likely prices which may be paid for compost.
- Identify competing products

In the light of an increasing public awareness on environmental issues, the market acceptance of new organic products has never been greater.

A major problem for composting facilities to over come is that although consumers are prepared to accept organic products they still want to achieve results as seen by chemical fertilisers.

For an organic fertiliser to deliver the same level of nutrients in an application as the chemical counterpart much larger volumes are required. In some cases these volumes may be impractical.

To overcome these problems without the risk of jeopardising the potential of future markets, care must be taken during the early stages of the products life on the market.

Compost possesses many natural qualities that a chemical fertiliser can't deliver, in relation to soil conditioning. Compost allows improved drainage and aeration of potted and garden plants, while at the same time delivering an array of nutrients, however due to the application quantities required the same level of nutrient concentration is hard to achieve.

For this reason it is recommended that during the early stages of marketing, that the composted material is sold as a soil conditioning and fertiliser booster, rather than as a direct soil fertiliser substitute.

Consumer confidence in composted products will be improved if:

- Consistency is controlled between independent batches in relation to compost characteristics. Regular customers like to be sure that they are always receiving the same product.
- All product is thoroughly screened to remove foreign objects, uncomposted material, and to break larger clumps of material down into a uniform size.
- The products colour is as dark as possible, hence conveying a sense of quality to the consumer.

6.2 COMPOSTING PROBLEMS IN PRODUCTION AND PRODUCT

During the trial period of numerous composting companies across the world, their product has failed for one or more of numerous reasons. In all cases of failure the underlying reasons have rested on quality or more precisely the lack of it.

a. Production Process Problems

Of all composting plants that have ceased production, world wide, the major reason for closure has been odour control related. The production of excessive odour production is a direct result of bad practices. A well managed composting site should produce few objectional odours. Odours are produced if the process is allowed to become anaerobic, due to lack of oxygen present within the heap. A compost heap which is turned regularly will stay an aerobic process producing few objectional odours.

Other problems of the composting process are in relation to employee health. A Danish research group found that 60 % of employees suffered complaints of:

- skin and respitory track problems
- upper air way
- mucosal eye
- gastrointestinal problems

Most of these problems are due to the high level of airborne micro-organisms during the aeration stage of the compost piles. Many of these problems were compounded as the sites were enclosed.

b. Product Problems

The problems encountered by an operation's product do not seem to have been a reason for closure but has ultimately resulted in low sales volumes. In many cases, the production of a low quality product, which has been badly managed and poorly aerated, has inadvertently resulted in the plant closure due to odour emission.

The success of any product is directly related to it having a consistent quality. The compost quality is dependent upon many processes throughout its production phase. Obviously, an unacceptable level of impurities and an inadequate final screening process will result in a low quality product however many problems experienced in relation to product quality are a direct result of inadequate maturation time.

Immature compost can cause a series of problems which would rapidly reduce the credibility of a product in a potential market. Such problems include:

(a) pH extremes
(b) temporary nitrogen deficiency
(c) allelopathic toxins, which are competition defence mechanisms in living plants
(d) oxygen starvation of the root zone through excessive microbial activity
(e) production of toxic metabolites from anaerobic activity such as organic acids
(f) fungal overgrowths which compete with plants and may render the soil hydrophobic
(g) stimulation of plant diseases
(h) increased availability of heavy metals
(i) emission of odour from packaged material

In all cases, any problems with a product will ultimately undermine the product's image and could severely restrict its potential future success, or the potential of other like products.

Perhaps the best method of minimising problems is to have an effective Quality Assurance System in place and to always adopt best practice Occupational Health and Safety standards.

7. CONCLUSIONS

Composting is an effective, and proven method for treating abattoir wastes. The resulting compost is of a high quality and can be used to produce valuable products such as: soil enhancers, growing media, and organic fertilizers.

While there appears to generally be a good market for compost products, it is unlikely that the revenue gained from selling compost will cover the compost operation costs. For composting at abattoirs to be financially feasible the financial savings in reduced waste management costs need to be taken into account.

The major market segments for compost products are: Urban, Horticulture, and Agriculture. The Urban and Horticultural segments offer the greatest economic returns; and are capable of supporting the compost production from a significant portion of the abattoir industry. However, if a high proportion of Australia's abattoirs were to compost their wastes, compost products would also need to be sold to the Agricultural industry and other markets.

Australia's abattoirs are located in a variety of land use areas, and as such, the local markets for compost will vary from site to site. While this report provides an outline of the overall compost markets, it is important to conduct a market survey of the region surrounding individual abattoirs prior to establishing a composting operation.

An individual marketing plan needs to be prepared for each abattoir on a case by case basis. Although if several abattoirs are located in close proximity to each other there would be benefits in having a co-ordinated approach. The marketing plan should:

- identify the main markets within a reasonable distance of the abattoir say up 50 kilometres.
- estimate the quantities and qualities of compost that can be produced.
- match the estimated production with the main potential markets, to ensure that the abattoir can meet the needs of the local available markets.
- source supplies of bulking materials for producing the compost.
- determine the market size, and the likely prices which may be paid for compost.

The MRC can play a useful role in supporting composting, through information dissemination, and further research into critical aspects, particularly in compost application to land.

8. RECOMMENDATIONS

To encourage and better define the markets for abattoir compost it is recommended that the following matters are addressed:

- The MRC should assist in the establishment of an abattoir composting operation in each state, which can be used to demonstrate the benefits of the composting method.
- The MRC should establish operational and Quality Assurance guidelines for the application of composting at Abattoir sites. A registration system should be developed to ensure consistent product quality, so as not to adversely affect national product markets.
- The MRC could nationally promote the compost products from its registered composted operations.
- Research be conducted into low cost methods of applying compost to broad acre agricultural properties.
- Growth trials should be carried out for landscape plants, sensitive to phosphorous.
- A T.E.M.P.S. strategy (Testing, Education, Market development, Product development and Sales strategy) should be initiated.
- Site/locational specific market evaluations for compost products should be conducted at individual abattoirs prior to embarking on full scale composting operations.
- A site specific environmental audit and waste management strategy should be conducted at individual abattoirs prior to embarking on composting operations.

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APPENDIX A :

WMAA, DRAFT "INTERIM BEST PRACTICE PROCEDURES FOR ORGANICS RECYCLING PLANTS AND RECYCLED ORGANICS QUALITY"

WASTE MANAGEMENT ASSOCIATION OF AUSTRALIA

DRAFT
(For public comment)

INTERIM BEST PRACTICE PROCEDURES

for

Organics Recycling Plants

and

Recycled Organics Quality

Prepared by the Compost Working Group, WMAA
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There are two stages to recognising a compost or recycled organic or inorganic product and a facility used to produce such producs as employing "Best Practice" procedures. Stage 1, approving the facility, Stage 2, proving product safety .

Although not specifically addressed in the body of this document, overseas experience has shown that source separation of organics for recycling is imperative in order to achieve the criteria set out herein. It is thus proposed that source separation does constitute a "best practice" and that such separation is a prerequisite for the production of "Best Practice" products.

Best Practice Guidelines:

1.0 Operation of the Facility

1.1 Planning and Development

The development approval process for organics recycling facilities is regulated by State planning legislations. For example, in NSW, a recent amendment to the Environment Planning and Assessment Regulations (June 1994) has expanded the range of waste management facilities that are designated development , ie, developments that require a full Environmental Impact Statement and have third part rights of appeal.

Below is the sections from the new NSW regulations for designated developments that are of most relevance to organics recycling plants:

Waste management facilities or works that store, treat , purify or dispose of waste or sort, process, recycle, recover, use of reuse material from waste and that:...

(3) purify, recover, reprocess or process (including by mulching or composting) more than 5,000 tonnes per annum of organic solid or liquid waste organic materials, including food waste, oil, sludge, pulp, garden refuse, sawdust or wood chips; or

(4) are located:
(a) in or within 100 metres of a natural waterbody, wetlands, coastal dune fields or an environmentally sensitive area; or
(b) in an area of high watertable, highly permeable soils, acid sulphate, sodic or saline soils; or
(c) within a drinking water catchment; or
(d) within a catchment of an estuary where the entrance to the sea is intermittently open; or
(e) on a flood plain; or
(f) within 500 metres of a dwelling or 250 metres of a dwelling not associated with the development and, in the opinion of the consent authority, having regard to topography and local meteorological conditions, are likely to significantly affect the amenity of the neighbourhood by reason of noise, air pollution (including odour, smoke, fumes or dust), vermin or traffic.

To complement the development approval process, the State agencies for environmental protection (such as Environmental Protection Authorities in many states) would issue licences for organics recycling facilities, Such licences would only be granted if the plant meets adequate environmental safeguards in its siting and operation.

Two states, NSW and Victoria, are currently developing siting criteria for organics recycling plants. It is expected that draft versions will be available for comment in 1995.

Best practice of the siting of an organics recycling facility would include water control facilities to prevent breeches of State pollution control legislation. Normal facilities would have leachate control ponds sufficient to prevent soluble and particulate nutrients and sediments from leaving the site. Records shall also be kept such to validate to the satisfaction of the regulatory authority, that effectiveness of any environmental controls. Such monitoring may include a soil, air, and water sampling program, including groundwater monitoring bores, where the regulatory authority deems this appropriate.

Table 1. Grade A Contaminant Acceptance levels.

Contaminant	Grade A Acceptance mg/kg*
Arsenic	20
Cadmium	3
Chromium	100
Copper	100
Lead	150
Mercury	1
Nickel	60
Selenium	5
Zinc	200
Aldrin	0.02
Dieldrin	0.02
Chlordane	0.02
Heptachlor	0.02
HCB	0.02
Lindane	0.02
BHC	0.03
PCB's	0.03

* Note: Values based on dry weight of contaminant/dry weight of solids.

2. A Compost or organic recycled product shall show at least 25% Organic matter as measured by loss on ignition of the oven dry product. Moisture content shall not exceed 45% by weight of fresh product. See Appendix I.1.

3. Shall not contain any more than 5% foreign matter such as glass, heavy plastics, metals or stones of > 5mm diameter or 0.5% > 2mm diameter measured on a dry weight basis. Light plastics such as plastic bag pieces > 5mm diameter shall not be present at any more than 0.05% by dry weight. See Appendix I. 2.

4. Shall not contain demonstrable vegetative or seed propagules. See Appendix I. 3.

5. Shall be shown to be stabilised with respect to pathogen reduction by an approved process, of products suspected to require pathogen reduction. One such approved process, established by NSW EPA (1994) is composting thermalisation namely-
The temperature of all materials in the composting mass must reach 53 deg C for 5 continuous days or 55 deg C for 3 continuous days.

Any other process proven and accepted by the EPA to result in acceptable pathogen reduction eg gaseous sterilisation, microwave sterilisation, shall also be accepted.

For products which may not require pathogen reduction, eg chipped recycled wood, the onus of proof shall be on the producer to validate microbiologically if required. The criteria for such validation shall be on a 50gram sample analysed according to AS Method 1766 and showing zero Salmonellae organisms and <100 MPN per gram of Faecal Coliforms.

APPENDIX I.

Sampling

The following test methods should be performed on a representative sample of finished product. The value of testing depends on the repeatability of any determination. To obtain repeatability on test results an inherently variable product like compost must be sampled carefully. As a guide to sampling the following points should be noted.

a. On recently (within 24 hours) screened, turned, or mixed windrows or stockpiles a reasonable degree of homogeneity can be expected and 6 subsamples taken from random positions within the pile and mixed for analysis. The size of each subsample and subsequent assay samples depends to a large extent on the particle size. For a -20mm product 1 litre subsamples are recommended, for products down to -5mm subsample size can go as low as 100mls.
b. On composting unfinished product not screened or turned recently a cross sectional sample should be taken. A front end loader is used to cut an open face in at least 3 places along the pile and subsamples taken from at least 3 positions within each fresh face. With unscreened product a large subsample is usually needed, up to 5 litres in size.

Whatever exact procedure is used, the operator must be able to validate the repeatability of the sampling procedure.

Test Methods.

1. Method for determining Moisture Content and Loss on Ignition.

Both methods are based on gravimetric (weighing) procedures after drying at 105deg for moisture content or 550 deg for loss on ignition. Method modified from German Quality Seal Compost (1992).

1.1 Moisture Content.

Materials- Foil or metal drying container to hold up to 1 litre.
Weighing balance to 0.1g
Oven calibrated to 105 deg C.

Method

Weigh the tare mass of the clean, dry, metal drying container and record (T)
Place about 0.5 litres of moist product into the metal drying container and record total mass (TM).
Dry the moist product to constant mass at 105 degrees and record mass (TD).

$$\text{Moisture content \% w/w} = \frac{(TM-TD) \times 100}{TD-T}$$

1.2 Loss on Ignition.

Materials- Crucible or similar refractory vessel.
Weighing balance to 0.1g
Muffle furnace or Gas burner capable of achieving at least 550 degC.

APPENDIX B :

AUSTRALIAN ABATTOIRS LISTING

Ref No	Company Name	Location	Population Centres > 10,000 within 50km radius.
New South Wales			
0	Cudgegong County Council Abattoir	Mudgee, 2850	
1	Australia Meat Holdings	Aberdeen, 2336	Muswellbrook +
2	Bindaree Beef	Casino,2480	Casino, Lismore, Ballina
3	Blayney Meat Industries	Blayney, 2799	Bathurst, Orange
4	Bunge Meat Industries	Corowa, 2646	Albury
5	Cargill Foods Australia	Wagga Wagga, 2650	Wagga Wagga
6	Country Fresh Australiasia	Wallangarra, 2350	
7	Desert Oak Australia	Broken Hill, 2880	Broken Hill
8	Farmicorp	Deniliquin, 2710	
9	Fletcher International Exports	Dubbo, 2830	Dubbo
10	Gilbertsons R J	South Grafton, 2460	Grafton
11	Gunnedah Shire Abattior	Gunnedah, 2380	Gunnedah
12	Guyra Meat Packing	Guyra, 2365	Armidale
13	ICM Farm Products	Mossvale, 2577	Wollongong,Kiama,60km
14	Lachley Meats (Forbes)	Forbes, 2871	
15	Mid Coast Meat Company	Macksville, 2447	Kempsey
16	Northern Co-operative Meat Co	Casino, 2470	Casino, Lismome
17	Northwest Exports	Inverell, 2360	Inverell
18	Pans Australia	Dorrigo, 2453	Coffs Harbour
19	Rockdale Beef	Yanco, 2703	
20	Sitebarn	Bourke, 2840	
21	Southern Meats	Goulburn, 2580	Goulburn
22	Wingham Abattoirs	Wingham, 2429	Taree
23	Beers Beef	Culcairn, 2660	
24	Burrangong Abattoir	Young, 2594	
25	Bush AJ & Son (Yanco)	Yanco, 2703	
26	Griffith Abattoir	Griffith, 2680	Griffith
27	Gundagai Killing Center	South Gundagai, 2722	
28	Hasting Meats	Port Macquarie, 2444	Port Macquarie, Kempsey
29	Junee Abattoir	Junee, 2663	Wagga Wagga
30	Scone Freash Meats	Scone, 2337	Muswellbrook
31	Scott G.M	Cootamundra, 2590	
32	Tamworth City Council Abattoirs	Tamworth, 2340	Tamworth
33	Tolsat	Fredrickton, 2440	Port Macquarie, Kempsey
Northern Territory			
34	Northern Meat Exporters	Katherine, 0851	
35	Tenarra	Batchelor, 0845	

Ref No	Company Name	Location	Population Centres > 10,000 within 50km radius.
South Australia			
72	Conroys Port Pirie Abattoir	Port Pirie, 5540	Port Pirie
73	K.I Export Abattoir	Kangaroo Island, 5223	
74	Metro Meat International	Old Noarlunga, 5168	Adelaide, Gawler
75	Metro Meat International (M.B)	Murray Bridge, 5001	Murray Bridge
76	Mount Gambier Meat Processing	Mount Gambier, 5290	Mount Gambier
77	S.E Meat (Australia)	Naracoorte, 5271	
78	South Australian Meat Corporation	Gepps Cross, 5094	Adelaide, Gawler
79	Tatiara Meat Company	Bordertown, 5268	
80	George Chapman	Nairne, 5352	Adelaide, Gawler
81	Lobethal Abattoir	Lobethal, 5241	Adelaide, Gawler
Tasmania			
82	Blue Ribbon Meat Products	Smithton, 7330	
83	Gilbertson R.J.	King Island, 7256	
84	Longford Meat Co	Longford, 7301	Launceston
85	Blue Ribbon Meat Products	Launceston, 7250	Launceston
86	Bridgewater Abattoirs	Bridgewater, 7030	Hobart, Kingston
87	Devonport City Abattoirs	Quoiba, 7310	Devonport, Ulverstone
88	Gee & Gee	Burnie, 7320	Burnie - Somerset, Ulverstone
Victoria			
89	Ararat Meat Exports	Ararat, 3377	
90	Australia Meat Holdings	Portland, 3305	Portland
91	Castricum Brothers	Dandenong, 3175	Melbourne, Cranbourne
92	Greenham HW & Sons	Tongala, 3621	Echuca - Moama
93	O'Conner G & K	Pakenham, 3810	Cranbourne
94	R J Gilbertson (Southern)	Altona North, 3025	Melbourne, Melton, Sunbury
95	Tabro Meat	Lance Creek, 3995	
96	Wodonga Meats	Wodonga, 3690	Albury, Wodonga
97	Ashton	Swan Hill, 3585	
98	Barnawartha Abattoirs	Barnawartha, 3685	Albury, Wodonga
99	Carrum Meatworks	Chelsea, 3196	Melbourne, Cranbourne
100	Cobram Abattoirs	Cobram, 3644	
101	D & S Meats	Hamilton, 3300	Hamilton
102	Echuca Abattoirs	Echuca, 3625	Echuca - Moama
103	Fosmeats	Foster, 3960	Morwell
104	Frewstal	Stawell, 3380	Horsham
105	Giles Le & Son	Trafalgar, 3824	Moe - Yallourn, Morwell
106	Gumby	Daylesford, 3460	Ballarat
107	ICM Yarrawonga Abattoirs	Yarrawonga 3730	
108	Minridge Abattoirs	Tynong North, 3813	
109	Tallangatta Abattoirs	Tallangatta, 3700	Albury, Wodonga
110	Tatura	Tatura, 3616	Shepparton- Mooroopna
111	Wagstaff Cranbourne	Cranbourne, 3977	Cranbourne
112	Wang Meat	Benalla, 3677	Wangaratta
113	Warrnambool Bayside Meatworks	Warrnambool, 3280	Warrnambool
114	Western District Meat Packing	Colac, 3250	Colac

APPENDIX C:

NATIONAL ABATTOIR WASTE SURVEY

Ref No	Company Name	Kill Volume p.a.						Solid Waste Volume m3	
		Beef	Calves	Sheep	Pigs	Goats	Deer	p.a	week
	New South Wales								
1	Australia Meat Holdings	145,000							
2	Bindaree Beef	62,500							33750 kg
4	Bunge Meat Industries				520,000			0	0
14	Lachley Meats (Forbes)	95,000						3000	60
15	Mid Coast Meat Company	232,000							
17	Northwest Exports	170,000						4800	90
24	Burrangong Abattoir	15,000		500,000	130,000			780	15
	Queensland								
44	Kilcoy Pastoral Company	80,000		120,000					15
47	MQF				160,000				30
51	South Burnett Meat Works Co-op Assn	150,000						5280	110
52	Teys Bros (Beenleigh)	108,000						4240	90
69	Sundland Wholesale Meats	27,472	28,056	9,146	41,484			520	10
	South Australia								
72	Conroys Port Pirie Abattoir			525,000		75,000			
74	Metro Meat International	86,500	854000 smallstock					1000	
	Victoria								
98	Barnawartha Abattoirs	31,200		260,000	14,000			1820	35
	Western Australia								
116	Green E G & Sons	130,000						30	Unknown
124	Hillside Meats			195,000					60
131	V & V Walsh	35,000		400,000					200
134	Watsons Food				250,000			850	17

Ref No	Current Waste Water Practices	Disposal Method	Treatment Cost cents/kl
1	1 Land irrigation; 2 Anaerobic ponds	In house	40
2	1 anaerobic - 2 aerobic - Irrigated during dry, trucked off site in wet	In House	150000
4	Facultative, aerobic pond		12.4
14	Anaerobic Pondage / Irrigation	In House	?
15	Screen - DAF - Anaerobic - Aerobic - Spray Irrigation	In House	2.1 c/kl
17	Top Skimmers, Rendering, Shaker Screens, anaerobic Dam, Aerobic Ponds, Irrig	In House	0
24	Irrigation of treated effluent, Sludge disposal off site		
		In House	
44	Irrigation, Sludge put in Cutting Trenches, Commercial operator	BCC	.734c/kl
47	Water - Brisbane CC, Sludge - Cleanaway	Combination	25
51	Screening & flotation; Anaerobic, aerobic ponds; Irrigation of crops	In House	
52	Spray & Flooding Irrigation. By products for Landfill.	In House	
69	2 Anaerobic, 2 Aerobic, then irrigation. Sludge spread on land. Only four months operation.		
72	Organic enzyme added to wastwater, evaporation. No odour	In House	0.05
74	Anaerobic/Aerobic pond system prior to irrigation on land	In house	1000
98	Pondage System		
116	Saveall then anaerobic/aerobic system, treated water irrigated. Anaerobic solids to land	In house	Nil
124	Evaporation Ponds	In House	0
131	Lagoon System	In House	
134	Pretreatment - Screens and DAF unit, final treatment - hybracter plant. Sludge compost or landfill	In house	140

Ref No	Neighbouring Agriculture industry within 50km radius.
1	Beef, Dairy, Cropping
2	Dairy, Sugar Cane, Orchard, Chickens
4	Uncle Toby, & Uncle Bens
14	Wheat - Sheep
15	Beef, Dairy, Fishing, Horticulture, Timber
17	Wheat - Sheep, Sheep, Beef, Goats, Pasture, cereal and oil seed crops
24	Wheat - Sheep, Sheep, Horticulture, Orchards
44	Dairy, Subtropical - everything
47	Dairy, Market Gardens
51	Feed lots, Dairy, Peanut processing, Chicken processing
52	Dairy, Sugar Cane
69	Beef, Dairy, Sugar Cane, Citrus, Pinapple
72	Wheat - Sheep
74	Small amount of sheep grazing
98	Wheat - Sheep, Sheep
116	Beef, Dairy, Citrus, Grapes
124	Wheat - Sheep, Sheep
131	Sheep, Dairy
134	None

APPENDIX D:

REPORT ON THE MAJOR SOILS AND HORTICULTURAL INDUSTRIES NEAR VICTORIAN ABATTOIRS

REPORT

ON

THE MAJOR SOILS AND HORTICULTURAL INDUSTRIES NEAR VICTORIAN ABATTOIRS

MAY 1995

FOR

Meinhardt (Vic) Pty Ltd

Consulting Engineers

by
A J Brown

State Chemistry Laboratory
Department of Agriculture, Energy and Minerals, Victoria

REPORT ON THE MAJOR SOILS AND HORTICULTURAL INDUSTRIES NEAR VICTORIAN ABATTOIRS.

Introduction:

Abattoirs produce considerable quantities of waste material from both their livestock holding yards and butchering process plants. This waste can be composted into a product which has use as a soil ameliorant to improve the structure of agricultural soils. An analysis of an experimental compost produced from Colac Abattoir Waste is presented in Appendix 1. The information presented in the body of this report was gathered in order to assist in the assessment of the market potential of composted abattoir waste within Victoria.

It was considered best to concentrate on marketing the product to the horticultural industries (fruit and vegetable). Broad-acre enterprises such as cropping and grazing are unlikely to be interested in such material, due to the expense of transport and spreading over large paddocks. Information on soils and horticultural industries was gathered for 50 km radii around each Victorian abattoir. Where these radii overlapped to a large extent (ie. Goulburn Valley, North East, around Melbourne and in Gippsland), the information was combined into regions. It some situations, an abattoir may be so located that it may not supply compost to parts of a region that are furtherest from it, either because of distance or topography. In other cases, a potential market could be readily supplied from more than one abattoir.More detailed study of the market around particular abattoirs could be made at a later stage of development in this project, if necessary.

A computerised Geographic Information System (GIS) called ArcView 2 was used to select particular data of interest and perform simple statistics. The soils data base used was that of the Atlas of Australian Soils (1960-62, Northcote, K. H., CSIRO). This information is in the form of Map Units with descriptions of topography and the major soils (principle profile forms) known to occur in each. (It must be kept in mind that many soil variations can and do occur within any mapped unit and therefore, when it comes to individual farms or sections of farms, specific examination is required before final assessment of the need for a soil ameliorant can be made.) Only Map Units comprising 2% or more of the total area of each region was tabulated for this report and only the Major Soils are listed. It should be noted that in some regions, horticulture is carried out on restricted areas of the better soils of a particular Map Unit. Comments are made on the major soils used for horticulture in each region and their likely need for organic compost.

Statistics on horticultural industries was sourced from the ABS and mapped on a parish by parish basis on the GIS. Data for vegetables derive from 1991 while fruit crops data derive from 1992. It is likely that some variation, to the presented information on this data, will have occurred over the last 4-5 years and particularly so in the winegrape industry. This report tabulates the number of farms/parish and the range and mean of farms/parish only when at least 10 farms/region occur. Parishes which record 10 or more farms for a particular crop are also listed in the tables to provide some identification of market potential. For grapes and vegetables, additional information was available on the number and range of hectares cropped for each parish and this is also presented in the tables. Parishes with > 20 Ha of grapes or > 200 Ha of vegetables are also identified.

Enterprise :

Crop	No. Farms	Farms/Parish with Crop		Parishes with >10 Farms
		range	mean	
Citrus	25	1-4	3	
Grape	161	1-37	11	Piangil Tyntynder Nth Tyntynder West Tyntynder Boga Kunat-Kunat
Apricot	105	1-46	12	Boga Kunat-Kunat Tyntynder
Nectarine	93	1-41	9	Tyntynder Boga
Peach	84	1-38	8	Tyntynder Boga
Plum	95	1-41	10	Tyntynder Boga
Vegetable	86	1-26	8	Tyntynder Tyntynder West

Crop	Area (Ha)	Area/Parish with Crop		Parishes with >20 Ha of grapes or >200 Ha of vegetables
		range	mean	
Grape	1,441	7-288	96	Piangil Tyntynder Nth Tyntynder West Tyntynder Boga Kunat-Kunat Woorinen Castle Donnington Bael-Bael
Vegetable	480	1-263	44	Tyntynder

Enterprise :

Crop	No. Farms	Farms/Parish with Crop		Parishes with >10 Farms
		range	mean	
Citrus	29	1-11	4	Yarroweyah Cobram
Grape	45	1-15	2	Shepparton
Apricot	189	1-89	9	Cobram Dunbulbalane Shepparton Mooroopna
Cherry	16	1-3	1	
Nectarine	71	1-19	5	Cobram Shepparton
Peach	190	1-65	7	Yarroweyah Cobram Dunbulbalane Shepparton
Plum	123	1-50	7	Cobram Shepparton Mooroopna
Pome Fruit	309	1-144	11	Yarroweyah Cobram Dunbulbalane Shepparton Mooroopna Toolamba
Vegetable	118	1-10	3	Cobram

Crop	Area (Ha)	Area/Parish with Crop		Parishes with >20 Ha of grapes or >200 Ha of vegetables
		range	mean	
Grape	413	1-107	19	Picola Bailieston Katunga Tabilk Shepparton
Vegetable	3,212	1-327	73	Cobram Undera Ballendella Carag Carag Nannella

Map Unit	% of Region	Topography	Major Soils
Wa7	3	undulating to hilly plateau and escarpment	sandy acidic yellow mottled soil (Dy5.41 and Dy5.21) and hard acidic yellow mottled soils (Dy3.41) with sands (Uc1.21, Uc2.2 and Uc4.11)
Ta5	3	low hilly to undulating areas	shallow grey-brown sandy soil (Uc6.11) and stony hard neutral to alkaline red soils (Dr2.22 and Dr2.23) and hard acidic yellow mottled soils (Dy3.21, Dy3.41 and Dy3.61)
Mk4	3	mountainous	red friable porous earths (Gn4.14) with red deep porous loamy soils (Um6.13)
B6	2	rugged hills	siliceous sands (Uc1.21 and Uc1.22)

Comments: The main agricultural industries in the region are beef, lamb and wool production with dairying in the river valleys (Map Unit Va10) and cereal and oilseed production on the plains (Map Units Qb3, Ub24 and Oc1). Wine-grape production is the major horticultural industry in the region, but pome fruit and nuts are also cultivated in the river valleys. Grape growing is carried out on a wide range of soils that occur on the plains, lower to mid slopes and valley floors of the region. Grape and vegetable growing is increasing in popularity in the river valleys as replacement industries for tobacco.

Most of the soils are hard setting (Dr2 and Dy3) and organic matter levels are generally lower than desirable for horticulture.

Enterprise :

Crop	No.Farms	Farm/Parish with Crop		Parishes with >10 Farms
		range	mean	
Grape	46	1-7	2	
Cherry	14	1-3	2	
Pome Fruit	11	1-2	1	
Vegetable	14	1-2	1	

ARARAT REGION

Abattoirs :

Ararat
Stawell

Major Soils :

Map Unit	% of Region	Topography	Major Soils
Tb1	37	hills and valley plains	hard yellow mottled soils (Dy3.4) with hard neutral red soils (Dr2.22 and Dr2.32), red mottled soils (Dr3.33) and shallow grey-brown sandy soils (Uc6.11)
Va2	19	plains with occasional stony rises	hard alkaline and neutral yellow mottled soils (Dy3.43 and Dy3.42) and shallow friable loamy soils (Um6.12, Um6.13 and Um6.21)
D4	11	hilly to mountainous	shallow grey-brown sandy soils (Uc6.11) with leached sands (Uc2.2 and Uc2.3)
X2	10	plains and valley plains	sandy neutral yellow mottled soils (Dy5.42)
S1	9	hilly to mountainous	hard acidic yellow soils (Dy2.21) and shallow grey-brown sandy soils (Uc6.11)
CC8	7	gilgai plains with occasional rises and dunes	cracking grey clays (Ug5.2) with hard alkaline red soils (Dr2.33)
Va1	6	valley plains and lower hill slopes	hard alkaline yellow mottled soils (Dy3.43)

Comments: The vast majority of this region is used for the production of wool and prime lambs. Beef cattle are also grazed. The only horticultural industry of any significance is winegrape production.

The soils used for grape production are mainly those of the red duplex (Dr) or yellow duplex (Dy) form on Map Unit Tb1. These soils are often devoid of organic matter and set hard. Many are also stony or gravelly.

DAYLESFORD REGION

Abattoirs :

Daylesford

Major Soils :

Map Unit	% of Region	Topography	Major Soils
Tb1	47	hills and valley plains	hard yellow mottled soils (Dy3.4) with hard neutral red soils (Dr2.22 and Dr2.32), red mottled soils (Dr3.33) and shallow grey-brown sandy soils (Uc6.11)
Va2	12	plains with occasional stony rises	hard alkaline and neutral yellow mottled soils (Dy3.43 and Dy3.42) and shallow friable loamy soils (Um6.12, Um6.13 and Um6.21)
HH2	12	undulating plain with volcanic cones	hard alkaline dark mottled soils (Dd2.33 and Dd2.43) with hard alkaline brown soils (Db1.43), friable red soils (Dr4.1) and friable earths (Gn3.11)
CC11	9	gently undulating dissected tableland	cracking grey clays (Ug5.2) and cracking dark clays (Ug5.41) with hard yellow mottled soils (Dy3.4 and Dy 3.13) and friable dark soils (Dd3.12)
Pb3	9	hilly to mountainous	hard acidic red soils (Dr2.21) with various Dy and Dr soils
CC10	6	dissected tableland with volcanic cones	cracking grey clays (Ug5.2) and hard yellow mottled soils (Dy3.43 and Dy2.43) with hard alkaine red soils (Dr2.13) and dark clays (Ug5.15)
Ta4	5	undulating with rounded hills and volcanic cones	hard acidic yellow mottled soils (Dy3.21) with friable neutral dark soils (Dd3.12) and dark cracking clays (Ug5.1)
Mg16	4	undulating with rounded hills and broad stream valleys	red friable earths (Gn4.11 and Gn4.14) with friable red soils (Dr4.1)
D5	3	rugged hills	shallow grey-brown sandy soils (Uc6.11) with shallow forms of hard red soils (Dr2.2) and hard yellow mottled soils (Dy3.2)
S1	2	hilly to mountainous	hard acidic yellow soils (Dy2.21) and shallow grey-brown sandy soils (Uc6.11)

Crop	Area (Ha)	Area/Parish with Crop		Parishes with >200 Ha of vegetables
		range	mean	
Vegetable	3727	1-892	96	Spring Hill Dean Bungaree Warrenheip Creswick

Comments: The region is basically used for the production of wool and prime lambs and beef cattle. Cereal cropping is carried out in parts of the northern areas and occasionally elsewhere. No horticultural production of any significance is carried out.

Enterprise :

Crop	No. Farms	Farms/Parish with Crop		Parishes with >10 Farms
		range	mean	
Vegetable	13	1-3	1	

Crop	Area (Ha)	Area/Parish with Crop		Parishes with >20ha of grapes or >200 Ha of vegetables
		range	mean	
Grape	68	5-51	17	Curracurt
Vegetable	179	1-56	20	

Comments: The region is mainly used for cattle (beef and dairy) and sheep grazing. Potato and onion production is common on the friable soils of Map Units G1 and FF1.

The friable soils used for horticulture, generally have good levels of organic matter. More marginal soils of hard set nature would benefit from organic matter input.

Enterprise :

Crop	No. Farms	Farms/Parish with Crop		Parishes with >10 Farms
		range	mean	
Vegetable	39	1-18	6	Yangery

Crop	Area (Ha)	Area/Parish with Crop		Parishes with >200 Ha of vegetables
		range	mean	
Vegetable	1145	4-548	163	Yangery Koroit Yarpturk

Comments: The region is mainly used for cattle (beef and dairy) and sheep grazing. Vegetable cropping, including potatoes and onions is reasonably common in some areas (eg. Map Unit G1), but farms are generally small.

Vegetable production on the friable soils of Map Units G1 (Um6.13, Gn3.42) and Ta1 (Gn4.31, Gn3.11 and Gn3.21) generally have no requirement for additional organic matter but the soils of Map Unit Ub1 are hard set and would be improved with additional material.

Enterprise :

Crop	No. Farms	Farms/Parish with Crop		Parishes with >10 Farms
		range	mean	
Vegetable	50	1-8	2	

Crop	Area (Ha)	Area/Parish with Crop		Parishes with >200 Ha of vegetables
		range	mean	
Vegetable	1076	1-148	36	

Map Unit	% of Region	Topography	Major Soils
Va9	2	gently undulating plain with swamps, lakes and volcanic cones	hard alkaline and neutral yellow mottled soils (Dy3.43 and Dy3.42) with shallow friable loamy soils (Um6) and dark cracking clays (Ug5.13)
Tb2	2	hilly with flat-topped knolls, ridges, gorges and river flats	hard acidic yellow mottled soils (Dy3.41) and hard alkaline red soils (Dr2.13)
Ob3	2	floodplain	hard alkaline red soils (Dr2.23, Dr2.33 and Dr2.43) with hard alkaline yellow mottled soils (Dy3.43)

Comments:

The region is mainly used for cattle and sheep grazing and some cereal cropping. Horse studs and agistments are common, particularly in the northern districts. Market gardening of a wide variety of vegetables, including brassicas, lettuce and onions is common in the Werribee area. Market gardening is also common in places such as Keilor and Melton. These market garden districts are generally confined to small areas, relative to the Region. Potatoes and other vegetables are commonly grown on the Bellarine Peninsula. Bacchus Marsh is also covered by this Region as well as by the Daylesford Region and is the site of some vegetable and pome and stone fruit production.

The red duplex soils (also known as red-brown earths) of the Werribee and Keilor areas (Map Units Ob3 and Oa2) are hard setting and often suffer from other soil structural problems, such as surface crusting, water infiltration, poor drainage and occasional salting. Organic matter inputs are necessary to maintain soil structure in the face of continual and intense cultivation and cropping.

The vegetable soils of the Bellarine are generally light textured (Map Units Va4 and Ub26) and low in organic matter, particularly when cropped for a number of years. Water retention could be improved on the lightest soils, despite the generally good and reliable rainfall the area receives.

EAST AND SOUTH OF MELBOURNE

Abattoirs :

Berwick
Braeside
Chelsea
Cranbourne
Dandenong
Harrisfield
Pakenham

Major Soils :

Map Unit	% of Region	Topography	Major Soils
Tb1	24	hills and valley plains	hard yellow mottled soils (Dy3.4) with hard neutral red soils (Dr2.22 and Dr2.32), red mottled soils (Dr3.33) and shallow grey-brown sandy soils (Uc6.11)
Mk2	9	mountainous	red and brown friable porous earths (Gn4.14 and Gn4.34) and red friable earths (Gn3.14) and yellow leached earths (Gn3.84)
Mk3	9	mountainous	red friable porous earths (Gn4.14) with red deep porous loamy sands (Um6.13) and red earths (Gn2.11) and friable acidic red soils (Dr4.21)
Tb4	7	undulating with a few rounded hills and volcanic cones	hard acidic yellow mottled soils (Dy3.21) with friable neutral dark soils (Dd3.12) and dark cracking clays (Ug5.1)
I3	7	swampy plain	highly organic clays (Uf5 and Uf6)
Cb23	6	coastal plains	leached sands (Uc2.33) with sandy acidic yellow mottled soils (Dy5.41 and Dy5.81)
Pb4	5	mountainous	hard acidic red soils (Dr2.21) with hard acidic yellow yellow mottled soils (Dy3.21) and other yellow (Dy2.2, Dy2.41, Dy2.71 and Dy3.81) and red (Dr2.61) soils with loamy soils (Um4.2 and Um4.1) and shallow grey-brown sandy soils (Uc6.11)
Tc4	4	undulating to low hilly areas	hard acidic yellow mottled soils (Dy3.61 and Dy3.41)
Tb20	3	undulating	hard acidic yellow mottled soils (Dy3.41) with other yellow soils (Dy5.4 and Dy3.2)
Ub20	3	plains with swampy areas	hard neutral yellow mottled soils (Dy3.42)

Enterprise :

Crop	No. Farms	Farms/Parish with Crop		Parishes with >10 Farms
		range	mean	
Citrus	28	1-14	3	
Grape	39	1-5	2	
Nectarine	59	1-22	3	Wandin Yallock
Peach	68	1-24	3	Wandin Yallock
Plum	39	1-15	3	Wandin Yallock
Cherry	59	1-35	5	Wandin Yallock
Pome Fruit	139	1-17	4	Wandin Yallock Bittern Balnarring
Vegetable	360	1-57	7	Kinglake Wandin Yallock Gembrook Cranbourne Koo-Wee-Rup Koo-Wee-Rup East Sherwood Tyabb

Crop	Area (Ha)	Area/Parish with Crop		Parishes with >20 Ha grapes or >200 Ha vegetables
		range	mean	
Grape	317	1-59	15	
Vegetable	6663	1-1435	126	Wandin Yallock Gembrook Cranbourne Koo-Wee-Rup Koo-Wee-Rup East Sherwood Tyabb

Map Unit	% of Region	Topography	Major Soils
Tb21	3	undulating plain, low dunes and swamps	hard yellow mottled soils (Dy3.41) with leached sands (Uc2.3)
Tb20	3	undulating	hard acidic yellow mottled soils (Dy3.41) with other yellow soils (Dy5.4 and Dy3.2)
Mg7	3	undulating to low hilly	red friable porous earths (Gn4.11 and Gn4.14) with hard acidic yellow mottled soils (Dy3.21, Dy3.41 and Dy3.61)
Mg4	3	rounded hills	red friable porous earths (Gn4.11)
Mg6	2	low rolling and rounded hills	red friable porous earths (Gn4.11)
Mc1	2	river floodplains and terraces	red friable earths (Gn3.12) with dark friable earths (Gn3.43) and hard neutral dark soils (Dd1.12)
Wc5	2	plain with low lying areas	sandy acidic yellow mottled soils (Dy5.61) and hard acidic yellow mottled soils (Dy3.61)

Comments: The region is mainly used for dairy farming and beef, wool and prime lamb production. Vegetable growing is mainly concerned with potatoes which are largely grown on the friable red soils of Map Units Mg7, Mg6, Mg5 and Mg4. In South Gippsland, potatoes are often grown on the sandy soils of Map Units Cb15 and Cb9.

Enterprise :

Crop	No. Farms	Farms/Parish with Crop		Parishes with >10 Farms
		range	mean	
Pome Fruit	20	1-9	3	
Vegetable	273	1-57	7	Mirboo Allambee East Narracan South Moe Warragul Koo-Wee-Rup East Koo-Wee-Rup

Appendix 1: Analysis of Colac Abattoir Waste Compost.

Received 24 Feb 1995 from Mr. Kevin Banner, Organic Recyclers, Warrnambool

Lab No. 3489/95

TEST	UNIT	RESULT
Total Nitrogen (N)	%	0.52
Total Phosphorus (P)	%	0.22
Total Potassium (K)	%	0.33
Nitrate (NO_3)	%	ND
Ammonium (NH_4)	%	ND
pH (1:1.5 moist soil:water)	-	7.2
EC (1:1.5 moist soil:water)	dS/m	1.15
Loss on Ignition	%	45.0
Water Holding Capacity	%	54.5
Air Filled Porosity	%	24.7
Total Manganese (Mn)	mg/kg	400
Total Arsenic (As)	mg/kg	< 5
Total Cadmium (Cd)	mg/kg	0.6
Total Chromium (Cr)	mg/kg	50
Total Nickel (Ni)	mg/kg	90
Total Lead (Pb)	mg/kg	< 3
Total Iron (Fe)	%	2.4
Total Zinc (Zn)	mg/kg	180
Total Copper (Cu)	mg/kg	17

ND = could not be determined, due to high organic colouring of extracts
(likely to be low, given level of Total Nitrogen)

Appendix 3: Regulations Applicable to Fertilisers in Victoria.

Fertiliser Value

According to the 'Agricultural and Veterinary Chemicals (Fertilisers) Regulations 1995' (please find copy enclosed), only nitrogen (and zinc and iron) could be claimed as ingredients of fertiliser value in the Colac Abattoir Waste Compost (Lab. No. 3489/95). Phosphorus and potassium are below the minimum levels accepted.

Note that these regulations were gazetted in early 1995 but have not been promulgated yet, pending changes to Section 79 of the Agricultural and Veterinary Chemicals Act of 1992. The current regulations (1975) have the same solid fertiliser minimum levels for claiming nutrients but have a higher Cd standard and no Pb standard.

Heavy Metals

Cadmium and lead contents in the Colac Abattoir Waste Compost (Lab. No. 3489/95) are not only below the maximum allowable concentrations in a fertiliser but are also below the levels that require warning statements to be made on labels or advice notes.