Analysis of Markets for Recycled Organic Products

Update Report 2004

Final Report

Department of **Environment and Conservation** NSW

Author

GHD Pty. Ltd.

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Executive Summary

Scope

GHD was commissioned by the Department of Environment and Conservation (DEC) to assess current supply and demand trends for quality Recycled Organic (RO) products manufactured from compostable organics materials diverted from landfill, and to update two previous studies undertaken in 1996 and 1999.

RO is a generic term for a range of products manufactured from compostable organic materials diverted from landfill such as processed garden organics, food scraps and/or discarded wood. In this report, sawmill wastes, animal manures, and sewage sludge are not considered as RO.

Organic Horticultural Products (OHP) is identified as finished organic products, as well as unfinished (primary processed) RO raw materials. OHP includes all organic products containing RO as well as products with no RO content.

Background

The initial market study was conducted by WARMMA Pty Ltd in 1996 for WMAA, with an update report produced in 1999 by the EC Sustainable Consultants for NSW Waste Boards. It covered the Greater Sydney Region only. GHD's study focuses on market changes that have occurred between 1999 to 2003. Where figures are quoted on an annual basis, the reference year is the financial year rather than the calendar year.

The geographic area for this current study covers the following geographic regions:

- Greater Sydney Region (GSR) – Metropolitan Sydney and surrounding Council areas including Wyong, Gosford, Blue Mountains, and Wollondilly;
- Mid North Coast (MNC) –the Council areas extending from the central coast (Cessnock and Lake Macquarie) up north as far as Copmanhurst and Maclean; and
- South East NSW (SE) –the Council areas within the south eastern statistical division, as well as the Council areas in the Illawarra south of Sydney.

Method

GHD estimated the level of existing demand for RO and OHP using a combination of a market survey undertaken in March 2004, and primary and secondary data sources. Secondary data was obtained from published reports. It should be noted that industry sources were reluctant to provide commercially sensitive information, such as tonnages produced. This affected the quality of data obtained from the market survey, and meant that secondary sources and anecdotal evidence had to be relied upon.

Forecasts for OHP and RO demand produced in this report are based on changes observed in each market and an assessment of the potential to utilise RO in new projects or developments.

Facility overview

Review of the NSW EPA's public register of licences indicates that there are over 60 current operating licences for composting and other related processing. Almost 40% of all the licences have been issued to facilities located in the GSR.

Organic materials processed at facilities located in the GSR include municipal garden organics, food organics sourced from municipal collections and commercial sources, timber and wood waste from commercial and industrial sources as well as demolition activity, biosolids, and some agricultural organics.

Of the 11 licensed composting and related facilities located in the MNC, 3 facilities licensed are used by private companies for mushroom substrate production, 3 are composting facilities used by Councils for garden organics composting, and 5 are facilities operated by private operators.

There are 6 licensed composting facilities located in the SE study region, of which 4 are operated by local Councils. 4 of the 6 composting facilities are located in the Illawarra, with the composting facilities identified in the South Eastern statistical division being those operated by Eurobodalla Shire Council.

Only 4 composting facilities are operated by local Councils outside the study area. Three licensed council operations are located in the central and north west of NSW (Mudgee, Bathurst and Orange) and one in the north of NSW (Ballina).

Since the 1999 market study, there has been a considerable increase in the volume of organic materials processed by the compost and related processing sector, and hence there is now a greater volume of product on the market than previously.

Recent changes

A number of new waste processing and organic processing facilities have been established including the Organic Resource Recovery Facility at Port Macquarie, the Earthpower Foodwaste processing plant at Camellia, the Bedminster Plant at Port Stephens, and the Wingecarribbee Council Vertical Composting Unit (VCU) in Moss Vale.

Increased RO production capacity is also linked to a greater emphasis on recovery of organic sources including municipal garden organics and organics from mixed waste streams.

Changes have also occurred within the various markets that use RO and at a broader environmental level. The ongoing incidence of drought in NSW and the reduced level of construction activity would have both reduced demand for RO. Federal government initiatives to support renewable energy sources would have potentially increased demand for RO, as more was directed to energy production.

Quantities produced

Estimated OHP sold in the Greater Sydney Region (GSR) was previously estimated at 1.03 million m^3/year in 1996, and 1.04 million m^3/year 1998 (WMAA, 1998 and NSW Waste Boards, 1999). Current OHP sold in the GSR alone is estimated at 1.37 million m^3/year.

Table S1 OHP demand in market segments

	GSR 1996 (m^3/yr)	GSR 1998 (m^3/yr)	GSR 2003 (m^3/yr)	MNC 2003 (m^3/yr)	SE 2003 (m^3/yr)	Outside study area 2003 (m^3/yr)	Total OHP 2003 (m^3/yr)	Total RO 2003 (m^3/yr)
Urban amenity	873,000	873,000	1,035,000	63,000	67,000	6,000	1,172,000	438,000
Intensive agriculture	151,000	127,000	65,000	21,000	2,000	9,000	96,000	52,000
Extensive agriculture	2,000	2,000	14,000	2,000	0	6,000	22,000	8,000
Enviro-remediation	NA	NA	8,000	0	0	0	8,000	3,000
Rehabilitation	N/a	5,000	45,000	17,000	12,000	13,000	87,000	70,000
Biofuels	N/a	25,000	198,000	24,000	2,000	277,000	500,000	274,000
Other*	N/a	5,000	0	14,000	2,000	50,000	66,000	16,000
Total	1,026,000	1,038,000	1,365,000	142,000	84,000	361,000	1,952,000	860,000
% OHP demand in 2003 over NSW	NA	NA	70%	7%	4%	19%	100%	NA

RO content in the existing OHP market (in the GSR) was estimated to have increased from 20% in 1996 to approximately 36% in 1998 (WMAA, 1998 and NSW Waste Boards, 1999). Current supply of RO is estimated to be 860,000 m^3/year (for all regions included in the 2003 market update), which represents about 46% of the existing OHP demand in the GSR and 44% overall.

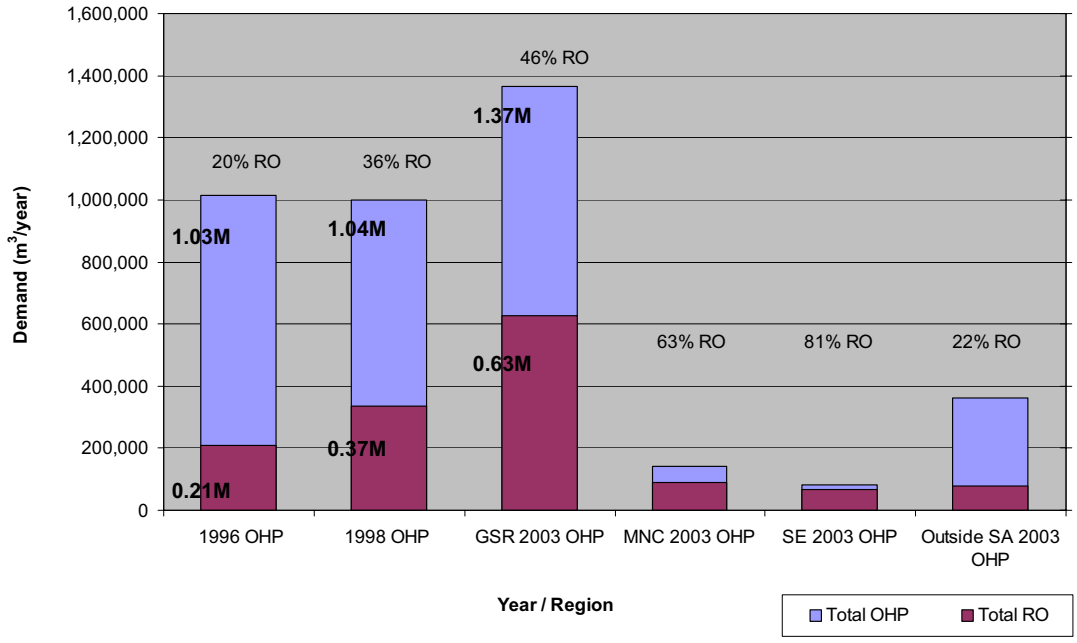

Figure S1 Overall RO content of OHP demand in each region

Potential growth in RO demand

Demand projections for RO were produced using detailed methods of estimation as used on other demand research (ROU, 2003c) and adapted to this study. It is important to note that the growth potential in markets for RO products is dependent on the production of suitable products for use by markets at prices within the capacity of users to pay. In some cases, demand potential estimates may be limited to sufficient quantities of material.

Demand projections for RO determined in this study suggested the following:

- In the GSR, total demand for RO can potentially increase above 2003 levels by 155,000 m^3/year in 2004 to 450,000 m^3/year in 2006 across all the analysed markets. This could result in total RO demand of over 1,000,000 m^3/year.
- In the MNC, total demand for RO can potentially increase above 2003 levels by 227,000 m^3/year in 2004 to 215,000 m^3/year in 2006 across all the analysed markets. This could result in total RO demand of up to 316,000 m^3/year.
- In the SE, total demand for RO can potentially increase above 2003 levels by 11,000 m^3/year in 2004 to 9,500 m^3/year in 2006 across all the analysed markets over the next three years. This could result in total RO demand of up to 79,000 m^3/year.

Figure S2 summarises the existing and potential demand for RO identified for each market segment in each region of the study area.

Figure S2 indicates significant potential growth in the biofuels market in the GSR, with potentially demand for biofuels exceeding current demand in the urban amenity market in this region. Growth in the biofuels market, however, is dependent on successful operation of technology, compliance with stringent environmental licence conditions and securing required levels of feedstock.

Figure S2 also indicates significant potential growth for RO demand in rehabilitation works in the GSR and MNC. Realisation of this potential strongly depends on Catchment Management Authorities implementing priority projects and obtaining sufficient funding to undertake the identified rehabilitation works.

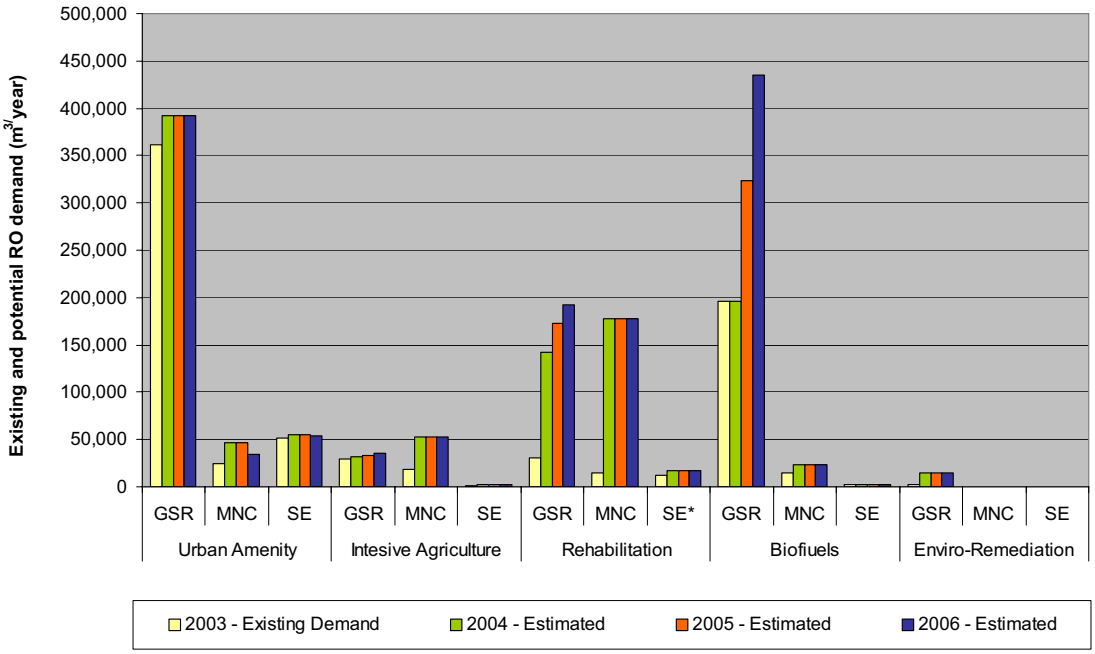

Figure S2 Comparison of estimated RO demand across markets and regions

Significant potential demand for RO is also likely to exist outside the study area, particularly in the Murrimbidgee region for the purposes of intensive agriculture and in the Hunter and Central West for biofuel. Potential RO demand located outside the GSR, MNC, and SE, may be determined from further market studies that include a wider geographic study area.

Conclusions

The key markets for RO have changed significantly since the last assessment was undertaken in 1999. At that time, site rehabilitation and intensive agriculture were seen as the major growth areas for RO, with the highest unrealised potential demand.

Traditional markets such as urban amenity and intensive agriculture were strong in 1999 and are still strong, but their future growth is limited. Renewable energy on the other hand, is currently a significant sector that was not previously identified as a key area for growth. Based on the findings of this study, the biofuels and rehabilitation markets present the greatest potential demand for RO out of all the sectors examined in this study.

The NSW Waste Avoidance and Resource Strategy 2003 has nominated aggressive targets for resource recovery in both the municipal and industrial waste streams. The continued success of recovery of RO through source separation and the introduction of more sophisticated processing systems such as AWT will continue to deliver greater quantities of RO to the market place.

Growing the production of RO beyond the current level of 860,000 m^3/year in NSW in a sustainable manner will require careful product development and capturing of the appropriate feedstock by RO processors. Less industry assistance should be required as demand for RO increases, due to increased awareness and higher costs of alternative virgin materials used in production of OHP.

1 Introduction

1.1 Project background

The NSW Department of Environment and Conservation (DEC), through its Sustainability Programs Division engaged GHD to conduct a review of market trends for recycled organics products in NSW.

Source separation, collection and processing of organic materials are one of the most common resource recovery activities occurring in NSW. Many councils provide separate garden organics collection to their residents. However markets need to be identified and developed in line with progress being made by councils, businesses and the community in diverting larger quantities of these materials from landfill.

1.2 Objectives

The main objective of this study is to assess current supply and demand trends for quality Recycled Organic (RO) products manufactured from compostable organics materials diverted from landfill, and to update two previous studies undertaken in 1996 and 1999 for COMMPOST NSW and the NSW Waste Boards respectively.

Other objectives of this study are to examine trends in both established and emerging markets, estimate the current level of market penetration of RO products, and identify barriers that prevent the increased usage of RO products relative to those with minimal or no recycled content.

Forecasts based on identified growth rates in product demand and supply are also to be produced. These forecasts will assist industry and Government stakeholders to develop approaches that maximize the creation of sustainable markets for RO products.

1.3 Project scope

This report considers current supply and demand trends for RO. For the purpose of this report, RO is a generic term for a range of products manufactured from compostable organic materials diverted from landfill such as processed garden organics, food organics and discarded wood. In this report, sawmill wastes, animal manures, and biosolids are not considered as RO.

Demand for RO is considered within the overall market demand for organic horticultural products (OHP). OHP for the purposes of this report is identified as the finished organic products listed in Table1–2, as well as unfinished (primary processed) RO raw materials where there is a market demand for such material (for example demand for shredded uncomposted vegetation).

OHP includes all organic products containing RO as well as products with no RO (for example those manufactured from animal manures only). Products containing RO are considered as either 100% recycled organics, or organic products that contain a proportion of recycled content. The terms “recycled organic products” (100% recycled organics) and “products containing recycled materials” (contain proportion of recycled content) are used to distinguish these two product categories.

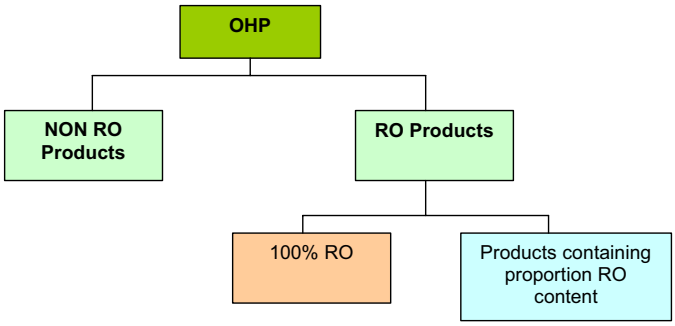

Figure 1-1 Overview of OHP

1.3.1 Study period

The original COMMPOST and WMMA market study was conducted in 1996, with the update report produced in 1999. This report therefore focuses on market changes between 1999 to 2003. Where figures are quoted on an annual basis, the reference year is the financial year rather than calendar year.

1.3.2 Organic materials

To provide consistency between this study and previous studies, organic materials considered in the market study were limited to those outlined in Table 1-1. Categories of organic products assessed in the market study were consistent with those used for previous studies, as outlined in Table 1–2.

Table 1-1 Organic materials included in market study

Organic material	Definition to be applied for this report*
Agricultural organics	Any residual organic materials produced as by-products of agricultural operations, including: ◗ Animal manures ◗ Cereals/grains/straw ◗ Mushroom compost ◗ Animal mortalities
Biosolids	Organic solids or semi-solids produced by municipal sewage treatment processes.
Food organics	Food organics derived from domestic or commercial and industrial sources including: ◗ Fruit and vegetables ◗ Meat and poultry ◗ Fats and oils ◗ Seafood (including shellfish, excluding oyster shells) ◗ Dairy solids and liquids ◗ Bread, pastries, flours, etc ◗ Food soiled paper products The definition does not include grease trap waste.
Garden organics (not including wood and timber)	Garden organics derived from domestic or commercial and industrial sources including: ◗ Putrescible garden organics (grass, clippings)

Organic material	Definition to be applied for this report*
	◗ Non-woody garden organics ◗ Woody garden organics ◗ Trees and limbs ◗ Stumps and root balls
Timber and wood	Wood and timber wastes derived from domestic, agricultural, commercial and industrial, construction and demolition sources that may be contaminated or uncontaminated, treated or untreated, solid or composite and that includes: ◗ Off-cuts; ◗ Crates; ◗ Pallets and packaging; ◗ Saw dust; and ◗ Timber shavings.
Other	Other organic matter of animal or vegetable origin including paper.
Forestry based organics	Organic waste matter from forestry operations including weeds, wood chips, etc

* based on definitions from the ROU Dictionary and Thesaurus (2002)

Table 1-2 Organic products included in market study

Organic product	Definition to be applied for this report*
Biofuels	Wood waste, food waste (i.e. Camellia)
Soil conditioner	Any composted or pasteurized organic product, including vermicast, manure and mushroom compost that is suitable for adding to soils. This term also includes 'soil amendment', 'soil additive', 'soil improver' and similar terms, but excludes polymers that do not biodegrade, such as plastics, rubber and coatings. Soil conditioners may be either 'composted soil conditioners' or 'pasteurized soil conditioners'. Soil conditioner has not more than 15% by mass of particles with a maximum size above 16 mm.
Fine Mulch	Any pasteurized organic product (excluding polymers which do not degrade, such as plastics, rubber and coatings) that is suitable for placing on soil surfaces. Fine mulch has more than 20% but less than 70% by mass of its particles with a maximum size of greater than 16 mm.
Mulch	Any pasteurized organic product (excluding polymers which do not degrade, such as plastics, rubber and coatings) that is suitable for placing on soil surfaces. Mulch has at least 70% by mass of its particles with a maximum size of greater than 16 mm.
Playground surfacing	The surface of a playground from which the use of the equipment. Solid surfacing includes compounds formed into sheets, tiles or mats, or wet pour substances that set on site.
Potting mix	A growing medium suitable for the establishment and development of a wide range of plants in containers.
Soil blend	General-purpose soil derived from blending two or more of: sand, natural soil material or organic materials and having a bulk density of greater than 0.7 kg/L and an organic matter content of between 3-15% by mass.
Top dressing	A soil that is suitable for surface application to lawn.

* based on definitions from the ROU Dictionary and Thesaurus (2002), AS 4454 (2003) Composts, Soil Conditioners, and Mulches, AS 4419 (2003) Soils for landscaping and garden use, AS 3743 (2003) Potting Mixes, and AS 4422 (1996) Playground Surfacing

1.3.3 Markets

For the purposes of this study, the RO Market has been divided into six different segments, as shown in Figure 1-1. Within each market are a number of sub-markets related to activities within each market segment.

It should be noted that export markets which have been considered in previous studies, were not considered in this study, as current information suggests that exporting of RO interstate or overseas is not significant due to the low value nature of the product.

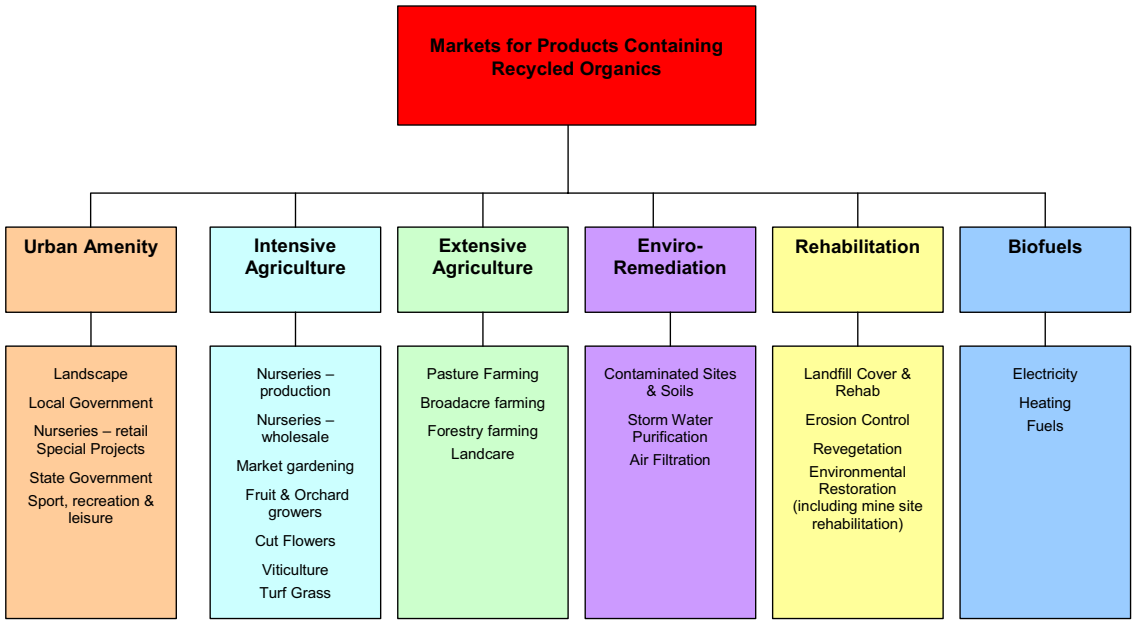

Figure 1-2 Recycled Organic Material Market Structure

Structure of recycled organics product markets as reported by the Recycled Organics Unit (ROU) (2002), *Guide to Selecting, Developing, and Marketing Value-Added Recycled Organics Products*

1.3.4 Geographic boundaries

The study area in the 1996 and 1999 studies comprised the Greater Sydney Region (GSR) and a 100 km radius beyond the GSR, which included Cessnock, Lake Macquarie, Newcastle and Port Stephens north of the GSR, and the Wollondilly, Wingecarribee, Wollongong, Shellharbour, Kiama, and the Shoalhaven south of the GSR. The study area for the 1996 and 1999 market study is shown in Figure 1-3.

The geographic study area for this update report is much larger than the previous studies. It comprises the following geographic regions:

- Greater Sydney Region (GSR) – Metropolitan Sydney and surrounding Council areas including Wyong, Gosford, Blue Mountains, and Wollondilly;
- Mid North Coast (MNC) – The MNC is considered as the Council areas extending from the central coast (Cessnock and Lake Macquarie) up north as far as Copmanhurst and Maclean; and

- South East NSW (SE) – The SE region includes all the Council areas within the south eastern statistical division, as well as the Council areas in the Illawarra south of Sydney.

The above regions are shown in Figure 1-4. All areas outside of the above regions are considered in the report as “outside the study area”.

Figure 1-3 Study area in 1996 and 1999 market analysis

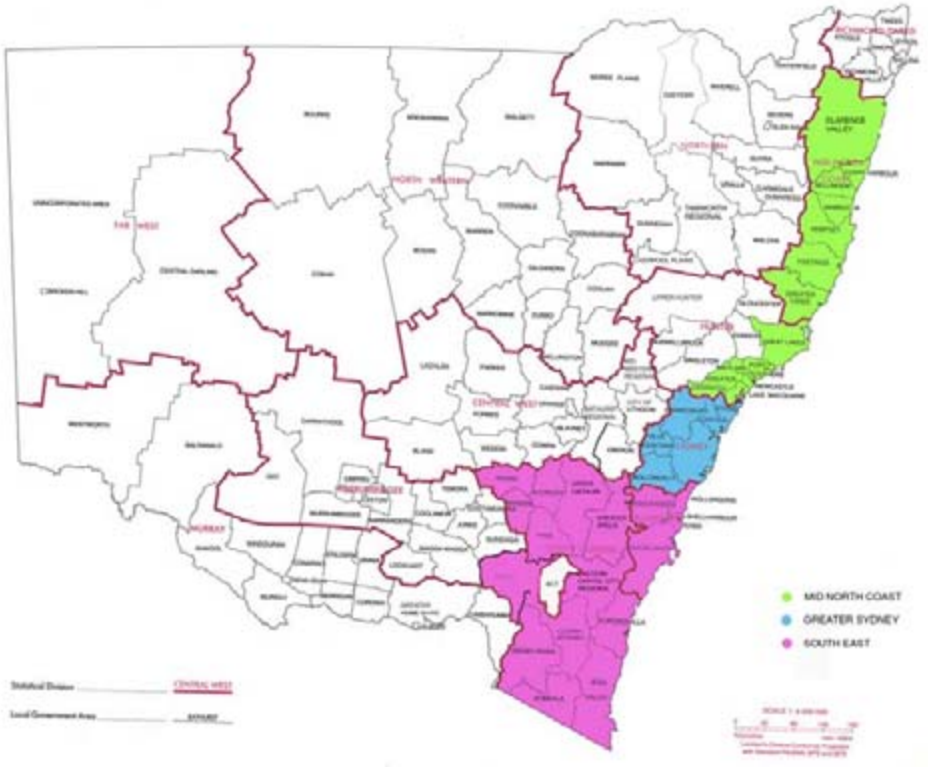

Figure 1-4 Study area for 2003 market update

2 Study Methodology

This Chapter outlines the methodology that was used to estimate existing demand, potential demand, and future demand for OHP and RO.

2.1 Existing demand

Existing demand was estimated using the results of a market survey undertaken in March 2004 by GHD, and through a review of a combination of primary and secondary data sources.

2.1.1 Primary data

Primary data was collected from organics processors, consumers, industry associations and government agencies. Data was collected via:

- Personal interviews;
- Written surveys;
- Telephone interviews; and

Survey sampling plan

Major processors and consumers in each of the six markets were identified through a preliminary market study and using in-house knowledge industry experience.

Surveying of these stakeholders constituted non-random sampling. These stakeholders were targeted due to the potential influence that their operations have on the existing markets for recycled organic products.

To ensure that a cross-representation of stakeholders were considered in the study, a number of stakeholders from each of the six product markets were included in the stakeholder survey list. While it would have been ideal to randomly select participants, the relatively small number of each in each market meant that under the constraints of the project this was not possible. Therefore, it was deemed more important to ensure good geographic coverage of the major stakeholders.

Survey instruments

Structured survey documents were prepared for stakeholders identified as either processors or consumers of organic horticultural products, biofuels, and recycled organics.

The surveys were mailed out to stakeholders and were followed up by either personal or telephone interviews as appropriate. Copies of the blank survey forms are included in Appendix A and Appendix B.

Use of primary data

Primary data from the survey responses was collated and aggregated for inclusion in this report.

2.1.2 Secondary data

Secondary data was obtained from published reports. A complete list of secondary data sources is included in Chapter 12.

2.1.3 Survey responses

The number of surveys sent out and received are summarised in Table 2-1. Overall, a 33% response rate was achieved for the consumer survey, and a 26% response rate for the processor survey.

An adjusted response rate of 42% for processors was used to analyse results. The adjusted response rate includes estimated data from six composting facilities that did not return the survey form.

Data estimates were determined based on summary information from previous surveys provided by DEC NSW. This data was included to ensure all of the major organic processors were included in the summary data to measure overall production.

The low response rate was due to a number of reasons that include the increasing commercial sensitivity of market related information and over supply in the market place. Based on these low response rates, additional information from summary reports was used to supplement this data.

The processor market is very close knit and competitive and as a result obtaining information about performance can be difficult. As such neither tonnages nor prices were provided by many of the larger processors.

Low response rates from consumers of RO can be attributed to their operational commitments or their lack of awareness of the products they use. Therefore attempting to gather surveys from these type of companies requires different methods of sampling.

Table 2-1 Survey response rate

Survey Instrument	Number sent out	Valid responses received*	Response rate	Adjusted response rate
Consumer survey	52	17	33%	
Processor survey	36	9	26%	42%

* Includes the number of responses that were received that were valid for use in the study – i.e they had sufficient data for inclusion

2.2 Demand potential

Demand potential for the 2002-2003 financial year has been estimated by assessing the potential to replace raw organic materials (or virgin materials) with RO.

2.3 Demand forecasting

Forecasts for future OHP and RO demand are based on an assessment of changes in each market and the potential to utilise RO in new projects or developments (identified through both the primary and secondary data sources identified above).

For example, review of the intensive agriculture market identified a number of current trials of the use of RO being undertaken in the viticulture and fruit and orchard submarkets. Future demand for RO in these submarkets is therefore estimated based on the potential application rate of RO, size of the application area, and potential availability of RO given the location of the potential users and the distance from composting facilities.

Commencement of operation of new processing facilities or processes that would consume RO (such as green power energy plants) was also considered in estimating potential future demand for OHP and RO.

2.4 Prioritisation of market segments

Prioritisation of market segments in each region (outlined in Chapter 10) has been conducted based on:

- Product supply (availability);
- Demand potential;
- Capacity to pay; and
- Market requirements.

3 Processors

3.1 Overview of processors

Review of the NSW EPA's public register of licences issued under the *Protection of the Environment Operations (POEO) Act 1997* indicates that there are over 60 current operating licences registered for composting and other related processing (including mushroom substrate production) in NSW. 24 of these licences (almost 40% of all the licences) are issued to facilities located in the GSR. A summary of issued (current) licences is shown in Table 3-1.

Table 3-1 indicates that composting facilities related to agricultural feedlot production activities are located outside the GSR (mainly in the Riverina, Murrumbidgee, and Murray), and production of mushroom compost is principally in the MNC of NSW.

Table 3-1 Summary of current Environmental Protection Licences for composting and related processing facilities

Composting and related facilities	Location				Total
	GSR	**MNC**	**SE**	**Outside the study area**	
Mushroom substrate production		3			3
Agricultural composting				9	9
Compost facility licensed to a council	4	3	4	5	16
Compost facility licensed to private operator	20	5	2	6	33
Total licensed facilities	**24**	**11**	**6**	**20**	**61**

(Source: summary based on review of information in NSW EPA, Protection of the Environment, Public Register of Licences, current licences only)

The location of processors throughout NSW is represented in Figure 3-1

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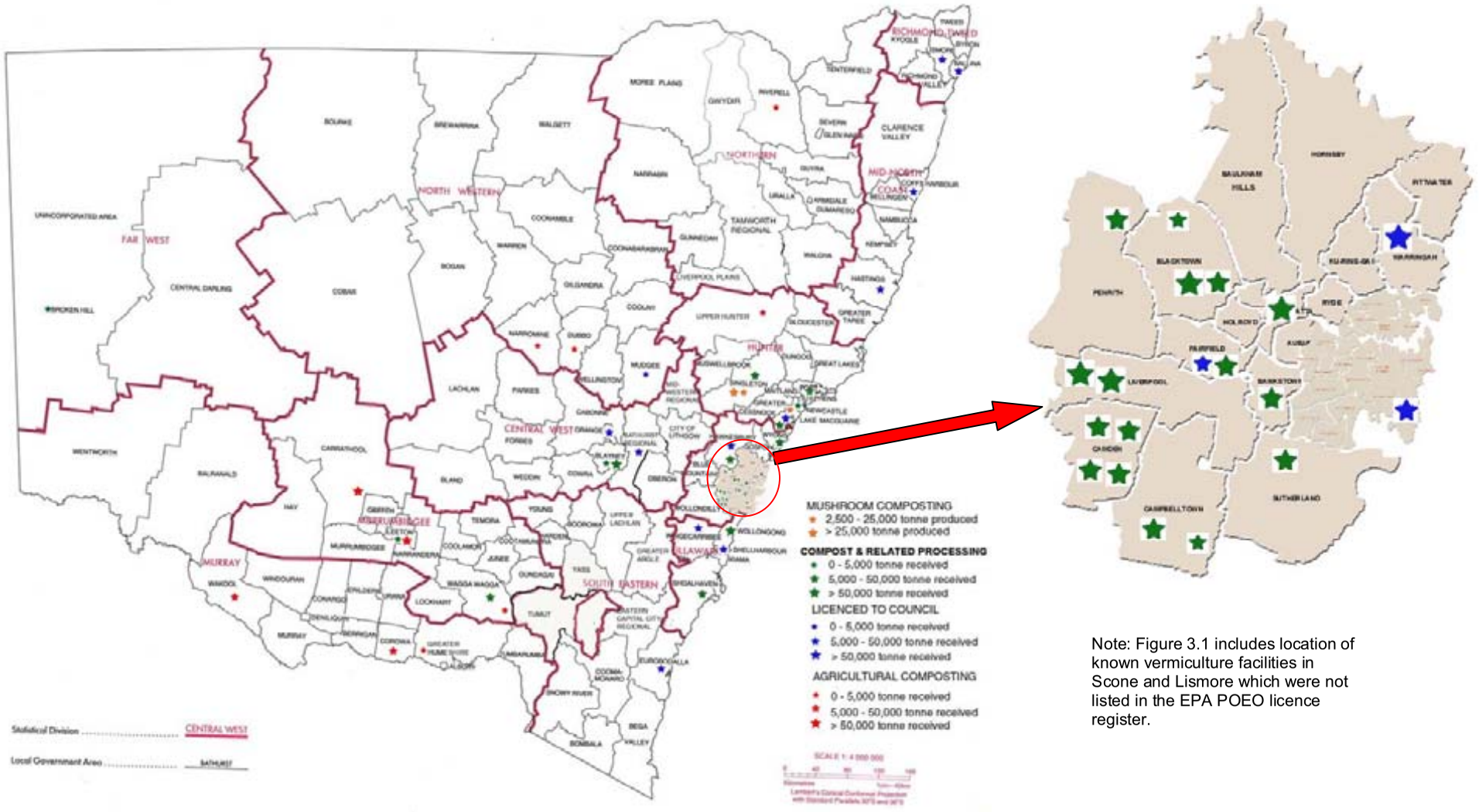


Figure 3-1 Location of composting and related facilities in NSW

3.2 Processors in the GSR

The majority of composting facilities located in the GSR (20 out of 24) are licensed to private operators. There are also four composting facilities licensed to Local Councils. A summary of licensed compost facilities in the GSR is provided in Table 3-2.

Table 3-2 Licensed compost facilities in GSR

Licence Holder	Suburb	Licensed for
A.C.N. 090 135 836 Pty Ltd	Bringelly	> 5000 - 50000 T received
Australian Native Landscapes Pty Ltd	Badgerys Creek	> 50000 - T received
Australian Native Landscapes Pty Ltd	Warnervale	> 5000 - 50000 T received
Brandown Pty. Limited	Kemps Creek	> 50000 - T received
Bulk Waste Management Pty. Ltd.	Bringelly	> 5000 - 50000 T received
Camden Soil Mix Pty Ltd	Campbelltown	> 5000 - 50000 T received
Collex Pty Ltd	Horsley Park	> 5000 - 50000 T received
Debco Pty. Ltd.	Berkshire Park	> 5000 - 50000 T received
Earthpower Technologies Sydney Pty. Ltd.	Camellia	> 50000 - T received
Global Renewables Limited	Eastern Creek	> 50000 - T received
Hallinan's Pty Limited	South Windsor	> 5000 - 50000 T received
Holloway, Peter Robert	Riverstone	0 - 5000 T received
L. V. Rawlinson & Associates Pty Ltd	Appin	0 - 5000 T received
M. Collins & Sons (Contractors) Pty Ltd	Spring Farm	> 5000 - 50000 T received
M. Collins & Sons (Contractors) Pty Ltd	Milperra	> 5000 - 50000 T received
Volk Holdings Pty Ltd	Bringelly	> 5000 - 50000 T received
Waste Recycling And Processing Corporation (Waste Service NSW)	North Ryde	> 5000 - 50000 T received
(Waste Service NSW)	Artarmon	> 5000 - 50000 T received
(Waste Service NSW)	Lucas Heights	> 5000 - 50000 T received
(Waste Service NSW)	Camden	> 5000 - 50000 T received
(Waste Service NSW)	Eastern Creek	> 5000 - 50000 T received
LICENSED COUNCIL OPERATIONS		
Fairfield City Council	Wetherill Park	0 - 5000 T received
Hawkesbury City Council	South Windsor	> 5000 - 50000 T received
Randwick City Council	Matraville	> 5000 - 50000 T received
Warringah Council	Terrey Hills	> 50000 - T received

(Source: NSW EPA, public register of licences issued under the *Protection of the Environment Operations Act 1997*)

Organic materials processed at the composting facilities located in the GSR include municipal garden organics, food organics sourced from municipal collections and commercial sources, timber and wood waste from commercial and industrial sources as well as demolition activity, biosolids (mainly from Sydney Water Sewerage Treatment Plants), and some agricultural organics.

3.2.1 Products

Products being made by processors located in the GSR consist largely of composts and soil conditioners, potting mix, mulch, and manufactured soils, as summarised in Figure 3-2.

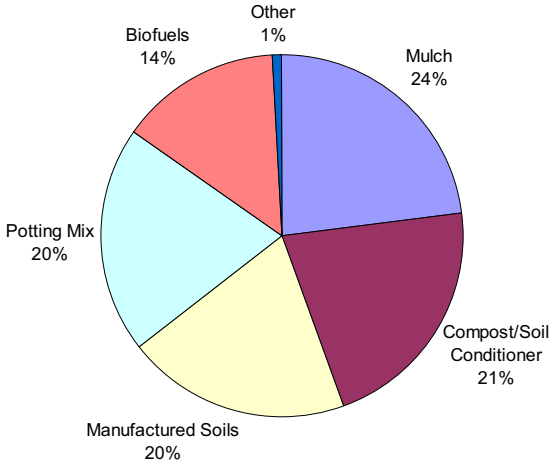


Figure 3-2 Product Demand – GSR 2003 (% by volume)

* "Other" category used where markets were not specified by processors in the market survey responses
(Based on outcomes of market survey undertaken by GHD in March 2004 and product estimates from previous surveys provided by DEC NSW)

3.2.2 Markets

Within the GSR, Urban Amenity remains the strongest market for both RO and OHP. The second strongest market which has increased significantly since the last study is the biofuels market which almost consumes 100% RO.

Table 3-3 Markets being accessed by processors located in the GSR

	OHP (m^3/year)	RO (m^3/year)	% RO of OHP market
Urban Amenity	1,035,000	362,000	35%
Intensive Agriculture	65,000	30,000	46%
Extensive Agriculture	14,000	5,000	34%
Enviro-remediation	8,000	3,000	34%
Rehabilitation	45,000	30,000	67%
Biofuels	198,000	196,000	99%
Total	1,365,000	626,000	**46%**

3.3 Processors in the MNC Region

Of the 11 licensed composting and related facilities located in the MNC, 3 facilities licensed are used by private companies for mushroom substrate production, 3 are composting facilities used by Councils for garden organics composting, and 5 are facilities operated by private operators. A summary of licensed compost facilities in the MNC is provided in Table 3-4.

According the NSW EPA Public Register of environmental protection licences, there are only six licences issued for mushroom substrate production in NSW, of these facilities 3 are located in the MNC.

Table 3-4 Licensed compost facilities in MNC

Licence Holder	Suburb	Licensed for:
Australian Native Landscapes Pty Ltd	Cooranbong	> 5000 - 50000 T received
Beresford Park Nursery Supplies Pty Ltd	Beresfield	0 - 5000 T received
Bio-Recycle Australia Proprietary Limited	Muswellbrook	> 5000 - 50000 T received
Orica Australia Pty Ltd	Wyee	> 5000 - 50000 T received
Port Stephens Waste Management Group Pty Ltd	Raymond Terrace	> 5000 - 50000 T received
LICENSED COUNCIL OPERATIONS		
Coffs Harbour City Council	Coffs Harbour	> 5000 - 50000 T received
Hastings Council	Telegraph Point	> 5000 - 50000 T received
Lake Macquarie City Council	Awaba	> 5000 - 50000 T received
MUSHROOM SUBSTRATE		
Mushroom Composters Pty Ltd	Singleton	> 25000 - T produced
Elf Farm Supplies Pty Ltd	Mulgrave	> 25000 - T produced
Gromor Enterprises Pty. Limited	Singleton	> 2500 - 25000 T produced

(Source: NSW EPA, public register of licences issued under the *Protection of the Environment Operations Act 1997*)

Organic materials processed at the composting facilities located in the MNC include municipal garden organics, food organics sourced from municipal collections and commercial sources, timber and wood waste from commercial and industrial sources as well as demolition activity, biosolids (mainly from Hunter Water Sewage Treatment Plants), and some agricultural organics.

3.3.1 Products

Products being made by processors located in the MNC consist largely of composts and soil conditioners and mulch, and lesser production of manufactured soils and potting mixes, as summarised in Figure 3-3.

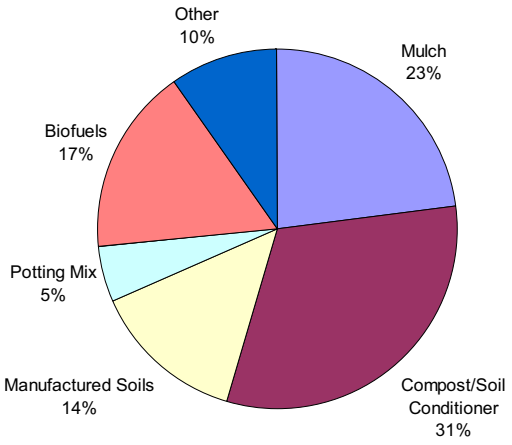


Figure 3-3 Product Demand – MNC 2003 (% by volume)

* "Other" category used where markets were not specified by processors in the market survey responses
(Based on outcomes of market survey undertaken by GHD in March 2004 and product estimates from previous surveys provided by DEC NSW)

3.3.2 Markets

Urban Amenity and Intensive Agriculture in the MNC region remain the two strongest markets for RO. The other markets are still insignificant at this point in time.

Table 3-5 Markets being accessed by processors located in the MNC

	OHP (m^3/year)	RO (m^3/year)	% RO of OHP market
Urban amenity	63,000	24,000	38%
Intensive agriculture	21,000	18,000	86%
Extensive agriculture	2,000	2,000	100%
Enviro-remediation	-	-	-
Rehabilitation	17,000	15,000	88%
Biofuels	1,000	200	20%
Other*	14,000	14,000	100%
Total	118,000	73,000	62%

* "Other" category used for markets other than those included in the market study or where markets were not specified

3.4 Processors in the SE

There are 6 licensed composting facilities located in the SE study region, of which 4 are operated by local Councils. 4 of the 6 composting facilities are located in the Illawarra, with the composting facilities identified in the South Eastern statistical division being those operated by Eurobodalla Shire Council.

Table 3-6 Licensed compost facilities in SE

Licence holder	Suburb	Licensed for:
Htt Huntley Heritage Pty Ltd	Avondale	> 50000 - T received
Soilco Pty Limited	Nowra	> 5000 - 50000 T received
LICENSED COUNCIL OPERATIONS		
Eurobodalla Shire Council	Dalmeny	> 5000 - 50000 T received
Eurobodalla Shire Council	Surf Beach	> 5000 - 50000 T received
Shellharbour City Council	Blackbutt	> 5000 - 50000 T received
Wingecarribee Shire Council	Moss Vale	> 5000 - 50000 T received

(Source: NSW EPA, public register of licences issued under the *Protection of the Environment Operations Act 1997*)

Organic materials processed at the composting facilities located in the SE include municipal garden organics, food organics sourced from municipal collections and commercial sources, biosolids, and some agricultural organics.

3.4.1 Products

Products being made by processors located in the SE consist largely of manufactured soils and mulch, and lesser production of composts and soil conditioners, potting mix and biofuels, as summarised in Figure 3-4.

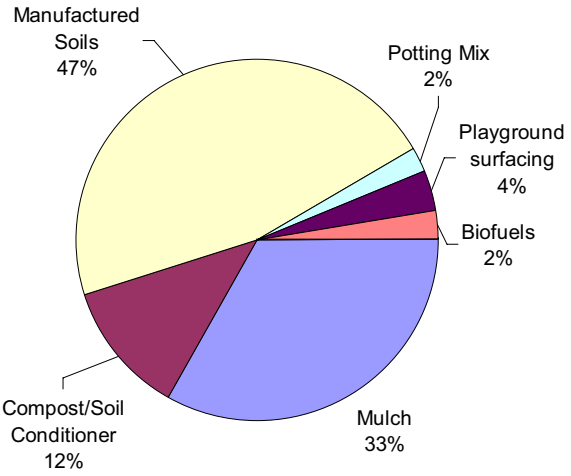


Figure 3-4 Product Demand – SE 2003

(Based on outcomes of market survey undertaken by GHD in March 2004 and product estimates from previous surveys provided by DEC NSW)

3.4.2 Markets

In the SE region, the Urban Amenity market is the strongest for both OHP and RO. The secondary market for RO is rehabilitation, which mainly relates to old mine sites.

Table 3-7 Markets being accessed by processors located in the SE

	OHP (m^3/year)	RO (m^3/year)	% RO of OHP market
Urban amenity	67,000	51,000	77%
Intensive agriculture	2,000	1,000	80%
Extensive agriculture	–	–	–
Enviro-remediation	–	–	–
Rehabilitation	12,000	12,000	100%
Biofuels	2,000	2,000	100%
Other*	2,000	2,000	100%
Total	84,000	68,000	**81%**

* "Other" category used for markets other than those included in the market study or where markets were not specified

3.5 Processors outside the study region

Review of the NSW EPA register of environmental protection licences indicates that there are only 4 composting facilities licensed to local Councils outside the study area. Three licensed council operations are located in the central and north west of NSW (Mudgee, Bathurst and Orange) and one in the north of NSW (Ballina).

Table 3-8 shows that about half of the composting facilities licensed to private operators located outside the study area use agricultural organics as the main organics source. These compost facilities are located largely in the Murray, Murrumbidgee and Riverina areas of NSW close to feedlot production activities.

Compost produced from agricultural organics is used largely either within the feedlot where it was generated (applied back to farm land) or nearby extensive agricultural applications. This is due to the close vicinity between agricultural composting facilities and extensive agriculture production areas as shown by the location of processors in Figure 3-1 and the location of extensive agriculture.

Some agricultural compost facilities and feedlot operators have arrangements with nearby farmers whereby there is a two-way arrangement for the feedlot to buy corn or grain from the farmer, in exchange for the farmer purchasing compost from the feedlot composting facility.

3.5.1 Products

Determining the product mix for processors located outside the study area was not within the scope of the market study update and thus the product mix is not presented here. However, given the high presence of agricultural composting facilities it is likely that processors outside the study area produce large quantities of composts compared to manufactured soils or mulches.

Local Council operations are likely to generate a mix of mulches and composts and soil conditioners.

Vermiculture facilities (of which there are 4 located outside area) produce a liquid fertiliser product and vermicast that have a high organic content and that can be used as a fertiliser, compost, or soil conditioner. The four vermiculture facilities are located in Broken Hill, Blayney, Lismore, and Scone.

Three of these vermiculture facilities are used for effluent and waste water treatment, and treatment of piggery solids. The vermiculture facility at Lismore (operated by Tryton Waste Services) processes municipal food and garden organics from source separated kerbside collections.

Table 3-8 Licensed compost facilities outside study region

Licence holder	Suburb	Licensed for:
Australian Native Landscapes Pty Ltd	Blayney	> 50000 - T received
Lord Howe Island Board	Lord Howe Island	0 - 5000 T received
Reberger; James R	Wagga Wagga	> 5000 - 50000 T received
Regional Vermiculture Australia Pty Limited	Broken Hill	> 5000 - 50000 T received
Soilwise Pty Ltd	Leeton	0 - 5000 T received
Wimbledon Worms Pty Limited (trading as BMG Environmental Waste Management)	Kings Plains	0 - 5000 T received
LICENSED COUNCIL OPERATIONS		
Ballina Shire Council	Ballina	> 5000 - 50000 T received
Bathurst City Council	Bathurst	> 5000 - 50000 T received
Mudgee Shire Council	Mudgee	0 - 5000 T received
Orange City Council	Orange	> 5000 - 50000 T received
LICENSED COMPOSTING FACILITIES LINKED TO AGRICULTURAL FEEDLOTS OR WHERE MAIN ORGANICS SOURCE IS AGRICULTURAL ORGANICS		
Australia Meat Holdings Pty Limited	Tabbita	> 50000 - T received
Fletcher International Exports Pty Ltd	Dubbo	0 - 5000 T received
Navhold Pty. Limited	Tarcutta	0 - 5000 T received
Qaf Meat Industries Pty Ltd	Moulamein	> 5000 - 50000 T received
Qaf Meat Industries Pty Ltd	Bungowannah	0 - 5000 T received
Rockdale Beef Pty Limited As Manager For Rockdale Beef Pty Partnership	Yanco	> 50000 - T received
Soil Power International Limited	Corowa	> 5000 - 50000 T received
Tiedive Pty. Limited	Narromine	0 - 5000 T received
Yolarno Pty Ltd	Inverell	0 - 5000 T received

(Source: NSW EPA, public register of licences issued under the *Protection of the Environment Operations Act 1997*)

3.5.2 Markets

Markets supplied by composting processors located outside the study area consist of intensive and extensive agricultural production, as well as some urban amenity and rehabilitation sub markets.

Due to the scope of the market study, quantitative values of products supplied to each market outside the study area are not included in this report.

4 Demand in overall markets

This Chapter summarises the assessment of individual market segments to present a consolidated overview of the existing level of market penetration of RO.

4.1 Market changes

Since the last market report in 1999, changes have occurred both within the various markets that use RO and at a broader environmental level.

4.1.1 Urban amenity

In NSW the incidence of drought over the last three years has affected demand of RO and OHP in both the urban amenity and intensive agricultural markets. While establishment and maintenance of new gardens may have slowed due to lower water availability, mulch has been promoted as a water retention alternative. The net effect on demand for RO is therefore difficult to determine without more detailed specific information.

Since the Sydney 2000 Olympics, the reduced level of construction activity in Sydney has resulted in lower demand for RO in landscaping of large developments.

4.1.2 Intensive agriculture

The recent establishment of Compliance Agreement CA-05 by NSW Agriculture to allow the movement of approved composts into Phylloxera Exclusion Zones (PEZ) will increase the usage of RO in the MNC produced in the GSR. This will increase potential demand but it will take some time for RO markets to develop.

4.1.3 Enviro-remediation

The enviro-remediation market is the slowest adopter of RO applications, and one of the smallest potential users. Local government is attempting through government funding to trial different applications of RO for enviro-remediation projects involved in stormwater filtration.

4.1.4 Rehabilitation

Rehabilitation of degraded land in catchment areas, old minesites and landfills is a large potential application for RO. However there is little evidence of large scale activity in this area since the last study. The timeframe for completing rehabilitation for minesites can be extended for long periods.

4.1.5 Biofuels

The establishment of the MRET scheme at the Federal level has resulted in significant demand for RO as a fuel substitute for various biofuels applications. As energy producers and heavy industries move towards adopting the Federal government targets, the biofuels market will increase but it will require major processing infrastructure.

4.2 Change in production capacity

Since the 1999 market study, there has been a considerable increase in the volume of organic materials processed by the compost and related processing sector, and hence there is a greater volume of product on the market.

For example, since the last market study a number of waste processing and organic processing facilities have been established including Organic Resource Recovery Facility at port Macquarie, the Earthpower Food waste processing plant at Camellia, the Bedminster Plant at Port Stephens, and the Wingecarribbee Council Vertical Composting Unit (VCU) in Moss Vale.

The increase in production capacity is linked to a number of factors including an emphasis on greater recovery of organic sources including recovery of:

- Municipal garden organics — there has been a significant increase in the number of local councils offering a garden organics collection service compared to when the previous 1996 and 1999 market studies were completed. For example North Sydney Council was the first local council in NSW to offer a garden organics service back in 1995. A recent survey of NSW Councils (undertaken in 2002 by the former Resource NSW), found that 119 Councils in NSW had in place some method of dealing with municipal garden organic wastes. Based on the survey responses at the time, about 50 of these Councils provide a regular kerbside service for garden organic wastes, with more than 25 of these Councils offering a weekly or fortnightly collection service to over 375,000 households (DEC, 2003b).
- Organics from mixed waste streams — since the previous market study the use of alternative waste technologies to recover organics from mixed waste streams has been further developed. There are a now a number of mixed waste processing plants in either operation, (the Bedminster facility in Port Stephens) or being constructed (UR3R facility at Eastern Creek) or planned (Hunter Waste Group). Prior to the implementation of mixed waste processing plants, feedstock for composting plants was sourced mainly from source separated organics collections.

4.2.1 Volume of OHP on the market

Estimated OHP sold in the Greater Sydney Region (GSR) was previously estimated at 1.03 million m^3/year in 1996, and 1.04 million m^3/year 1998 (WMAA, 1998 and NSW Waste Boards, 1999). Current OHP sold in the GSR alone is estimated at 1.37 million m^3/year.

Table 4–1 summarises the volume of OHP demand in each market segment based on data extracted from the two previous reports and the current survey data. As outlined in Section 1.3.3, the market segments examined in the initial study were limited to those of amenity, intensive agriculture, extensive agriculture and “other”.

Table 4-1 OHP demand in market segments

	GSR 1996 (m^3/yr)	GSR 1998 (m^3/yr)	GSR 2003 (m^3/yr)	MNC 2003 (m^3/yr)	SE 2003 (m^3/yr)	Outside study area 2003 (m^3/yr)	Total 2003 (m^3/yr)
Urban amenity	873,000	873,000	1,035,000	63,000	67,000	6,000	1,172,000
Intensive AGRICULTURE	151,000	127,000	65,000	21,000	2,000	9,000	96,000
Extensive agriculture	2,000	2,000	14,000	2,000	0	6,000	22,000
Enviro-remediation	NA	NA	8,000	0	0	0	8,000
Rehabilitation	NA	5,000	45,000	17,000	12,000	13,000	87,000
Biofuels	NA	25,000	198,000	24,000	2,000	277,000	500,000
Other*	NA	5,000	0	14,000	2,000	50,000	66,000
Total	1,026,000	1,038,000	1,365,000	142,000	84,000	361,000	1,952,000
% OHP demand in 2003 over NSW	NA	NA	70%	7%	4%	19%	

NA – not applicable as not included in 1996 market study

* “Other” category used for markets other than those included in the market study or where markets were not specified

OHP sold in 2003 is based on outcomes of market survey undertaken by GHD in March 2004 and product estimates from previous surveys provided by DEC NSW

4.3 Current demand for OHP

Current (2003) demand for OHP was estimated based on the quantity of products sold by processors, and the consumption of OHP by consumers, where the OHP was not sourced from composting facilities (for example the use of sawmill residues and wood and timber materials from landfill used as biofuels).

OHP demand is summarised in Table 4–1. Demand for OHP in the intensive agriculture market located in the GSR and surrounds appears to have decreased since the 1999 market study update.

OHP demand in the enviro-remediation and rehabilitation markets has increased since 1999 indicating development of these markets. However current use of OHP in the enviro-remediation market is only identified for the GSR with no current demand identified for the MNC or SE.

Demand for biofuels in the GSR has increased significantly. There is demand currently for biofuels in the MNC and SE, however the greatest current demand for biofuels is outside the study area (this is discussed further in Section 4.3.1).

4.3.1 Regional differences in demand in 2003

The summary of regional demand (shown in Table 4–1) indicates that approximately 70% of current demand for OHP as identified for overall NSW is located in the GSR. OHP demand in the urban amenity market is significantly higher in the GSR compared to the MNC and SE (and outside the study area).

Current demand for biofuels is largely outside the GSR in the central west and western parts of the Hunter. This is largely the result of consumption of biomass at the Delta Electricity (Mt. Piper and Wallerawang) and Macquarie Generation (Liddell) power stations.

Demand for OHP in rehabilitation works exists throughout the GSR, MNC and SE, whereas current demand in the enviro-remediation market appears limited to the GSR.

4.3.2 Comparison of changes in market demand 1996 – 2003

Referring to Figure 4-1, results from the 1996 study highlighted the greatest existing market for OHP in the amenity sector (85% of total demand). OHP demand in the intensive agriculture market was significant at 15%, but there was little evidence of existing demand in the other market segments.

The 1999 study included the further market segments of bio-remediation, rehabilitation, biofuels, and export. The revised existing market demands for 1999 (shown in Figure 4-2) reflect the continuing importance of the amenity and intensive agriculture sectors as the largest markets for OHP products (83% and 14% respectively), with relatively small demands for OHP measurable in the biofuels, rehabilitation, and export markets.

The current demand for OHP in the GSR is shown in Figure 4-3. OHP demand in the urban amenity market continues to represent the most significant demand in the GSR (76%), with demand for biofuels (14% of OHP demand in the GSR) also being significant.

A comparison of market demand in the GSR in 1996, 1999, and 2003 is provided in Figure 4-1 to Figure 4-3. The size of the pie chart in each of these figures indicates the relative size of market as estimated by each study. *Note that the study area in the 1996 and 1999 market study also included demand in the 100 km surrounding the GSR.*

A summary of 2003 OHP demand in each market for the different regional areas include in this update report is presented in Table 4-2.

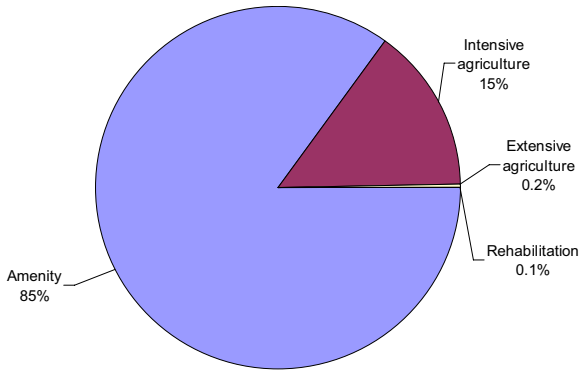


Figure 4-1 Market segment demands – 1996

(Estimated total OHP demand 1,026,000 m^3/year)

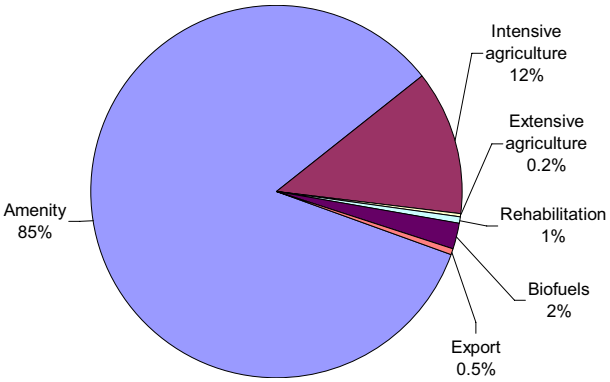


Figure 4-2 Market segment demands – 1998

(Estimated total OHP demand 1,038,000 m^3/year)

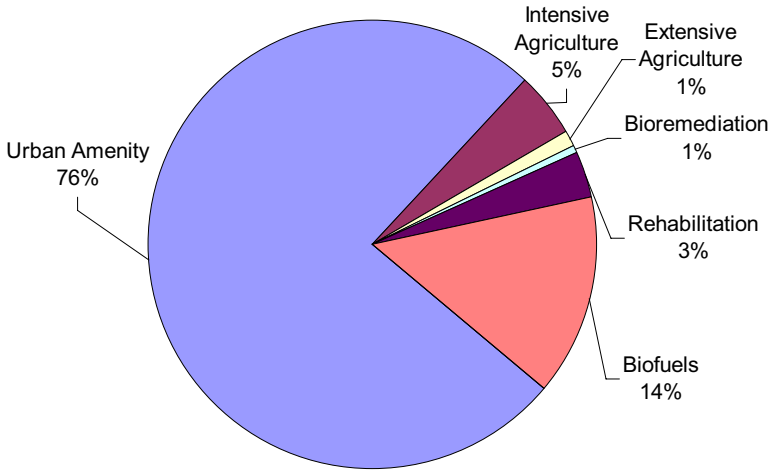


Figure 4-3 Market segment demands – 2003 GSR

(Estimated total OHP demand 1,343,000 m^3/year)

Table 4-2 Summary of OHP demand in 2003 in different geographical regions

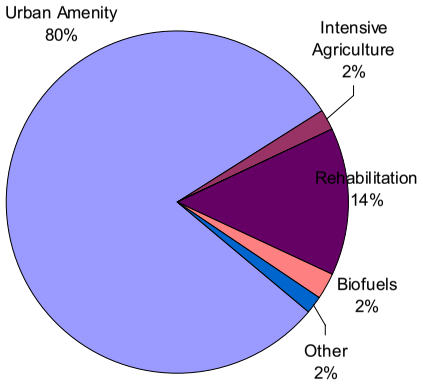


Figure 4-4 Demand in SE

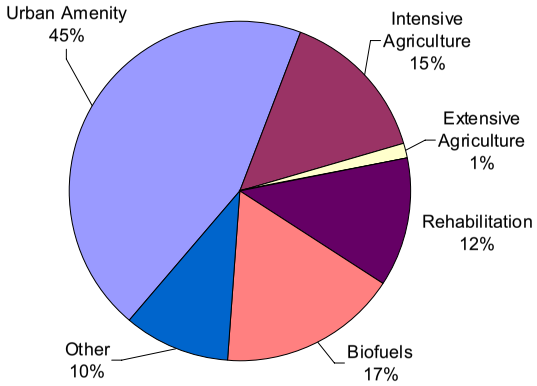


Figure 4-5 Demand in MNC

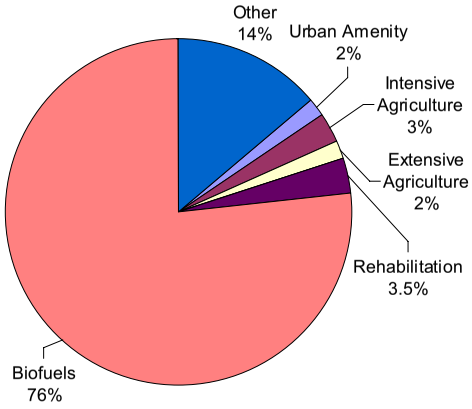


Figure 4-6 Demand outside study area

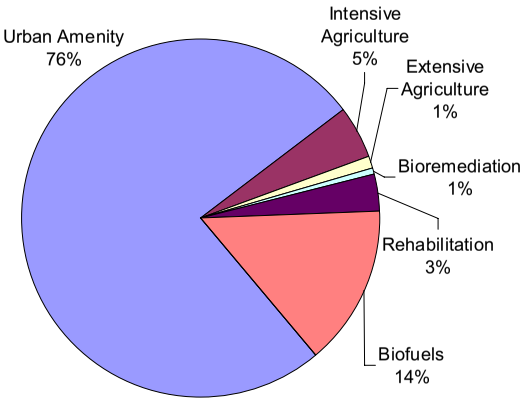


Figure 4-7 Demand in GSR

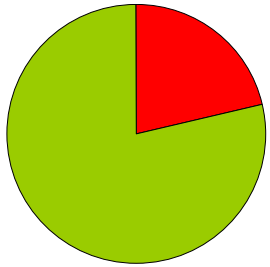
Size indicative of relative OHP demand in each region, red portion represents RO share of OHP market

Estimated 4% of OHP demand in NSW

RO share of OHP market = 81%

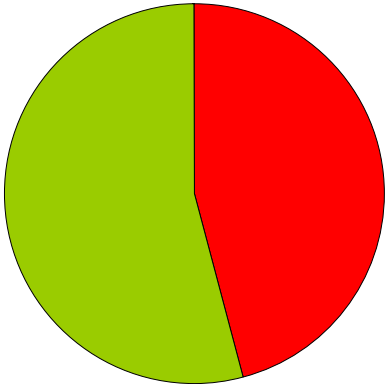
Estimated 7% of OHP demand in NSW

RO share of OHP market = 63%



Estimated 18% of OHP demand in NSW

RO share of OHP market = 22%



Estimated 70% of OHP demand in NSW

RO share of OHP market = 46%

4.4 Current demand for RO

RO content in the existing OHP market was estimated to have increased from 20% in 1996 to approximately 36% in 1998. Current supply of RO is estimated to be 860,000 m^3/year (for all regions included in the 2003 market update), which represents about 44 % of the existing OHP demand.

Current demand for RO is summarised in this section in the following figures:

- The overall RO content of all OHP sold in the different regional areas of this study is shown in Figure 4-8.
- The RO content of all OHP sold in each market segment is summarised in Figure 4-9 and Figure 4-10.
- The RO content of different OHP products sold in different regional areas is summarised in Figure 4-11.

The current demand for RO as shown in Figure 4-8 to Figure 4-11 has been estimated based on the RO content of products reported by processors (as reported in Chapter 3), and the RO content of OHP products used by consumers where the products were not sourced from compost facilities (as reported by consumers in the market survey undertaken by GHD in March 2004).

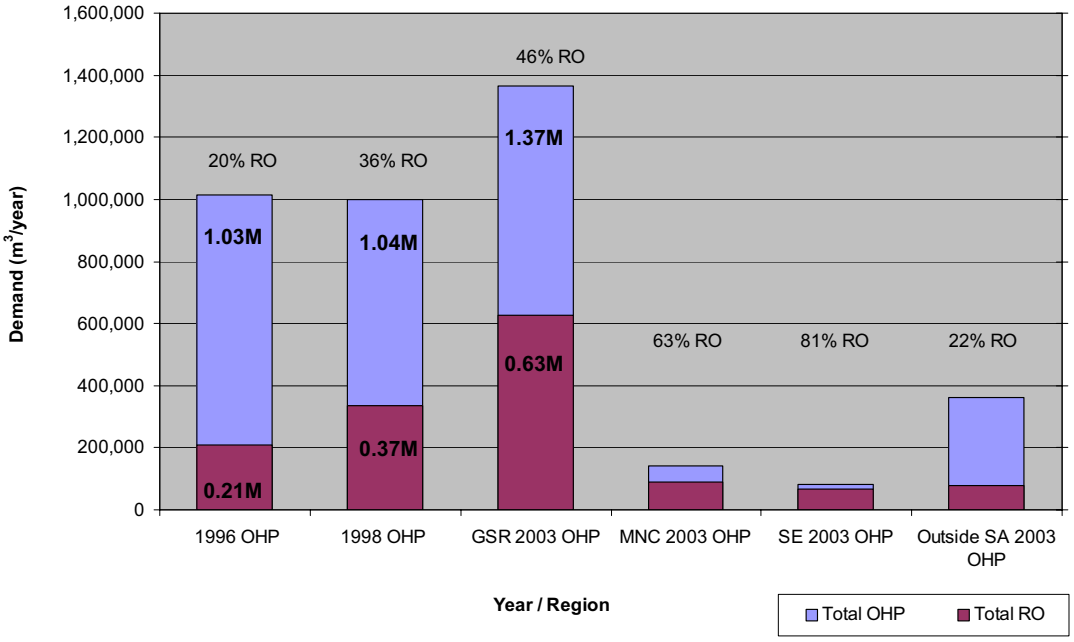


Figure 4-8 Overall RO content of OHP demand in each region

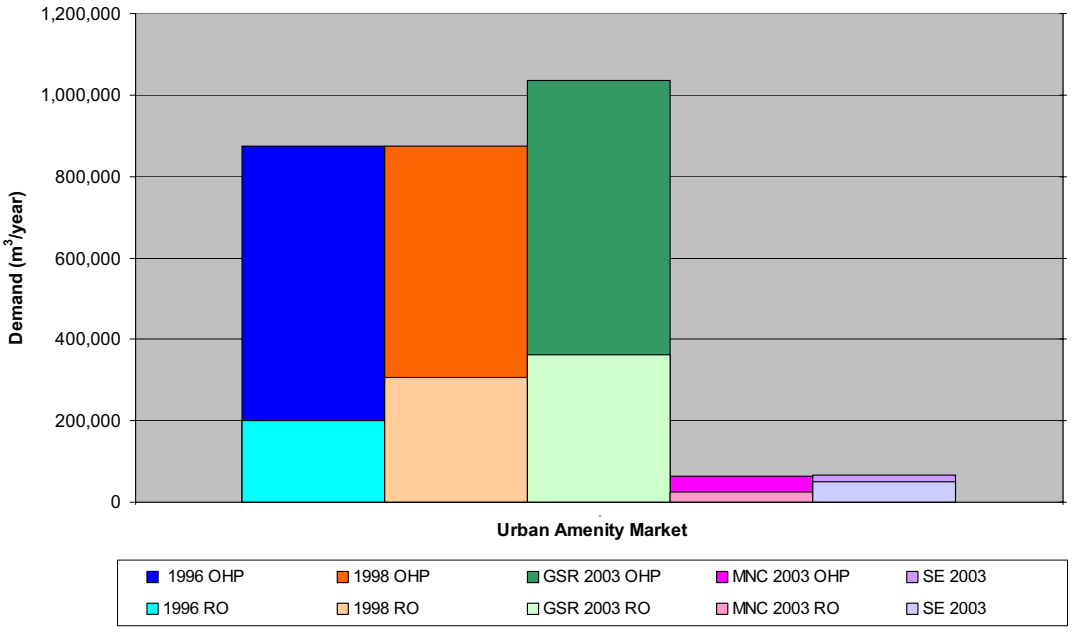


Figure 4-9 RO content of OHP demand in the urban amenity market sector

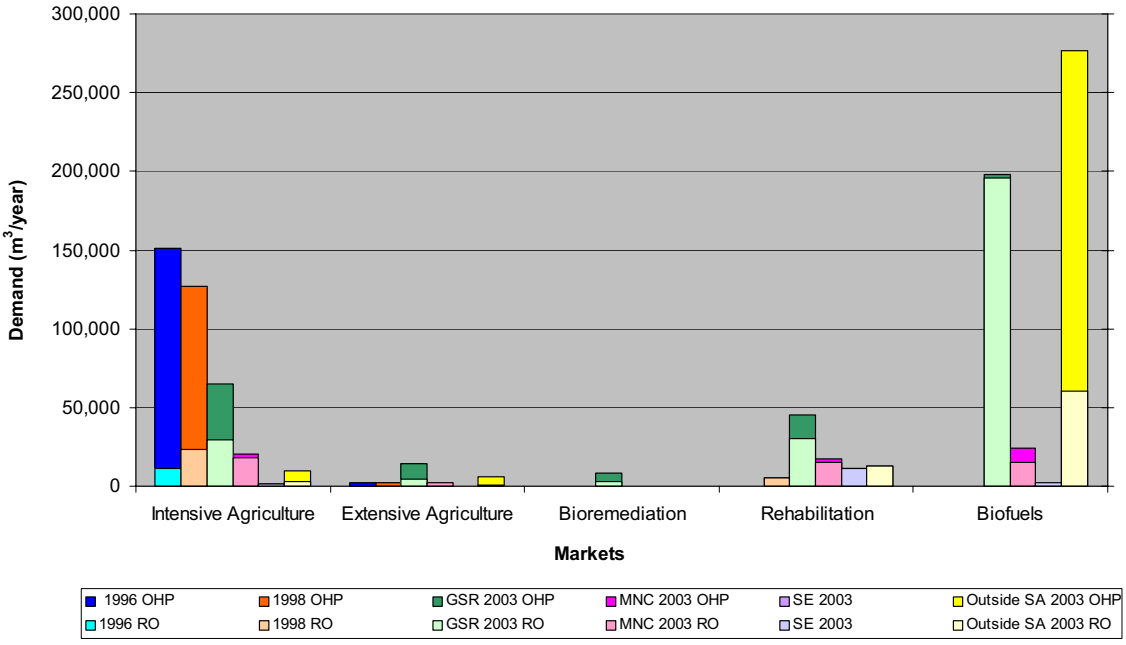


Figure 4-10 RO content of OHP demand in the other market sectors

Note: for clarity, the export and "other" markets are not shown in the above figure

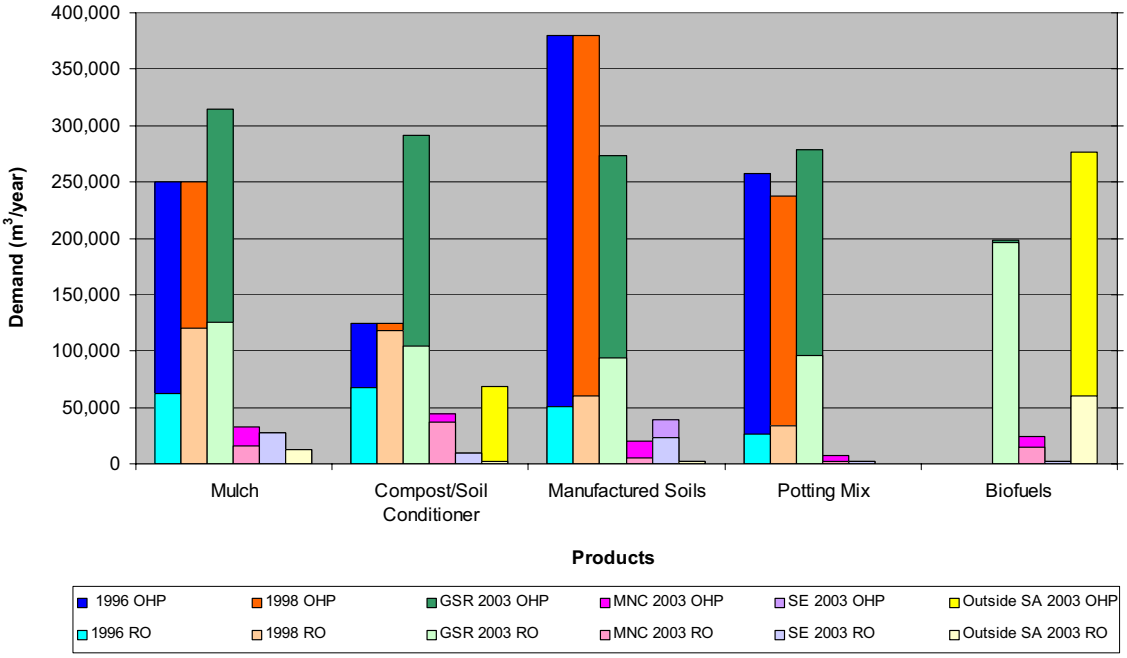
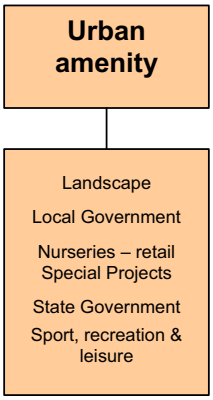


Figure 4-11 RO content of OHP demand in different regions

5 Urban Amenity

5.1 Market overview



The amenity market for OHP is described as the market for products used in the maintenance or enhancement of the physical landscape or streetscape, areas of vegetation and public and private spaces for parks, gardens, and reserves.

Participants in this market segment are also involved in the maintenance of sport, leisure and recreation fields and grounds such as golf courses, bowling greens, and racing clubs.

According to Nursery and Garden Industry Australia (2003), the amenity and retail markets constitute the largest market share of the Australian Garden Market[1],[2].

Sales of garden products and services in NSW represent about 34% of the national gardening market, which reflects the number of dwellings and spread of population across Australia (NGIA, 2003). The value of the total garden market (sales) for NSW/ACT in 2002/2003 was $1.96 billion, with sales of "greenlife" attributable to $0.6 billion of this total[3].

5.2 Factors affecting demand in the urban amenity market

Increasing population growth throughout NSW and urban consolidation within the Greater Metropolitan Region has lead to increasing population, expansion of urban development, and increased housing density within city areas. This intensification places increasing pressure on the natural environment (and availability of open spaces), infrastructure, and transport networks within urban areas. These factors are likely to have potential impacts on the urban amenity market for OHP products.

Along with increasing urbanisation, there have been a number of other changes in NSW which may also impact urban amenity markets. These include changes in family structure, working commitments and spare time, and lifestyle attitudes and interests.

These factors are briefly discussed in this section.

Demographics

An overall increase in the NSW population of about 11% has occurred between 1996 and 2002. The population of NSW is ageing, with the proportion of people over the age of 50 increasing from 26% in 1996 to 29% in 2002 (ABS 1996, and ABS 2004).

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[1] Statistics published by the Nursery and Garden Industry represent the overall Australian gardening market which includes growers, retailers, wholesalers, garden maintenance, and landscapers.

[2] In statistic published by the Nursery and Garden Industry Australia, the amenity market includes landscapers, government, revegetation and plant hire, and the retail market includes retail nurseries, wholesale direct sales, markets, hardware stores, supermarkets, and mail order and internet sales. In this study, the amenity and retail sub-markets listed above are considered as part of the overall amenity market.

[3] Greenlife category includes: bedding plants and colour, bulbs and seeds, indoor and patio plants, propagation stock, trees and shrubs, turf, and other plants.

Implications of an ageing population include less demand for open space areas for active recreation such as sports. Demand for open areas would likely still exist, but the focus of open space design would be changed as older persons are more likely to gain higher amenity from leisure pastimes such as walking or relaxing in parks and gardens.

Low maintenance gardens would be desirable to elderly persons living alone. Alternatively landscape services may be employed to maintain larger gardens or estates. Therefore promoting the use of recycled organics in landscape services may be a potential area for market development. Promotion of organic mulches and compost as products to help improve soil health and quality and moisture retention (thereby reducing the need for frequent watering and fertilising of gardens) is also identified as potential area for development.

Family structure

The relative number of couple families with dependant children in NSW decreased from 40% of all families in 1997 to 38% of all families in 2003. At the same time has there has been an increase in the number of couple families without dependant children from 44% to 47% of all families. This increase represents an actual of 19.6% in the actual number of families without dependant children (141,900 families).

The decrease in the number of dependant children for couple families reflects that these families may potentially have more time available for pursuing leisure activities such as gardening or recreational sports. It may also indicate an increase in the amount of disposal income for these couples, which could be spent on urban amenity.

Housing and construction trends

There has been a noticeable increase in the number of people living in semi-detached housing (including row and terrace houses) and flats or units since 1996. Statistical data for NSW indicates that the number of people living in separate houses increased by 5% between 1996 and 2001, compared to an increase of 21% of people living in semi-detached housing, and 14% for people living in flats or units (ABS Census data for 1996 and 2001).

In the mid-1990's over 40% of development approvals for new dwellings in Sydney alone were for separate housing, with 16% for semi-detached housing and 34% for units. By 2003 development approvals for flats and units had increased to 44% of all new housing development approvals, with a decline in approvals for separate housing to about 34%. This general trend is also evident in the approvals for overall NSW (based on information reported in ABS, 2004).

As well as potential impact on the amenity market from the increase in multi-unit dwellings, there is also the potential impact from the obvious change in land and housing size for new detached dwellings. Of the type of housing dwellings proposed for Sydney over the next five years (shown in Table 5–1), the majority of detached houses are planned for the outer new suburbs of Sydney (Castlebrook, Rouse Hill, Spring Farm, Camden, St Marys and Blacktown), with some also in the outer established suburbs of Sydney (Holroyd, Hornsby) and the Central Coast (Wyong and Gosford).

Table 5-1 Housing dwellings proposed for Sydney over the next 5 years

Area	Number of planned developments	Type of developments
Inner City South Sydney, Sydney, Randwick, Botany, North Sydney	32,460	98% multi-unit dwellings
Middle Ring Parramatta, Canada Bay, Rockdale, Hurstville, Ryde	39,427	87% multi-unit dwellings
Outer established suburbs Castlebrook, Rouse Hill, Spring Farm, Camden, St Marys and Blacktown	32,930	71% multi-unit dwellings
Outer new suburbs Holroyd, Hornsby, Wyong and Gosford	34,580	94% detached houses

(Source: Planning NSW: Managing Sydney's Urban Growth - Housing Forecasts as reported in Ohlin, 2003)

The increase in urban density, as shown by changes in development and construction has implications for the amenity industry. A move towards flats and units and large separate developments on small blocks indicates that:

- Many new properties would have limited garden and open space areas;
- New residential developments are likely to have landscaped areas to make the most out of the limited open space available;
- Residents in flats and units or large homes on small blocks would be limited to having plants in pots on verandas and patios (more small to medium sized); and
- The decrease in new separate home development would lead to more renovations and trying to increase the value of existing home properties (including garden renovations).

The increased demand for indoor and patio greenlife compared to bedding plants and trees and shrubs was already reflected in plant sales for the 2002/2003 period compared to previous year, as shown in Table 5-2. There was a 9.2% increase in the sale of indoor and patio greenlife, which was the highest out of all plant categories.

Table 5-2 Greenlife product sales — Australia 2002–2003

Greenlife category	Share of total	+ / - from previous year	Market value ($/000)
Bedding Plants and Colour	15.6%	0.8%	$288,000
Bulbs and seeds	4.5%	4.3%	$83,000
Indoor and patio	6.8%	9.2%	$125,000
Propagation stock	5.9%	20.%	$110,000
Trees and shrubs	57.9%	4.0%	$1,072,000
Turf	8.2%	6.3%	$151,000
Other plants	1.1%	0.9%	$21,000
Total		**3.7%**	**$1,850,000**

(Source: Nursery and Gardening Industry Australia, 2003)
Note: Above figures are for all of Australia

Open space

Urban green space can provide social, cultural, economic and environmental benefits to a community. Urban green spaces include parks, reserves, gardens, recreation and other open spaces such as nature strips and corridors. Benefits of open spaces include improved recreational facilities, air quality, enhancement of biodiversity, water retention, general improvement and contribution to aesthetics (NSW EPA, 2003).

With increasing demands for living space in city areas and development of multi-uni dwellings, there is increasing pressure to include some form or provision for open space in designs – with limited space available, open spaces are generally landscaped to make the most use out of them.

Factors affecting demand and the supply of open space have been identified by Sydney Urban Parks Education and Research Group as:

- Continued population growth (at a minium of 1% per year for at least the next 5 years);
- Changing demographics – ageing population – elderly have little participation in active sports and focus more on walking for pleasure;
- Urban consolidation;
- Importance of outdoor physical activities; and
- Greater prominence given to ecological benefits and conservation values.

Climate and gardening practices impacts

Ongoing drought conditions resulted in NSW may have impacted on use of OHP. The entire state of NSW was declared drought affected in February 2003. Water restrictions have been in place in many areas of NSW, including mandatory restrictions in place in Sydney from 1 October 2003.

These water restrictions allow watering of the garden and lawns by hand using a hose or bucket at any time. If the restrictions are increased to prevent the watering of lawns and limit the watering of gardens to certain times and in certain ways, then the impact of the restrictions may be more significant.

The impact of water restrictions on sales of garden products is uncertain, but has been predicted to be negative. Previous experience has indicated that the introduction of water restrictions decreases greenlife sales by 25-30% and has a flow on effect to other garden products and services (Nursery and Gardening Industry Australia, February 2004).

Water restrictions may have impacted on the activity of some gardeners, however a number of strategies and initiatives have been pursued to encourage gardening using water wise practices. Strategies that have been promoted (and which have influenced the use of RO and OHP) include:

- Use of mulch to minimise evaporation from soils and potting mixes – it has been shown that mulching can reduce the irrigation requirements of plants by up to 70%, and reduce the soil temperature by up to 3^{o}C, which reduces water loss and reduces plant stress (DEC, 2004c);
- Use of compost to improve moisture holding capacity of the soil – for example it has been shown that turf grown with the application of a composted soil conditioner can require up to 30% less water (DEC, 2004c);
- Cut back on the use of chemical fertilisers, to reduce reliance on water;

- Help establish lawns by applying top dressing (rather than using large amounts of water in initial establishment);
- Cut back on lawn areas by using paving; and
- Use more drought tolerant plants such as succulents and Australian natives.

5.3 Overview of current market demand and RO penetration

5.3.1 Overall OHP and RO demand

In 1996 the amenity market segment was reported as the largest existing market for OHP with 85% of demand, estimated at about 875,000 m^3/yr. The outcomes of this study indicate that the amenity market continues to have the largest demand for OHP in both the GSR (77% of overall OHP demand in GSR), MNC, (45% of overall OHP demand in MNC), and the SE (80% of overall OHP demand in SE).

The existing OHP demand and RO content of OHP demand for the overall amenity market is shown in Figure 5-1.

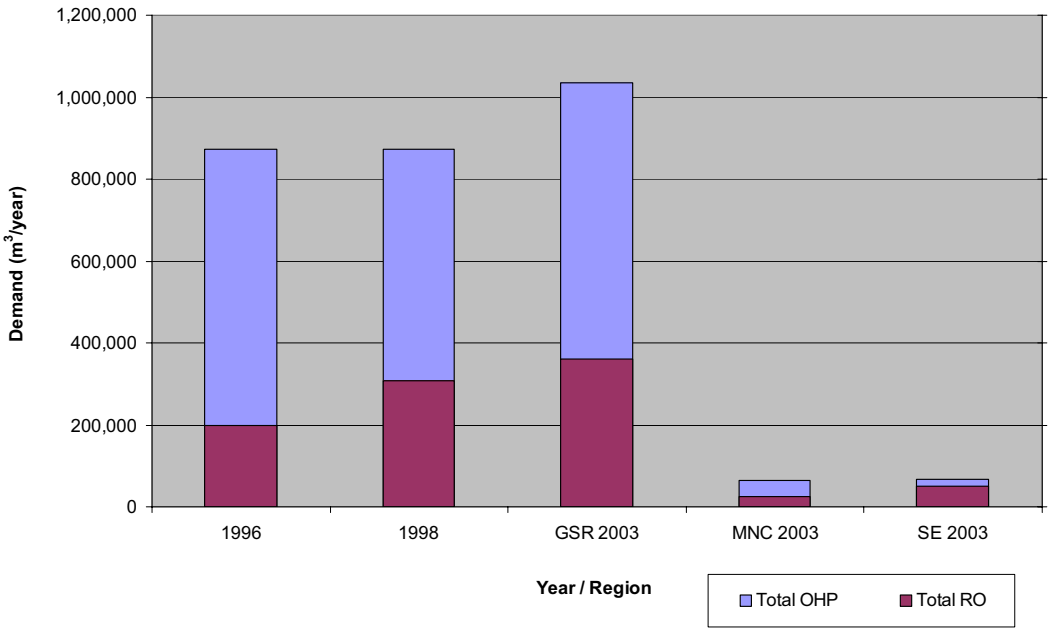


Figure 5-1 Overview of demand in urban amenity market

5.3.2 Overall OHP and RO demand in sub-markets

Due to the limited survey response, demand in individual sub-markets cannot be accurately determined and is thus not reported. However, based on the data made available by the survey, it is apparent that demand for OHP and RO remains the highest in the landscape sub-market.

5.3.3 Product demand

Product demands in the overall amenity market are summarised in Figure 5-2.

In the GSR both soil conditioners and potting mixes have increased significantly for both OHP and RO in the urban amenity market in comparison to the mulch and manufactured soils. This can be attributed to increased emphasis on home values and landscaping.

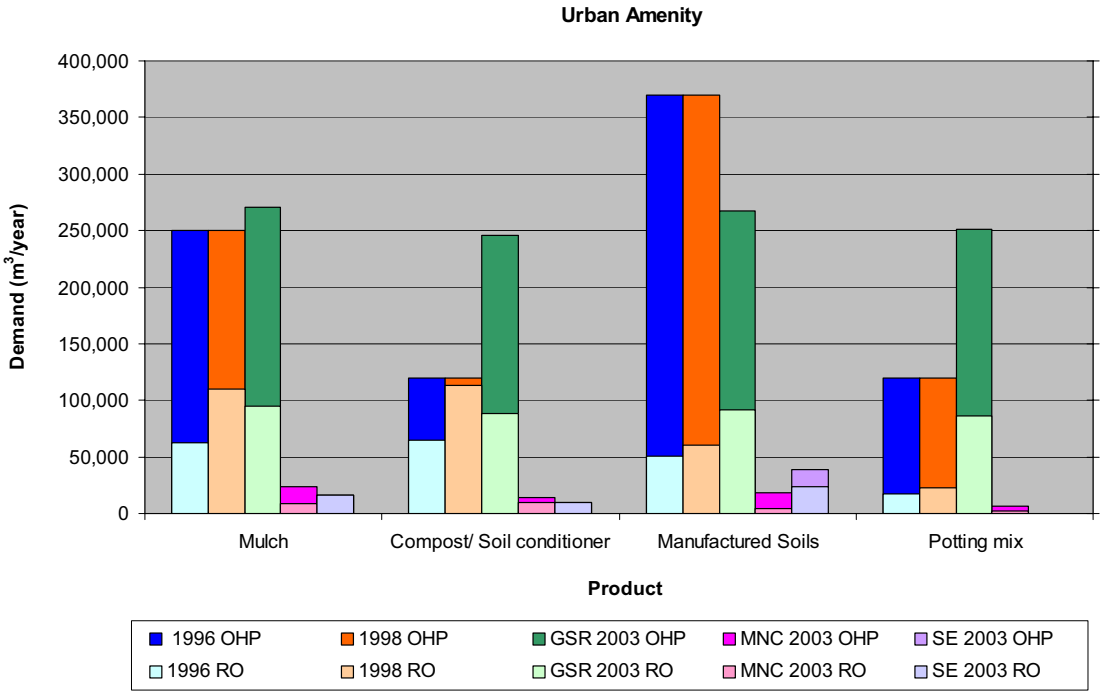


Figure 5-2 Product demand in the amenity market – RO content

5.3.4 Product demand in sub-markets

Due to the limited survey response, product demand in the amenity sub-markets cannot be accurately determined and is thus not reported in this update study.

5.4 Current demand in sub markets

5.4.1 Landscape

Market factors

The landscape contract market is a growing sub-market within the urban amenity market. The landscape contractor market in the greater Sydney region had been previously estimated to have a turnover of around $60 million dollars in 1998 (Love and Rochfort, 1998), the turnover would be significantly higher now due to the increased reliance on landscape services as outlined below.

Landscapers have specific product characteristic requirements (depending on the application), and delivery related requirements (depending on the size and location of the projects).

Demand can be seasonal because of the nature of the work. Depending on the size of the contract work, landscapers may purchase products in either bagged (for small projects) or bulk form (for major works).

Increasing use of contractor services is reflected in the increasing contribution to garden product distribution. There has been a change in the most popular distribution channels for market and garden products, as indicated by the Nursery and Garden Industry Australia Market monitor for 2002/2003, the results of which are summarised in Table 5-3.

Table 5-3 Sale of garden products via distribution channels

Distribution channel	Market share	+ / - from previous year	Market value ($'000)
Landscapers	25.0%	15.4%	$1,429,895
Local Government & Sports	1.8%	3.8%	$102,269
Revegetation	1.7%	4.2%	$94,943
Plant Hire	1.3%	4.9%	$75,560
Garden Services	8.4%	2.7%	$482,895
Retail Nursery	18.1%	-2.8%	$1,035,249
Discount Dept Store	5.1%	9.3%	$288,745
Garden Supplies	16.5%	4.0%	$945,010
Hardware	16.4%	3.7%	$939,939
Mail order & E-comm	0.5%	2.5%	$27,374
Markets	0.2%	4.9%	$12,428
Supermarkets	2.3%	7.9%	$130,443
Wholesale Direct	0.7%	0.5%	$40,295
Propagators	1.9%	2.0%	$109,701
Total		**5.4%**	**$5,714,745**

Source: Nursery and Gardening Industry Australia, 2003
Note: The above figures are for all Australia, however it is likely that similar trends would be expected for state specific sales performance

The four largest channels for distribution of garden products and services are landscapers, retail nurseries, garden supplies and hardware stores. The results in Table 5-3 show that the market share of landscape contractors is increasing, with the market value of products distributed through this sub-market increasing 15% (approx $200 million) just over the 2002/2003 period.

The market share of retail nurseries actually declined in the 2002/2003 period, with the greatest increase in market share going to landscapers. This change in distribution channels reflects the changes in market factors impacting on the urban amenity market, particularly the tendency towards low maintenance and low fuss gardens. Increasing urbanisation and less skilled gardeners are decreasing the overall demand for products from retail outlets, as there is an increasing desire to landscape or remodel open spaces so that they require minimal upkeep.

5.4.2 Local Government

Local Government utilises OHP in gardening, amenity, recreation, and landscaping works including parks, gardens, ovals, government run nurseries, road works, landscaping, nature strips, playgrounds, and sporting fields. The local government sector is one of the largest sub-markets within the amenity market.

Local Government is one area targeted by the DEC as a potential increased user of RO. Increased usage of RO by Councils, and increased requirements that contractors operating for Councils use RO, will help market development. Indirect influence local government has over broader community purchasing which can influence market direction includes influence in subcontractor purchases, new developments and re-developments, and usage by community groups such as Landcare and Bushcare (Sustainable Environment Consultants, 2000).

Councils using RO can help demonstrate the environmental and cost benefits of utilising recycled materials, as well as providing open information to the general public. The “Healthy Parks and Gardens Program” is an example of a program set up to promote and demonstrate the effectiveness of using recycled organics in local government operations. Examples of where RO has been used in trials/remediation works through the program have been well documented elsewhere, including by Resource NSW, 2002.

The Healthy Parks and Gardens Program not only focuses on using RO materials in amenity applications, but also aims to expand Council’s use of RO materials in emerging fields such as stormwater purification, sediment control, and erosion control.

Market factors

The factors which impact on consumption of RO by local government in the amenity sub market include price surcharges, working within local government tendering regulations, compliance with Australian standards and the self mulching by council parks and gardens departments.

5.4.3 Nurseries — retail

Market factors

As shown in Table 5-3, the market share of retail nurseries is generally declining. The value of garden products distributed through this sub-market declined about 3% in the 2002/2003 period, with the greatest increase in market share going to landscapers.

This change in distribution channels reflects the changes in market factors impacting on the urban amenity market, particularly the tendency towards low maintenance and low fuss gardens. Increasing urbanisation and less skilled gardeners are decreasing the overall demand for products from retail outlets, as there is an increasing desire to landscape or remodel open spaces such that they require minimal upkeep.

As outlined in Section 5.2, the drought in NSW is also likely to be contributing to the decrease in nurseries and retail trade, with previous experience indicating that the introduction of water restrictions can decrease greenlife sales by 25-30% and have a flow on effect to other garden products and services (Nursery and Gardening Industry Australia, February 2004).

5.4.4 State Government

Market factors

Market factors impacting on the usage of RO in large State Government department projects include specification of amenity products when awarding tender, price discounting, available supply, and supporting the Waste Reduction and Purchasing Policy (WRAPP) of the NSW Government.

To ensure that RO is utilised, product standards must be nominated by the government department when awarding the tender to subcontractors. Otherwise once the contract is awarded the subcontractor will supply the cheapest product to minimise their internal costs. RO manufacturers also will have difficulty in supplying the high demands of large-scale projects.

5.4.5 Sport, recreation & leisure

The sport, recreation, and leisure sub market considers demand for OHP and RO products for maintenance of turf surfaces and garden areas at private sport and recreational facilities such as golf clubs, bowling greens, and racing clubs. Maintenance of council operated sporting fields is considered in the Local Government market segment.

Market factors

Sport, recreation, and leisure fields are under pressure to maintain turf at sites that are under heavy use and pressure, particularly given the current drought conditions. Use of organic composts in different applications has advantages of (R Alexander and Associates, 2003):

- Athletic fields – compost can improve soil quality, by reducing bulk density and field compaction, as well as improving moisture penetration and percolation through the soil profile; and
- Golf courses – composts as alternative to peat products in sand-based media because of its ability to supply and maintain nutrients in the turfs root zone as well as suppress a variety of soil borne diseases.

5.5 Potential demand

Potential demand in the urban amenity market is estimated based on a review of major projects planned by State Government Agencies.

The future supply and demand for RO products by State Government agencies is based on the NSW DEC Draft "*Assessment of Demand Potential for Recycled Organics Products in NSW: Major Developments Market Sector*" (2004a). This assessment considered the demand potential for State significant developments (under Clause 6 of SEPP 59) with a capital investment value of $20 million or more and that fulfilled the following criteria:

- Projects having a clearly discernable and significant site landscaping or rehabilitation component; and
- Having just commenced and are long term (ie 2+ years to completion), OR:
- Are approved but have not yet commenced; OR
- Are at "detailed proposal" stage and are likely to proceed within the next 2 to 5 years.

The assessment focused on projects by the RTA and Landcom, who together handle approximately 83% of all major projects with significant potential for RO products (NSW DEC, 2004a).

Projects identified for the assessment based on the above criteria are shown in Table 5-4.

Table 5-4 Major developments identified for potential use of RO

Project	Region	Start date	Completion date
LANDCOM PROJECTS			
Greenway Park	GSR	2002	2006
Macarthur RC	GSR	2004	2011
Newbury	GSR	1999	2006
Park Central	GSR	2002	2006
Seconds Pond	GSR	1995	2009
Rouse Hill	GSR	2004	2015
Interciti	GSR	2003	2010
Bagnall Beach	MNC	1992	2007
Woodlands	SE	1999	2007
RTA PROJECTS			
Westlink	GSR	2003	2006
Penrith to Orange - other upgrades	GSR	2003	2006
Liverpool to Parramatta Transitway	GSR	2003	2006
F3 Widening	GSR	2003	2005
Cowpasture Rd Upgrade	GSR	2003	2008
Bangor Bypass	GSR	2003	2008
Penrith to Orange - Leura to Katoomba	GSR	2003	2006
Hoxton Park Rd Upgrade	GSR	2003	2008
Penrith to Orange - Lawson upgrade	GSR	2003	2006
Windsor Road upgrade - Seven Hills to Windsor Road	GSR	2003	2006
Windsor Road upgrade - Roxborough Rd to Showground Rd	GSR	2003	2008
F3 to Braxton Connection	MNC	2003	2006
Pacific Highway - Karuh to Bulahdelah Upgrade	MNC	2001	2007
Pacific Highway - Bonville Deviation	MNC	2001	2007
Pacific Highway - Karuh Bypass	MNC	2001	2007
Newcastle Inner City Bypass	MNC	Date not available	
Central Coast - Pacific Highway	MNC	Date not available	
Pacific Highway - Coopernook bypass	MNC	2001	2007
Pacific Highway - Taree to Coopernook	MNC	2001	2007
Central Coast - The Entrance Road	MNC	**started**	2005
Princess Highway - North Kiama Bypass	SE	2003	2006

* Note, projects outside of the GSR, MNC, and SE are not included in the above table

In the DEC study, the assumed application rates were 500 m^3 of composted mulch per hectare, and 120 m^3 of soil conditioners per hectare. These were based on an average depth of application of 50 mm for composted mulch, and 12 mm for soil conditioners.

Project demand estimates the GSR, MNC, and SE over the next three years (2004-2007) are summarised in Table 5-5. Demand estimates for individual projects are included in Appendix D.

Table 5-5 Estimated RO demand for major projects in study regions

	Mulch (m^3/year)			Compost (m^3/year)			Total RO demand (m^3/year)		
Year	2004	2005	2006	2004	2005	2006	2004	2005	2006
LANDCOM PROJECTS									
GSR	3,200	3,200	3,200	3,500	3,500	3,500	6,800	6,800	6,800
MNC	200	200	200	200	200	200	400	400	400
SE	900	900	900	1,000	1,000	1,000	1,900	1,900	1,900
Total	**4,300**	**4,300**	**4,300**	**4,700**	**4,700**	**4,700**	**9,100**	**9,100**	**9,100**
RTA PROJECTS									
GSR	20,000	20,000	19,300	4,000	4,000	4,000	24,000	24,000	23,300
MNC	18,200	18,200	5,800	3,100	3,100	3,100	21,300	21,300	8,900
SE	1,500	1,500	0	200	200	200	1,700	1,700	200
Total	**39,700**	**39,700**	**25,100**	**7,300**	**7,300**	**7,300**	**47,000**	**47,000**	**32,400**
COMBINED RTA + LANDCOM									
GSR	23,200	23,200	22,600	7,500	7,500	7,500	30,700	30,700	30,100
MNC	18,400	18,400	6,000	3,400	3,400	3,400	21,800	21,800	9,300
SE	2,400	2,400	900	1,300	1,300	1,300	3,700	3,700	2,200
Total	**44,000**	**44,000**	**29,500**	**12,100**	**12,100**	**12,100**	**56,200**	**56,200**	**41,600**

(Source: based on NSW DEC, 2004a)

Case Study: Urban Amenity – Randwick City Council

Project: **Randwick City Council Recycled Organics Program**

Randwick City Council (RCC) currently undertakes recycling of organics as part of their overall recycling program.

Organics from a number of sources including kerbside collections, parks and gardens maintenance, from contractors working within the Council area, and organics self-hauled to the facility by residents are processed to meet AS 4454 (Composts, Soil Conditioners, and Mulches). It is estimated that over 12,000 tonnes of organics will be processed in the 2004 financial year.

Products and markets

RCC produces a number of organic products such as leaf litter, premium mulch and a product that is currently being tested against the compost standard. Other products include various garden mixes and soil blends.

The recycled organic products are used within the local area, as well as sold to external customers. It is estimated that more than 80% of the recycled organic products produced at the RCC facility are sold to external customers.

RCC has opted for a diverse approach to the use of organics, including:

- Use within garden areas where not only visual impact is required, but where a significant reduction in watering is achieved;
- Addition to garden areas as a soil improver;
- Use as a garden blend mixture where old garden can be revitalised or for the establishment of new gardens;
- Turf underlay; and
- Supply to residents.

Recycled organics have been used in major construction work at Marine Parade, Maroubra where a product mix of mulch and soil were used as the turf underlay. Premium mulch was also used for the garden areas and for establishing the garden beds.

Benefits of the program

The organics recycling program has allowed RCC to process organics to a quality that matches or even betters external product quality, at a lower cost compared to having to buy in product from external sources. The recycling program is also successful at significantly reducing the amount organics that would otherwise go to landfill.

Limitations

RCC has identified issues associated with the ability to economically process, store, and load the products within the existing environmental guidelines as the main limitations and barriers of operating the service. The pressure to achieve an economic return for processing the product is also linked to the increasing supply of recycled products within the Sydney metropolitan area.

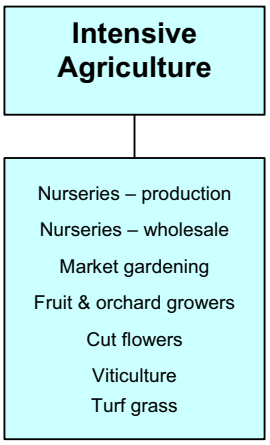
Future development

RCC has undertaken a lease on a new site where it is planned to further implement improvements in organics storage, processing and loading techniques. It is also anticipated that several new products will be marketed. Limitations on the current site have restricted only limited amounts to be processed. RCC intend to continue to market the products to external sales customers to ensure ongoing economic operation of organics recycling.

(Source: Randwick City Council)

6 Intensive Agriculture

6.1 Market overview



The intensive agriculture market incorporates production and wholesale nurseries, fruit and orchard growing, cut flowers, market gardening, turf grass growing, and viticulture.

Intensive agriculture differs from extensive agriculture in that there is considerably more capital and labour invested per hectare, the land use area is also generally smaller than for extensive agriculture.

Intensive agriculture involves intensive working of the land including practises such as ploughing, rotary hoeing, mounding, planting, fertilising and harvesting. Therefore the site soil is more susceptible to on-site environmental impacts such as compaction, loss of soil organic matter and soil structure, wind and water erosion, salinity, soil borne diseases, and weed invasion and off-site environmental impacts including water pollution and loss of ecological integrity and biodiversity (Recycled Organics Unit (ROU), 2003a).

Intensive agriculture production can be undertaken either in open or under cover growing structures such as glasshouses, green houses and shade houses (NSW Waste Boards, 1999). Both situations use land and many potentially purchase RO products such as composts, garden soils and potting mixes (NSW Waste Boards, 1999).

The potential for use of recycled organics in intensive agriculture is higher compared to extensive agriculture due to its use in the production of higher value crops, as farmers are likely to invest more money to manage these crops on a per acre basis (R Alexander and Associates, 2003).

6.2 Factors affecting demand in the intensive agriculture market

6.2.1 Nature of intensive agriculture

Intensive working of land under intensive agriculture production systems is prone to loss of soil organic matter, resulting in soil structure decline, land degradation and loss of soil productivity (ROU, 2003a).

Application of organic matter to the soils can improve soil quality, increase soil moisture retention, reduce the risks of pests and disease and lead to improved farm yields. However, growers in the intensive agriculture industry have in the past often used low cost animal manures, as these are readily available in preference to purchase organic products.

Replacement of chemical fertilisers and manure-based products could benefit intensive agriculture markets through improvement of soil quality and suppression of certain soil borne diseases. Recycled organic uses and benefits in intensive agriculture include:

- Composts for soil for field crops, vegetables, and fruit crop fields;
- Raised bed planting component;
- Composts and soil blends for hothouse crop media component;
- Organics and/or certified organic fertiliser;
- Weed free source of organic matter;
- Source of stabilised organic matter;
- Provides more organic matter than cover crops; and
- Able to reduce/eliminate need to fallow fields.

6.2.2 Changes to intensive agriculture in NSW

Since 1997, there has been a decrease in the number of establishments with agricultural activity (both intensive and extensive) from 42,758 to 41,650 (ABS 1997, ABS 2004). The change in the number of intensive agriculture establishments between 2000 and 2002 is summarised in Table 6-1.

Table 6-1 Establishments in NSW with selected intensive agricultural activity

ANZIC Code	Description	As at 30 June 2000	As at 30 June 2002
0111	Plant nurseries	974	858
0112	Cut flower and seed growing	295	263
0113	Vegetable growing	986	831
0114	Grape growing	1175	1220
0115	Apple and pear growing	233	176
0116	Stone fruit growing	465	435
0117	Kiwi fruit growing	1	24
0119	Fruit growing n.e.c	2001	1881
	Total	**8160**	**7720**

(Source: ABS 2002, 2000)

However, over 1997 – 2002, the total area of agricultural holdings has increased from 60,901 to 63,387 (an increase of 4%) and the area used for cropping has significantly increased from 5,589,300 ha to 6,635,000 ha (18%) (ABS 1997, ABS 2004).

The 18% increase in crop areas recorded between 1997 and 2002, is largely due to increases in crop areas in the Central West and Murray. There has also been substantial increase in the Murrumbidgee, Northern and North West of the state, and the Richmond-Tweed area. There appears to have been a decline in crop activity in the Far West.

As outlined in Chapter 3 and shown in Figure 3-1, there are only limited composting facilities located in these regions where there has been an increase in crop area. In particular, the majority of composting facilities located in these areas are largely processors of agricultural organics rather than RO. There are however some composting facilities licensed to local Councils that process RO located in Orange, Bathurst, Mudgee and Ballina that could potentially supply OHP to agricultural establishments in the surrounding local areas.

Table 6-2 Change in crop areas in NSW 1997 - 2002

Region	Crop area at 30 June 1997 '000 ha	Crop area at 30 June 2002 '000 ha	Change '000 ha	% change
Central West	961	1,232	271	28.2%
Murray	670	937	267	39.9%
Murrumbidgee	988	1,157	169	17.1%
Northern	1,398	1,565	167	11.9%
North Western	1,279	1,399	120	9.4%
South Eastern	147	176	29	19.7%
Richmond-Tweed	44	63	19	43.2%
Hunter	58	61	3	5.2%
Mid-North Coast	20	22	2	10.0%
Illawarra	2	3	1	50.0%
Sydney	8	8	0	0.0%
Far West	14	12	-2	-14.3%
New South Wales	**5,589**	**6,635**	**1046**	**18.7%**

(Source: ABS 1997, ABS 2004)

Establishments in the Hunter, Mid-North Coast Illawarra, Sydney, and likely South Eastern are also potential markets for RO, however the area of holding in these areas is significantly less than for other areas of the State such as the Northern, North West, Central West, and Murrumbidgee regions of NSW.

6.3 Overview of current market demand and RO penetration

6.3.1 Overall OHP and RO demand

In 1996 and 1998, demand in the intensive agriculture sector was second highest only to amenity. The intensive agriculture market continues to be one of the largest markets for OHP.

OHP demand in the intensive agriculture market in the GSR and surrounds was estimated at about 150,000 m^3/yr in 1996, and 130,000 m^3/yr in 1998. RO penetration was estimated to have increased from 11,000 – 23,000 m^3/yr over the same period.

Current demand for OHP is estimated at around 65,000 m^3/yr with an RO content of 30,000 m^3/yr (5% of OHP). The latest survey results indicate that there is less demand for OHP in intensive agricultural applications is less in the MNC and SE compared to the GSR. The existing OHP and RO demand for the overall intensive agriculture market is summarised in Figure 6-1.

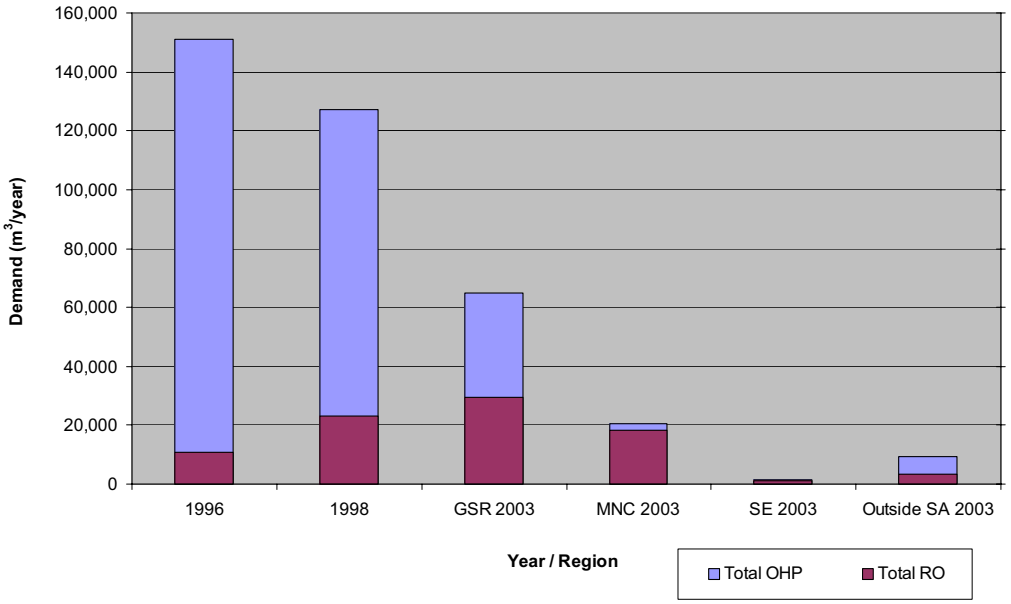


Figure 6-1 Overview of demand in intensive agriculture market

6.3.2 Overall OHP and RO demand in sub-markets

Due to the limited survey response, demand in individual sub-markets cannot be accurately determined and is thus not reported.

6.3.3 Product demand

Product demand in the intensive agriculture market is summarised in Figure 6-2.

There has been an apparent increase in demand for mulch and compost/ soil conditioner products in the GSR. Negligible demand for mulches was previously identified for the intensive agriculture market in the GSR; current demand is now estimated at about 15,000 m^3/yr, with an RO content of 6,000 m^3/yr.

The market for composts and soil conditioners in the GSR has increased from 5,000 to about 15,000 m^3/yr (with an estimated RO content of 5,000 m^3/year).

Demand for potting mix is significantly lower in GSR (from 115,000 m^3/year to only about 25,000 m^3/year). This may be due to the recategorising of bagged potting mix under urban amenity if sold through nurseries and retail outlets but used in green house applications. No demand for manufactured soils was identified, which may be due to survey limitations (10,000m^3 of product was unidentified in GSR). Demand for compost and soil conditioner also high in MNC (14,000 m3/year), and mulch demand in MNC estimated at 7,000 m^3/year.

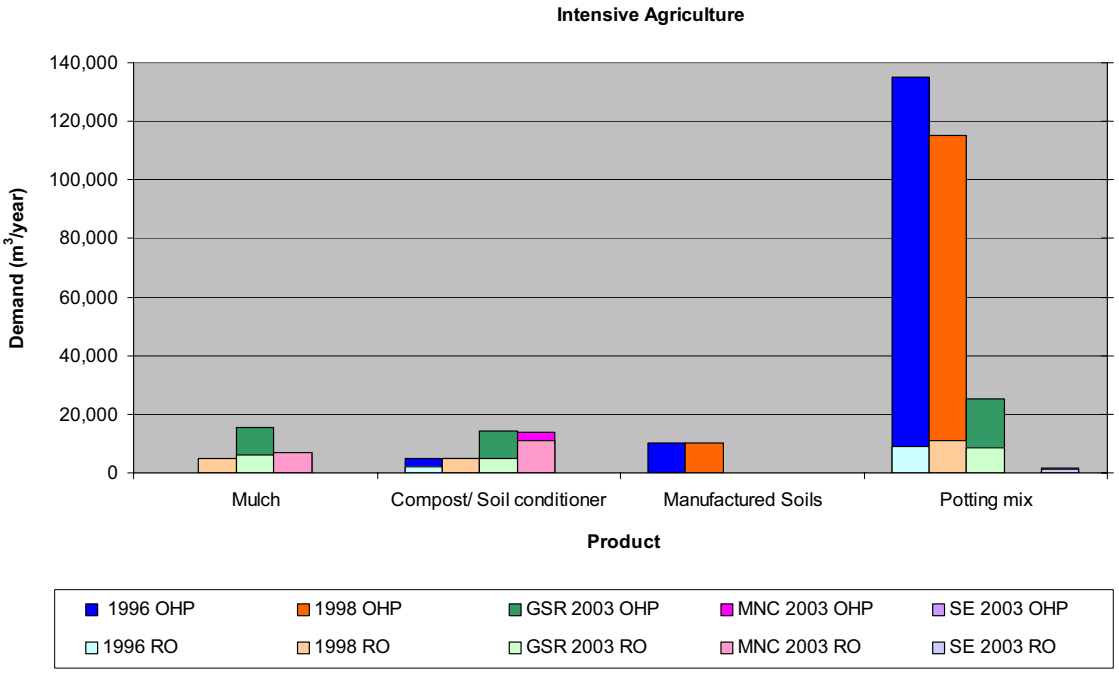


Figure 6-2 Product demand in the intensive agriculture market – RO content

6.3.4 Product demand in sub markets

Due to the limited survey response, product demand in the intensive agriculture sub-markets cannot be accurately determined and is thus not reported in this update study.

6.4 Demand in sub markets

6.4.1 Wholesale and production nurseries

Wholesale and production nurseries are described as entities involved in the cultivation of plants either in ground or containerised for distribution to retail outlets, landscape contractors, and other amenity and intensive agricultural applications (NSW Waste Boards, 1999).

The number of plant nurseries has decreased over the past few years, with numbers in NSW previously estimated at 1434 in 1996/7 (Nursery and Garden Industry Australia website), decreasing to 974 in 1999/2000 (ABS, 2001). The number of plant nurseries in NSW is currently estimated at approximately 858 (ABS, 2004).

Market factors

This market is prominent in the Central Coast, Northern Sydney, Western Sydney, Macarthur and Illawarra regions. There is also moderate numbers in the Hunter and South Sydney area and in the 100 km zone outside of Sydney (NSW Waste Boards, 1999).

Nurseries grow plant stock either in the ground, or in raised beds or containers under shade cloth or in greenhouses. In 1996/97, approximately 8% of the total area use for plant growing in NSW (1280 ha) was under shade cloth, and 5% was in greenhouses (Nursery and Garden Industry Australia).

RO mulches and composts/soil conditioners can be used to improve soil quality and help suppress weeds for in ground growing of plant stock. Potting mixes and plant growth media are needed for container growing.

Factors impacting demand in this sub market are related to those reported for the amenity market, as described in Chapter 5. In summary, these are considered as:

- Increasing demands for landscaped urban areas influence demand for larger plant stock, which is often grown in-ground; and
- Increasing development of multi-unit housing may in general decrease demand for nursery items such as vegetables, larger shrubs, and garden bed plants, however there will be some demand for potted patio and indoor plants.

6.4.2 Market gardens

Market Gardeners are described as producers of vegetables and some fruits such as tomatoes and strawberries for the resale through markets and roadside stalls (NSW Waste Boards, 1999). They also generally produce much of the State's perishable vegetables that have a short shelf life, such as leafy green vegetables and herbs (DEC, 2003a).

Figure 6-3 La Perouse market garden

Market Gardeners in NSW comprise a mix of demographics, cultures, and nationalities. The diversity of the industry and the people, who run it, has in some cases formed an important part of the history and heritage of the local area. For example, the La Perouse Market Gardens at Botany in Sydney have operated since the 1830s. They are the oldest market gardens in the country, and are listed on the State Heritage Register, particularly for their heritage value to Sydney's Chinese community (Gardening Australia, 2001).

Market gardens are located in both urban and non-urban areas and on the fringe of cities and towns. They are generally small, comprising of 2 – 5 hectares (DEC, 2003a). It is estimated that up to 10,000 hectares of land in the Sydney Basin is used for market gardening and growing flowers (DEC, 2003a).

Market factors

Market gardening is considered by many as detrimental to water quality. Land management practices include intensive and frequent fertiliser inputs, cultivation, irrigation and pesticide use. Growers frequently use animal manures as a source of organic material, however concern over potential disease and health risk has led to some buyers specifically purchasing products from market gardens that only use composts made from non-animal manure organic sources (Meinhardt, 2000).

There are two main factors that potentially impact the demand for OHP and RO in this market segment, namely:

1. A decrease in the size and profitability of the industry due to the increased trading in fruit and vegetables by major supermarkets such as Coles, Woolworths, and Franklins who may not purchase materials from market gardeners; and
2. A decreased presence of market gardeners in Sydney and surrounding areas due to the pressure of increasing urban density and hence land values that encourage growers to sell and move out of the industry.

6.4.3 Fruit and orchard growers

Orchards in NSW are predominately located near major river and irrigation systems, or they are grown in areas of high rainfall or in areas with accessible and reliable water supplies.

Fruit growers and orchardists are most prominent in the Central West, Murrumbidgee, Murray, and some areas of the Northern, Mid-North Coast, Hunter, and Sydney regions, as shown in Figure 6-4 and Figure 6-5. The main types of crops grown in this target market in the above regions are citrus, avocados, stone fruits and pomes.

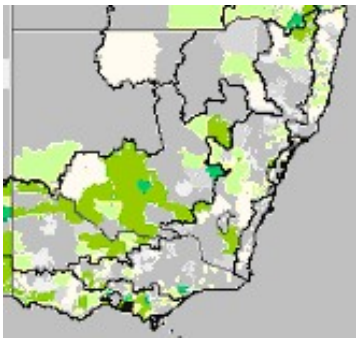


Figure 6-4 Area occupied by annual horticulture in NSW

Annual horticulture includes: beans and peas, brassicas, cucurbits, leaf vegetables, melons, nurseries, onions and garlic, peppers, potatoes, root vegetables, sweet corn and tomatoes.

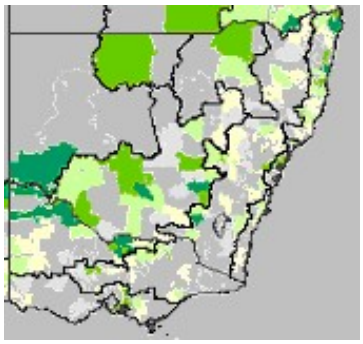


Figure 6-5 Area occupied by perennial horticulture in NSW

Perennial horticulture includes: asparagus, bananas, berry fruit, citrus, nuts, pome fruit, pyrethrum, stone fruit and tropical fruit

(Source: National Land and Water Resources Audit, 2001)

Market factors

Intensive working of land for fruit production, like other intensive agriculture production systems, causes loss of soil organic matter (ROU, 2002c). Application of organic matter as either a mulch or compost/soil conditioner can greatly improve soil quality, water evaporation, and suppress weed growth.

NSW Agriculture regularly provides information to growers on best practice techniques for sustainable farming practices. For best practice soil management in vegetable growing, NSW Agriculture recommends using a balance of manufactured and organic fertilisers; “the former provide immediately available (but more easily leached) nutrients, while the latter release nutrients more slowly over a longer period and also provide some organic matter” (NSW Agriculture a, undated). Similarly, NSW Agriculture recommend a mulch layer of 10 cm thick of composted organic material to help reduce erosion and improve soil structure and nutrient composition for orchards (NSW Agriculture, 1999).

Product demand

Due to limitations in the survey data, OHP demand for the fruit and orchard production sub-market are not presented for the GSR. OHP demand in the MNC study area was identified for 7,000 m^3/yr of mulch and 6,000 m^3/year of composts and soil conditioners. No current usage for manufactured soils or potting mixes was identified for the MNC study area.

No previous OHP demand was identified in the 1999 market study which examined demand in the GSR and 100 km surrounding the GSR.

6.4.4 Cut flowers

The cut flower market within NSW is a growing industry due largely to expansion of the market in the area of growing Australian and South African natives (some of which are shown in Figure 6-6 to Figure 6-8).

Figure 6-6 Alloxylon

Figure 6-7 Blandfordia grandifora

Figure 6-8 Grevillea

(Source: pictures from NSW Agriculture)

NSW Agriculture estimates the value of the cut flower industry in New South Wales to be up to $202.7 million per annum at the farm gate climbing to $800 million at the retail level. The ABS recorded the number of cut flower growing agricultural establishments in NSW as 263 in 2002 (ABS, 2002) however NSW agriculture estimate that there are over 700 established growers within NSW (NSW Agriculture website).

Figure 6-10 shows the location of the flower industry as it stood in 1997. The majority of the cut flower industry is located in the GSR and MNC, with significant areas also in the Illawarra, South East and the Murray.

The flower industry along the north coast areas of NSW has largely developed within the past 5-10 years. Crops in this area can be grown at times that coincide with the heavy demand for exports to Japan (NSW Agriculture).

Figure 6-9 Sydney Flower Market

The location of flower growers is highly influenced by climate and topography. Major growers are located in areas where the climate allows for year long flower growing, and/or where a particular climate is required for growing cold or hot climate flowers. Growers also need to consider distance to markets. Flowers are either exported or sold on the domestic market, mostly through the Sydney Flower Market at Flemington.

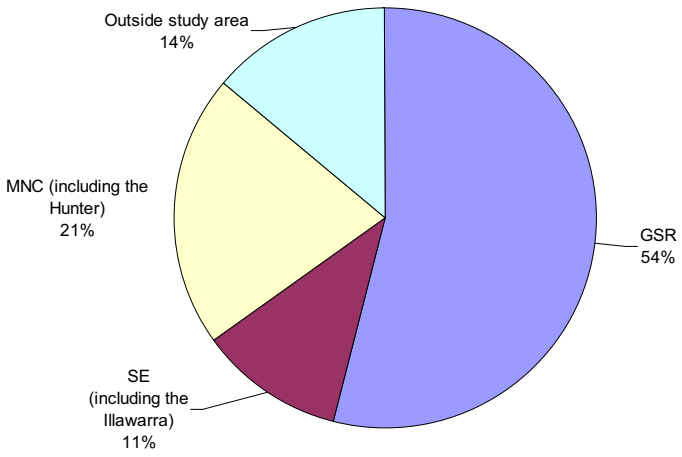


Figure 6-10 Location of the cut flower growing industry

(Based on land Agriculture Statistics for land holding of cut flower industry in NSW as reported by National Land and Water Resources Audit, 2001)

Market factors

Environmental Management Guidelines have been prepared by NSW Agriculture (2001). The Guidelines recommend that organic matter be added to soils to reduce leaching and to increase the soil's moisture and nutrient holding capability around the root zone. The guidelines also emphasis the benefits of using an organic mulch to reduce evaporation and erosion.

Cut flowers can be grown as:

- Open field crops;
- Hydroponic crops; or
- In greenhouses or other structures.

Cut flowers grown in beds in open fields are generally massed together to achieve maximum returns per unit area. These conditions can result in pest and disease problems developing and spreading comparatively faster than for the other growing systems. Growing cut flowers in greenhouses has the advantages of being able to minimise pest and diseases, as well as improve the efficiency of water and fertiliser supply (NSW Agriculture, 2001).

The organic (or non-organic) fertilizer requirements for flowers vary according to the type of growing process that is used. The guidelines indicate that organic mulches, composts and soil conditioners can be beneficially used in the industry, however they refer mainly to composts made from manures, with no mention of other sources of recycled organics.

The financial costs of operation influence the amount of money flower growers will make available for organic mulches and composts in preference to inorganic fertilisers or composts made from animal manure. Operating costs include allowing for labour, pesticides, fertilisers, irrigation, packaging, transport, harvesting, and other maintenance and insurance and utility

overheads. Therefore the margin made on flower growers can be small depending on the products and markets.

Product demand

RO mulches and composts can be used for both indoor and outdoor growing. Diseased and poor quality soils arising from growing in elevated field beds or containers are often replaced at the end of an average two-year crop life (NSW Waste Boards, 1999).

Demand for OHP was previously estimated at 12,000 m^3/yr for compost/soil conditioners, garden soils and potting mix. The RO content in 1999 was estimated at about 1,000 m^3/yr.

Due to limitations in the survey results (only two of the 2003 market surveys were returned from flower growers) revised demand for products in the cut flower market segment is unable to be calculated.

6.4.5 Viticulture

Viticulture describes grape growing for production of various products particularly wine, dry grapes, fresh consumption, and juice for non-alcoholic consumption (ROU, 2003). Grape production in NSW is primarily for the purpose of wine growing, with typically over 80-95% of grapes grown in NSW put into wine-making (see Table 6-3).

The NSW grape growing industry has increased in size considerably since the previous market study. Viticulture is prominent in the Hunter Valley, however there are also significant wine regions located at Mudgee, Canberra, the Riverina, Gundagai, and the Murray Darling.

Wine regions in NSW are shown in Figure 6-11, it can be seen that major wine regions closest to existing OHP processors (as shown in Figure 3-1) are located in the Hunter and Mudgee. Smaller wine regions close to OHP and RO sources are located in Cowra, Orange, the Shoalhaven, Southern Highlands, and Hastings River.

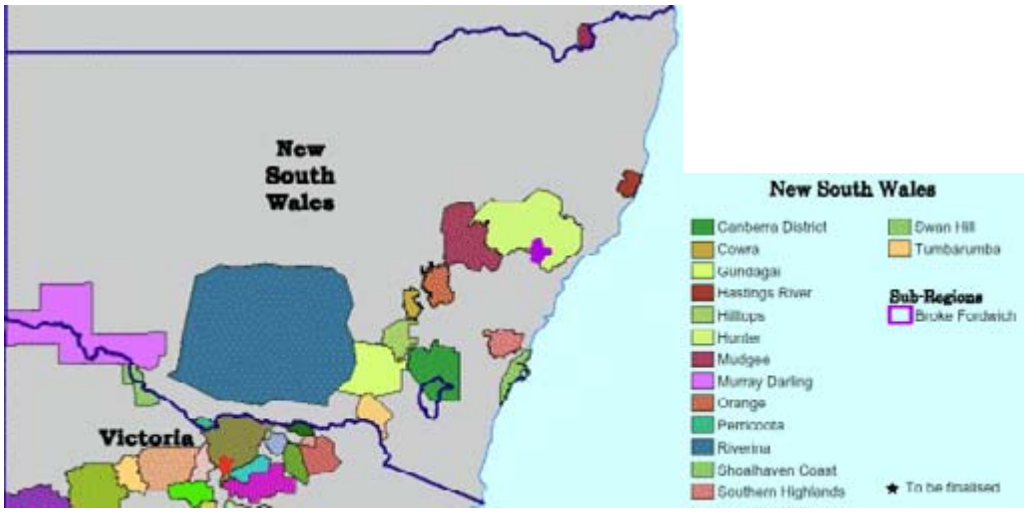


Figure 6-11 Wine regions of NSW

(Source: Australian Wine and Brandy Corporation)

The area of vineyards in NSW has increased from almost 29,000 ha in 1999 to over 37,000 ha in 2003, representing an increase in vine plantation area of almost 30%, as shown in Table 6-3.

Table 6-3 Area and production of vineyards in NSW

Year	Total area of vines*	% Change in area under vines	Grape production Total tonnes/year	Grape production for wine making Tonnes/year
1998	22,197		217,987	175,321 (80%)
1999	28,744	27.0%	303,501	270,236 (89%)
2000	32,269	12.3%	326,618	287,954 (83%)
2001	34,559	7.1%	348,709	323,687 (92%)
2002	37,381	8.2%	452,297	415,026 (92%)
2003	37,039	-0.9%	386,887	362,526 (94%)

*Total area of vines include area bearing grapes, area prior to collection year, and area during collection year

(Source: ABS Viticulture Survey, 2003 and ABS, 2004)

Market factors

Many growers are undertaking trials with sample loads of mulches containing RO. The ROU (2003) has compiled a review of relevant project reports, publications, and presentations on RO product application in viticulture, including a review of 27 field trials carried out across Australia. Two case studies presented at the end of this Chapter also provide information on the trial of RO in viticultural applications.

Growers in viticulture are very concerned with potential contamination of materials with phylloxera – they also want to conduct trials themselves prior to investing in products.

Phylloxera is an aphid that attacks the roots and vines and exposes them to disease. It is one of the biggest issues facing the viticulture industry. There are three phylloxera management zones in NSW (as shown in Figure 6-12), these are:

- Phylloxera Infested Zone (PIZ): Area that contains vineyards known to be with phylloxera or to have been infested with phylloxera;
- Phylloxera Exclusion Zone (PEZ): Area that has been established by historical information and/or survey program as not being infested by phylloxera, and is governed by appropriate regulations to control the movement of grapevine material, specified grape products, and vineyard equipment into the area; and
- Phylloxera Risk Zone (PRZ): All areas not defined as a PIZ or PEZ.

(National Vine Health Steering Committee, 2003)

Figure 6-12 Phylloxera management zones

(Source: Phylloxera and Grape Industry Board of South Australia)

Recent research activities by NSW Agriculture include investigating the survival of phylloxera during the composting process. This will now be extended as part of a quality assurance program for Sydney-based compost manufacturers which intend to target viticulture markets (NSW Agriculture). This approval enables further penetration in this market that has been identified as a big potential user of RO.

Products used in phylloxera exclusion zones in NSW need to be supplied by manufacturers holding a NSW Agriculture Compliance Agreement (CA-05) that demonstrate that products are free of phylloxera.

Product demand

No measurable demand for OHP was previously identified for the viticulture market, however a potential of 144,000 m^3/yr for mulch and 10,000 m^3/year for composts and soil conditioners was identified.

Results from the 2003 market survey indicate an existing OHP demand of at least 4,000 m^3/yr for composts and soil conditioners in the MNC.

Due to limitations in the survey results the demand for OHP in the viticulture sub-market in the GSR is unable to be calculated. However, as the viticulture industry is not prominent in the GSR area, there is unlikely to be significant OHP demand in this sub-market in the GSR.

6.4.6 Turf

The turf grass growing industry presents one of the lowest potential markets for RO products, particularly given the recent drought and water restrictions in place throughout NSW.

The majority of agricultural land held for turf grass growing is within Sydney and around surrounding areas, as shown in Figure 6-13. The location of turf farms chosen for reasons relating to irrigation, customers, and land availability.

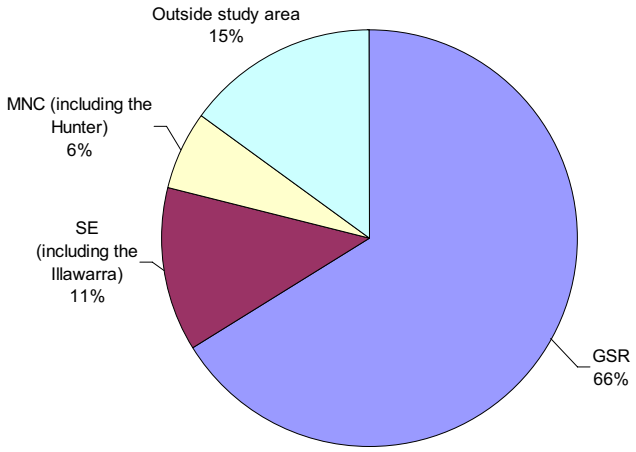


Figure 6-13 Location of the turf farms

(Based on land Agriculture Statistics for land holding of turf grass industry in NSW as reported by National Land and Water Resources Audit, 2001)

Market factors

Traditionally growers in the turf market have used poultry manure and chemical fertilisers to produce turf grass (NSW Waste Boards, 1999). Organic matter in turf farms is used to improve soil characteristics and encourage more extensive rooting and establishment of a variety of grass species (R Alexander and Associates, 2003).

The greatest challenge to the turf growing industry at present is the drought. A number of articles have recently been published by the media highlighting the extent of the problem for turf growers.

For example, Amy Bainbridge from ABC Canberra radio interviewed a representative from Canturf at Bungendore, the largest turf farm in the Southern Highlands on 11 March 2004. The interview revealed that the turf farm had experienced a 50 per cent drop in sales over the summer period, reportedly attributed mainly to the water restrictions in place in Canberra. Similarly, Melissa Fyfe from the Melbourne Age (May 2003) reported the financial difficulties facing turf growers in Melbourne struggling to maintain sales and maintenance of stock during the drought.

A further factor affecting the turf industry would be the potential impact from changes in urban density planning. As previously discussed in Chapter 5, the increase in urban density has lead to a greater demand for landscaping services, whilst there has been a simultaneous decrease in the amount of open space available in many urban areas. The potential impact of this change on the turf market is difficult to determine at present due to the impacts currently being felt due to the drought.

Product demand

The 1999 market studied had identified a limited potential to replace poultry manure and chemical fertilisers with RO products (about 4,000 m^3/year). Current demand for OHP in the turf industry is at least 1,500 m^3/year in the GSR, this number is however an underestimate due to

lack of valid survey data. Due to limitations in survey data no product demand or demand in the MNC and SE study areas can be provided in this report.

6.5 Potential demand

Future OHP (including RO) demand is recognised for the fruit and orchard and viticulture sub-markets of the intensive agriculture market segment. As outlined in the sub-market overviews above (and the case studies at the end of this Chapter), there have been a number of recent trials undertaken examining the potential use of RO in these sub-markets. The location of fruit and orchard growers and viticulture industry is also within close proximity to RO processors as outlined further below.

No significant additional potential demand is considered for the Turf industry due to the current financial difficulties faced by the industry as a result of the drought and water restrictions.

No significant additional potential is estimated for either the market garden or cut flower industry either due to the lack of available information.

6.5.1 Potential demand in the fruit and orchard sub-market

The 1999 market study identified potential demand in the fruit and orchard sub-market at 17,000 m^3/year (1,500 m^3 for mulches, 15,000 m^3 for composts and soil conditioners, and 500 m^3 for potting mixes).

Potential demand for RO in this target market segment is estimated at up to 19,300 m^3/year in the GSR. This estimate is based on an evaluation of current orchard production in NSW, assumed orchards with highest potential to utilise RO, and approximate application rate – as outlined below. No significant additional demand for the MNC and SE regions within the next three years is identified.

Potential demand for fruit and orchard production has been estimated using the following methodology.

Methodology to estimate potential demand in the fruit and orchard sub-market

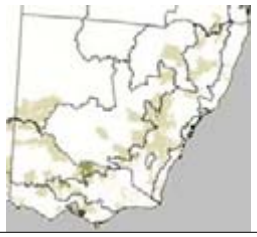
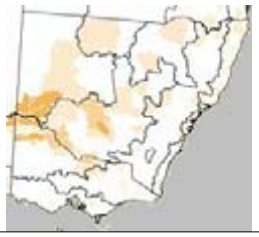
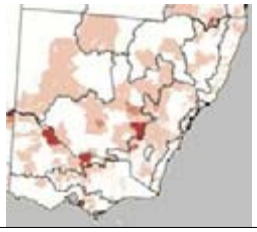
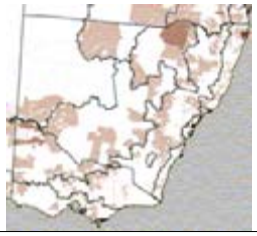
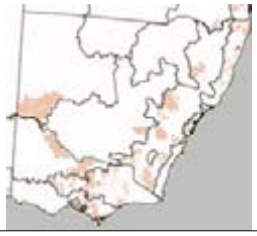
The ROU (2003d) recently undertook an evaluation of orchard activity in NSW to identify orchard production systems and regions in NSW with the highest potential for viable and significant use of RO products.

Criteria used to evaluate the value and potential of different fruit crops for potential RO application were as follows (ROU, 2003d):

- Gross potential affordability (in terms of gross margin per hectare);
- Area under cultivation;
- Soil improvement value;
- Potential for significant input substitution; and
- Proximity to composting facilities.

An overview of the RO application potential for various orchards in NSW as presented in the report is provided in Table 6-4.

Table 6-4 Overview of potential RO product applications for various orchards based on evaluation criteria

Fruit	Location in NSW	Measure	RO potential
All fruit	NA	Area (NSW): 46,982 ha (total)	Low to high
Pome fruit Apples, Pears, Nashi		Area: 2,520 ha Gross margin: $1,350 – $6,230/ha irrigated Crop value: High	Medium to high
Citrus fruit Oranges, mandarins, lemons, limes, grapefruit and other citrus		Area: 8,780 – 6,100 ha Gross margin: $1,860 – $21,130/ha irrigated Crop value: High	Low to medium
Stone fruit Peaches, nectarines, cherries, olives, plums, prunes, apricots and other stone fruit		Area: 8,240 – 4,120 ha Gross margin: Not supplied Crop value: Not supplied	Low to high
Other orchard fruit Avocados and mangos		Area: 480 ha Gross margin: $8,620 /ha irrigated for avocados Crop value: High	Low to medium
Nuts Macadamias, almonds, pecans, and other nuts		Area: 6,840 ha Gross margin: $3,510 /ha irrigated for macadamias Crop value: High	
Berries Blueberries, raspberries, and strawberries		Area: 481 ha Gross margin: $21,930/ha (for strawberries based on south-east QLD data) Crop value: High	Low to high
Tropical fruit Bananas, kiwi fruit, paw paws, and pineapple		Area: 2,820 ha Gross margin: -$1,090 – $1,070/ha (not irrigated for bananas) Crop value: Low	None

(Source: ROU, 2003d, location maps from National Land and Water Resources Audit 2001)

Following the overall evaluation of orchard types in NSW, identification of potentially viable and significant regions and fruit types concluded that the following fruit types and regions present the greatest potential for use of RO products at present in terms of affordability, scale, and access to viable market opportunities:

- Apples in the Murrumbidgee region (Tumut) and the Central West region (Orange and Cabonne); and
- Peaches and nectarines in the Murrumbidgee region (Tumut); the Sydney region (Gosford, Hawkesbury, Wollondilly, and Wyong); and the Richmond Tweed region (Ballina and Byron).

Using the above assessment criteria (affordability, scale, and access to RO markets), no potential RO applications are identified for the MNC.

Despite the Tumut area being the main growing area for peaches, apples, and nectarines, there are currently no major regional composting facilities processing recycled organics located in the Tumut area (refer Section 3.4). However whilst there are no major composting facilities in the area, Australian Native Landscapes operate a bulk holding and transfer facility in Tumut for organic products. The ANL Tumut operation receives organic materials from their other processing sites, which are then either refined (graded) at the Tumut facility, or bulk stored for transport to another location. Therefore, growers in the region could potentially obtain recycled organic products via the ANL facility in Tumut. Growers in the Tumut area may also be close to the organics processing facility located in the ACT (Corkhill Bros facility operating out of Mugga Lane Landfill, and Canberra Sand and Gravel).

Trials of the application of composted garden organics on local orchards in the Tumut area were conducted in 1999. Whilst the outcomes of the trial showed benefits for growing (including weed suppression and moisture retention), it was concluded that the current costs of applying composts to orchards in the area was prohibitive and a centrally located composting site for the Riverina was needed to make the process viable (Tumut and Adelong Time, 1999).

A survey undertaken by Tumut Council at the same time also indicated that although 74% of orchardists were interested in using composted products, only 40% of them indicated a willingness to pay for it (EPA, undated). Therefore this barrier would need to be overcome to ensure successful penetration of this potential market.

Based on the above assessment, additional potential is likely to exist mainly in the GSR, in the Gosford, Hawkesbury, Wollondilly, and Wyong areas for peach and nectarine production, and also outside the study area in the Tumut region. As the Tumut region is outside the study area, the potential demand for recycled organics in intensive agriculture is not included within the following assessment.

Estimates of potential RO demand for the fruit crops in the GSR (as outlined above) were calculated as follows:

- Determine area under cultivation in each region;
- Determine number of trees in area;
- Estimate plant separation distance; and
- Assume RO application rate of 10 cm (0.1m) for mulch or soil conditioner.

An application rate of 10 cm was assumed based on the recommended organic rate for composted mulches for orchards (NSW Agriculture, 1999). It is assumed that the mulch was spread over a 50 cm width beneath the trees once per year. This application rate is based on field trial results that showed application of mulches greater than 10 cm, although more effective

in weed suppression, can potentially promote vegetative growth resulting in reduced fruit yield and quality (ROU, 2003d). As yet, field trial results have not focused on determining an optimum mulching depth.

Similarly, an optimum application rate for soil conditioners is yet to be determined. For the purpose of this study, it is assumed that composts/soil conditioners are only used to a depth of 10 cm. This is a conservative estimate for the purposes of providing a preliminary estimation only. It is assumed that growers use only mulch or compost/soil conditioner – not both. This is because the benefits of mulching appear generally more well tested and understood then application of composts/soil conditioners. As yet optimal levels of application for both mulch and compost simultaneously are yet to be determined, and the affordability of both RO products as opposed to only one is not yet known. Therefore, it is assumed that 50% of farms use mulch, whilst the other 50% use compost/soil conditioner – this is also based on the survey results that show equal amounts of the two products are currently being consumed in this market.

An average planting density of 740 trees/ha (spacing of 3 m x 4.5 m) is assumed for peaches and nectarines based on the observed range of 500 – 1000 trees/ha in current peach and nectarine farms as reported by the ROU (2003d).

Using the above methodology, the potential for RO mulch and soil conditioner on nectarine orchards in the Gosford was calculated as follows:

- Mulch or compost/soil conditioner
  - Number of trees in region = 16,800
  - Area covered by trees = 23 ha (16,800 trees / 740 trees/ha)
  - Length of area to be covered with RO = 50,400 m (16,800 trees X 3 m between trees)
  - Width to be covered with RO = 0.5 m
  - Total area to be covered with RO = 25,200 m^2 (50,400 m x 0.5 m)
  - Depth of application = 0.1 m
  - Application volume = 2,500 m^3 (rounded to the nearest 100)

Potential demand for RO products will be maximised where all orchards identified above use RO for all plantings. A summary of maximum potential demand is provided in Table 6-5.

Table 6-5 Maximum potential RO application for apples, peaches and nectarines

Region	Area	Fruit	Number of trees*	Area (ha)	Potential for RO application (m^2)	Potential RO Volume (m^3)
GSR	Gosford	Nectarines	16,800	23	25,200	2,500
GSR	Gosford	Peaches	6,000	8	9,000	900
GSR	Hawkesbury	Nectarines	23,200	31	34,900	3,500
GSR	Hawkesbury	Peaches	29,200	39	43,800	4,400
GSR	Wollondilly	Nectarines	27,500	37	41,200	4,100
GSR	Wollondilly	Peaches	7,800	11	11,700	1,200
GSR	Wyong	Nectarines	8,600	12	12,900	1,300
GSR	Wyong	Peaches	9,700	13	14,500	1,400
Total						19,300

* Number of trees based on number of trees under cultivation in each statistical division as reported by the ABS for 2001

Table 6-5 shows that if RO were used by all orchards identified as having a high potential to use RO, the potential demand could be as high as 19,300 m^3 in the GSR.

Existing processors in the GSR could easily meet the potential demand of 19,300 m^3 /year for mulch or compost and soil conditioners (assuming an annual application of product).

The results of the latest market survey are inclusive about trends in the OHP use in the fruit and orchard growing sub-market. Therefore to estimate potential demand in this sub-market over the next three years, it is assumed that penetration of the market occurs at staged intervals as shown in Table 6-6. This assumes a limited introduction of RO and gradual increase of trial periods.

Table 6-6 RO potential in fruit and orchard production

Year	Demand as % of maximum potential demand	Potential RO demand for mulches or compost (m^3/year)
2004	10%	1,930
2005	20%	3,860
2006	30%	5,790

6.5.2 Potential demand in viticulture

Potential demand for RO in the viticulture has been estimated using the following methodology:

- Identify wine regions sufficiently close to processors in the GSR, MNC, and SE that could access RO products within an economic transport distance;
- Determine the land area per hectare to be covered by either mulch or soil conditioner, based on the assumed number of vines per hectare;
- Determine the application rate for mulch and compost/soil conditioner per hectare;
- Determine the area of vineyards that would potentially benefit from RO application and assume this to be the application sites.

Wine regions within economic transport distance to organics sources and processing facilities

Wine regions located within approximately 150 km (assumed to be the maximum economic transport distance) of processors located in the GSR, MNC, and SE regions are identified listed in Table 6-7. Table 6-7 also shows the approximate area under vines in each of these areas.

Table 6-7 Area covered by grape vines near RO processors

Region	Wine regions with access to organics processors and product markets	Area under grape vines (ha)*
GSR	Gosford	0.5
	Hawkesbury	2
	Sub-total GSR	2.5
MNC	Bellingen	1.2
	Cessnock	2058.5
	Coffs Harbour	2.5

Region	Wine regions with access to organics processors and product markets	Area under grape vines (ha)*
	Dungog	30.6
	Hastings	45.8
	Kempsey	8.3
	Maitland	37.7
	Muswellbrook**	1228.8
	Port Stephens	9
	Singleton**	895.9
	Sub-total MNC	4318.3
SE	Shoalhaven	23.5
	Wingecarribee	86.3
	Sub-total SE	109.8
Total		**4430.6**

* Total area of grapes in each statistical area as reported by the ABS for 2001

** Vineyards in Muswellbrook and Singleton could potentially be supplied with RO from processors located in the MNC, they are therefore included as potential users of RO even though they are located outside the MNC study region

From the information in Table 6-7, it can be seen that there is minimal potential for increasing the use of RO in viticulture in the GSR (only 2.5 ha under vines), however there may be potential to use further RO in viticulture located in the SE and MNC.

In order to estimate the potential demand in these areas it is assumed that mulches and composts would primarily be applied to vines where land is not irrigated to maximise the moisture retention benefits including reduced crop stress and increased crop growth and productivity (ROU, 2003b). Australian viticulture statistics indicate that in 2003, 32,743 ha of the total 37,039 of vineyard area in NSW (88% of land) are currently irrigated (ABS Viticulture Survey, 2003).

Assuming that RO would only be applied to 12% of vineyards (that are not irrigated) within the next three years provides a conservative estimate for potential RO demand. It is likely that RO would also be used in irrigated lands, however as yet the potential benefits of reduced irrigation water have not been proven (ROU, 2003b).

Therefore an estimate of the potential area where RO could be used is 500 ha in the MNC (12% of 4318.3 ha) and 13 ha in the SE.

Application rate for vineyards

A conservative vine-planting rate of 1,500 vines per hectare was assumed based on typical reported rates of 1,515 vines/ha in hot areas, and 1,666 vines/ha in cool areas (ROU, 2003b). A vine spacing of 1.75 m was also assumed, based on the same report.

The application rate of mulch was assumed to be 10 cm, spread over a width of 50 cm around the base of the vines. The application rate is based on field trial results that showed application of mulches greater than 10 cm, although more effective in weed suppression, can potentially promote vegetative growth resulting in reduced fruit yield and quality (ROU, 2003b). As yet, field trial results have not focused on determining an optimum mulching depth.

Similarly, an optimum application rate for soil conditioners is yet to be determined. For the purpose of this study, it is assumed that composts/soil conditioners are used in planting, applied

to a depth of 30 cm in the planting trench, which is also assumed to be 30 cm wide. According to the National Wine and Grape Industry Centre (2002), only low nutrient value composts should be used a the time of planting as the nutrient demands of the vines at this time are low.

Potential application area

The potential application area was determined by assuming a biennial application of mulches under vines to maximise the benefits of weed suppression, which have been shown to have a decreased effect after 6 – 12 months.

It was also assumed that composts and soil conditioners could be used in helping to establish new plating areas. The area under planting at any year is assumed to be only 10% of the vineyard area. This assumption is based on the historical information in Table 6-3 that shows an average increase in vineyard area of greater than 5% for all years between 1999-2002.

Therefore the assumed application rates were as follows:

- Mulch
  - Length of area to be covered = 2625 m (1,500 vines X 1.75 m between vines)
  - Width to be covered = 0.5 m
  - Total area = 1313 m^2 (2625 m x 0.5 m)
  - Depth of application = 0.1m
  - Application rate = 132 m^3/ha
  - Assuming mulch is only applied every 2 years, this would be equivalent to an average application rate of 66 m^3/ha/year
- Compost
  - Length of area to be covered = 2625 m (1,500 vines X 1.75 m between vines)
  - Width to be covered = 0.3 m
  - Total area = 788 m^2 (2625 m x 0.3 m)
  - Depth of application = 0.3m
  - Application rate = 236 m^3/ha

Using the above methodology, the estimated potential demand for mulches and soil conditioners is summarised in Table 6-8.

Table 6-8 Estimated RO potential for viticulture

Area	Size (ha)*	Area not irrigated (ha)	Potential mulch demand (m^3/year)	New Planting area (ha/year)	Potential compost demand (m^3/year)	Total potential RO (m^3/year)
MNC	4318.3	501	33,000	50	1,200	34,200
SE	109.8	13	1,000	1	-	1,000
Total	4,431	514	34,000	51	1,200	35,200

* based on ABS, 2001

6.5.3 Overall potential demand in the intensive agriculture market

Overall, the potential RO demand in the intensive agriculture market over the next three years is estimated as shown below.

Table 6-9 Overall potential demand in the intensive agriculture market (m^3/year)

Year	2004	2005	2006
GSR	1,930	3,860	5,790
MNC	34,200	34,200	34,200
SE	1,000	1,000	1,000

Overall demand is the sum of estimated total demand in fruit and orchard production and viticulture

Case Study: Intensive Agriculture - Application of Recycled Organics in Viticulture

Project: **Trial of composting grape marc and garden organics**

Project Participants: **Lowe Family Wines and Mudgee Shire Council**

Project Location: **Mudgee**

The Lowe Family Wine Company in conjunction with Mudgee Shire Council are currently undertaking a trial of composting of grape marc and garden organics at the Lowe Family Wine Company vineyard in Mudgee.

The aims of the trial are to:

- Minimise winery waste;
- Produce material that can be incorporated back in to the vineyard; and
- Improve the structure and sustainability of the soil.

Grape stems and marc from the winery are the main component of the compost, with the addition of garden organics from Mudgee Shire Council, and horse manure from a local stud. All the grape material included is from Phylloxera Exclusion Zones.

Composting methods

Harvested grape stems were used to form the base of the composting pile with an aim of increasing aeration through the pile due to their shape and low bulk density.

The marc (grape skins, seeds and pulp) was then dumped on top of the stems and kept moist using the winery wastewater. The winery wastewater is reasonably high in biological activity and nutrients helping microbial decomposition of organic matter in the pile. The temperature of the pile was monitored and recorded to determine the optimum times for turning. The pile was turned with a front-end loader as required to ensure the pile temperature remained below 70 Degrees Celsius.

Analysis

Analysis of materials will be carried out after composting is complete to assess the nutritional components and organic carbon levels. Petiole analysis will be done on the vines following application of the composted material in order to gauge its effect on vine nutrition.

Application

Once the composting process has finished, the piles will be left to cure and will be spread under the vines. The block of vines selected for treatment is an older vineyard that has some problems such as erosion, compaction, low levels of nutrients, soil biota and organic matter.

It is expected that the composted material will be spread after a systemic herbicide application. The material is expected to lower weed re-growth and reduce the need for a second herbicide application. It is also expected that there will be nutritional benefits from the compost for the vines and the soil will likely see an increase in soil biological activity.

Future development

The composting process is itself quite simple, however Lowe Family Wines are still fine-tuning the machinery used and order of operations. For example, they are considering the use of a permanent irrigation system and more efficient turning techniques for managing the compost pile.

Marty Gransden (Vineyard Manager) of Lowe Family Wines standing in front of the compost piles

Compost made from recycled organics during the trial

(Source: Lowe Family Wines)

Case Study: Intensive Agriculture - Application of Recycled Organics in Viticulture

Project: **Trial of composting grape marc and garden organics**

Project Participants: **Winter Hill Tree Garden, Australian Native Landscapes (ANL), Block 5 Kelvin Grove**

Project Location: **Cowra, NSW**

Winter Hill Tree Farm at Canyonleigh in the Southern Highlands, is a leading grower of advanced to semi-mature trees. As well as using recycled organics in their growing production system, Winter Hill Tree Farm offer a commercial organic compost spreading service.

Winter Hill has been working with a vineyard in Cowra to help assess the potential benefits of using recycled organics in viticulture. A trial was conducted in December 2003 of the application of mulch (supplied by ANL) that contained recycled garden organics to a sample test plot in the Cowra Vineyard.

The trial was conducted to access the effect of the mulch on:

- weed growth,
- water use and yield, and
- fruit quality.

The mulch was applied at the rate of approximately 60 cubic meters per acre (300 mm wide by 75 mm deep).

The affect of the mulch product was determined by comparing test results from the trial plot with an untreated (control) area. Gypsum blocks were used as standard measurements of soil moisture.

Testing revealed that the available moisture in the treated plot was at times up to twice that compared to the moisture level in the untreated area. The benefits of irrigation also improved in the test plot, with more water being available following irrigation compared to the untreated area.

One of the main findings of the trial so far has been the benefit of mulch application in improving the resistance of the vines to excessive heat. Temperatures above 40^{o}C were experienced between the 7th and the 22nd of February 2004. This led to leaf burn and partial defoliation across both the treated and untreated areas. The treated area however showed much greater resistance to the heat, with much less defoliation and less sunburn on the grapes.

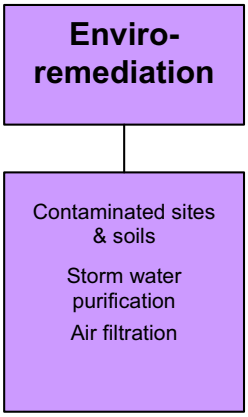
Results for testing weed growth and fruit yield and quality, whilst being positive and showing general advantages for the treated areas will be further confirmed by ongoing testing in 2004-2005.

Pictures courtesy of Winter Hill Tree Farm, pictures show an example of the mulch spreading service provided by Winter Hill Tree Farm.

(Source: Winter Hill Tree Farm, http://www.winterhill.com.au)

7 Enviro-remediation

7.1 Market overview



The enviro-remediation market includes the market segments of contaminated sites and soils, water purification and biofiltration.

Enviro-remediation describes the process by which micro-organisms are stimulated to rapidly degrade hazardous organic contaminants to environmentally safe levels in soils, sub-surface materials, water, sludges, and residues (ROU, 2002a).

For example organic composts can be used to degrade specific petroleum based contaminants and reduce the bioavailability of heavy metals (R Alexander and Associates, 2003).

The use of compost in these applications has been shown to be economically viable, and often allows for the treatment of soils onsite either in-situ or ex-situ (R Alexander and Associates, 2003).

Selected RO can be used on its own, or blended with other media such as sand and soil, to physically, biologically, and chemically purify or treat contaminated air, soil, and water:

- Physical – removal of suspended soils and sediments by filtration;
- Chemical – removal of dissolved contaminants through chemical processes;
- Biological – removal of contaminants through biological degradation by micro-organisms that convert them to plant nutrients and elements.

7.2 Factors affecting demand in enviro-remediation market

Factors affecting the enviro-remediation market include:

- Proving and developing enviro-remediation techniques;
- Cost of enviro-remediation projects in already developed areas; and
- Market knowledge.

7.3 Overview of current market demand and RO penetration

Use of recycled organics in enviro-remediation has been demonstrated to be effective through numerous trials, including those conducted under the “Healthy Parks and Gardens Program”. One of the aims of the program is to increase awareness of applications of RO for Local Governments; examples of where RO has been used in trials/remediation works through the program include using products containing RO for run-off control barriers during construction works, and to prevent erosion of banks and pollution of waterways by purifying stormwater runoff prior to discharge to stormwater systems (Source: Resource NSW).

7.3.1 Overall OHP and RO demand

No use of OHP or RO was identified in the previous market study, however the potential demand in this market was estimated at 100,000 m^3/year.

Use of OHP and RO is identified for the enviro-remediation market in this study. However the identified usage remains the smallest of all markets considered in this study at about 8,500m^3/yr for OHP, of which nearly 3,000 m^3 is RO. This demand was identified for the GSR, no demand was identified in the MNC and SE study areas.

7.3.2 Overall OHP and RO demand in sub-markets

Due to lack of survey data for sub-markets, demand in individual sub-markets (contaminated lands, storm water, air filtration) is not reported. Data for the enviro-remediation market is therefore presented in aggregate, however an overview of factors affecting demand in each sub-market is presented below.

7.3.3 Product demand

Demand for OHP products in the enviro-remediation market in the GSR includes demand for OHP mulches, composts and soil conditioners, and manufactured soils, as shown in Figure 7-1.

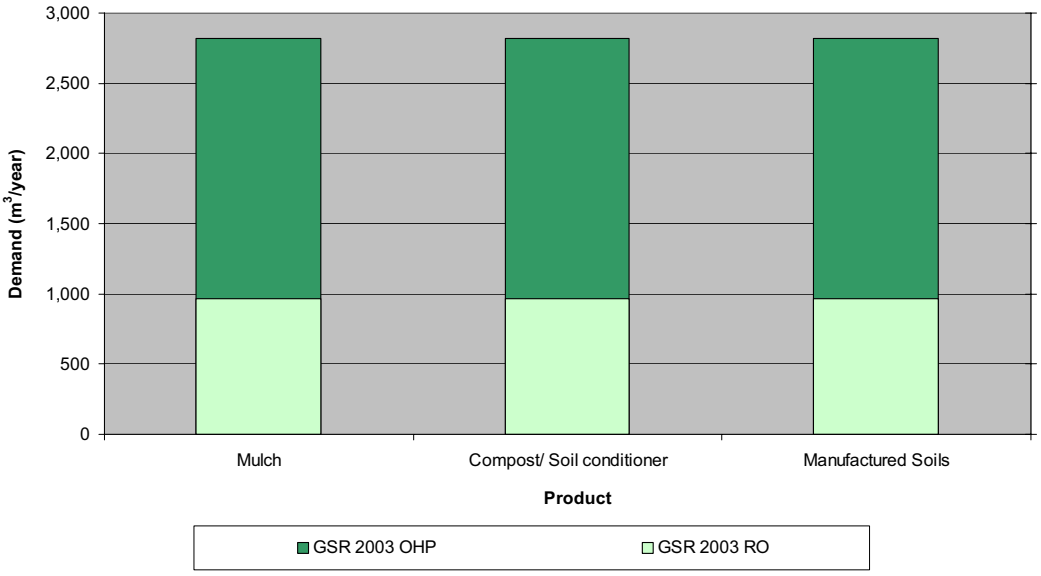


Figure 7-1 Product demand in the enviro-remediation market – RO content

7.4 Demand in sub markets

7.4.1 Contaminated sites and soils

NSW Waste Boards (1999) estimated that there are between 10,000 to 60,000 contaminated sites in Australia. Under Section 58 of the NSW *Contaminated Lands Management Act* 1997, the EPA (now part of the Department of Environment and Conservation) is required to make

available copies or details of actions taken under certain provisions of the act by the way of notices to the public.

The publicly available Contaminated Lands Record contains information on notices issued for:

- Declarations of land as investigation areas or remediation sites;
- Investigation orders;
- Remediation orders;
- Site audit statements;
- Existence of voluntary investigation;
- Remediation proposals agreed to by the EPA; and
- Required maintenance of remediation action.

As at Thursday, 13 May 2004 there were 568 notices in the record relating to 212 sites on the EPA database. These records however do not include Section 60 notifications (under the *Contaminated Lands Management Act* 1997) which are records of notification of contamination provided by owners or polluters of land when they become aware that contamination of land that they own or polluted poses a significant risk of harm to human health or the environment. These notifications are not included in the database as they are not considered an accurate indicator of the EPA's regulatory involvement with contaminated sites under the *Contaminated Lands Management Act* 1997.

Therefore, the number of significant remediation works in which the EPA is involved is approximately 212, however the actual number of remediation sites in NSW would be significantly higher than this.

Market factors

The main factors affecting the demand for organic materials in remediation works are the cost of remediation works, the distance between the contaminated site and sources of remediation materials, choice of remediation technology dependant on the level of contamination, and the size and required completion time of the remediation works.

Since the previous market study, the Australian Government has released a National Environment Protection Measure (NEPM) that deals specifically with site contamination. The National Environment Protection (Assessment of Site Contamination) Measure was made by the Environment Protection and Heritage Council in December 1999 and commenced in the same month.

One of the main objectives of the NEPM is to provide adequate protection of health and environment through “the development of an efficient and effective national approach to the assessment of site Contamination”. Adoption of the NEPM in NSW has been achieved through Section 105 of the *Contaminated Lands Management Act* 1997 which allows for the NSW EPA to make or approve guidelines associated with the Act.

The hierarchy of options for site clean-up and contamination in Section 4(16) of the NEPM includes a preference for on-site treatment of contamination. Increased on-site treatment in preference to off-site treatment may potentially increase demand for recycled organic materials. Typical on-site treatments that can potentially utilize RO include land farming, windrows, and aerated static piles (as outlined in NSW Waste Boards, 1999).

7.4.2 Stormwater purification

Stormwater can be polluted from litter, chemical pollution from spills, motor vehicles, and fertiliser runoff, and "natural" pollution such as organic leaf litter and animal droppings. Filtering off these pollutants out of the stormwater stream prior to discharge to natural waterways or mixing with groundwaters is important to maintain the quality of waterways.

Increasing urbanisation in city centres has reduced the amount of open space and grassed areas, resulting in greater ground coverage by hard surfaces (such as pavements and driveways). The reduced infiltration of rainwater to soils thus results in an increase in runoff, and higher potential for transportation of pollutants into our waterways. It also changes the timing of flows in creeks, rivers, and receiving waters with greater occurrence of high flow events due to the reduced lagtime between rainfall occurring and runoff reaching waterways. Therefore incorporating sound stormwater management principles into urban design is important to maintain the health of the surrounding aquatic environment.

Market factors

On 24 April 1998 the Environment Protection Authority (EPA) issued a legal direction under section 12 of the *Protection of the Environment Administration Act* requiring councils to prepare stormwater management plans. Development of stormwater management plans will address how to manage stormwater flows and pollution in order to protect natural waterways and environmental health.

As part of the drive to protect waterways and improve stormwater management a Stormwater Trust has been established. Administered by the NSW EPA (now part of the Department of Environment and Conservation), one of the functions of the trust is to allocate grants and provide technical assistance for development of stormwater improvement projects. Grants can be allocated for strategic and management projects, structural and non-structural projects. Up to 5 grant schemes have been initiated by the trust, the last grant (announced on 18 August 2003) was for strategic projects. Stage 4 grants announced 19 March 2002, offered 75 individual grants of between $35,500 and $961,100, totalling $15 million.

New concepts in stormwater management combine the principles of infiltration, distributed storage and treatment as well as delayed transport of stormwater runoff (ROU, 2002b). Technologies and products available for stormwater management and the potential use of RO, as reported by the ROU (2002b) include permeable pavers, biofiltration through active organic media, and the use of filter bales containing organic media.

Figure 7-2 Permeable pavers, Smith St Manly

(Source: ROU, 2002b)

Figure 7-3 Infiltration basin in Annandale

(Source: NSW EPA)

Figure 7-4 Filter bales and socks

(Source: CORE, May 2002)

7.4.3 Air filtration

Biofilter air purification is used to remove odours, generally from manufacturing processes such as food and pet food processing, enclosed composting facilities and rendering works (NSW Waste Boards, 1999). They can also be used at sewage treatment works as shown in Figure 7-5.

The air is passed through a bed containing an organic material. The micro-organisms in the organic material trap and consume the volatile organic odours.

Figure 7-5 Odour biofilter at Burwood Beach Waste Water Treatment Plant

A soil bed biofilter is used as a final stage odour cleaning step at the Hunter Water's Burwood Beach Waste Water Treatment Plant. The organic filter consists of layers of gravel, soil, peat, and bark chips. Similar technology is also used at the Hunter Water treatment plants in Toronto and Edgeworth.

(Source: Hunter Water, undated)

Market factors

Biofilters can consist solely of recycled organics such as compost, bark chips, and sludge, or they can be a composite with other organic materials such as woodchips.

Biofilters generally consist of 1.5 – 2.0m of stable organic material laid above a liner over the air exhaust system. The volume of organic material required in biofilters varies according to the application from as little as 1-5 m^3 to up to 1000 m^3, but generally filters using greater than 1000 m^3 would be considered a large application. The replacement time for filters varies between 1 to 2 years up to 5 years.

Since the previous market study, the use of biofilters has increased with important applications including:

- Biofiltration of air from the Bedminster composting aeration bays;
- Biofiltration of air from the EarthPower Technologies food processing plant; and
- Biofiltration of waste air from the Rethmann Organic Recovery Resource Facility.

7.5 Potential demand

Potential demand for RO in the enviro-remediation market is identified for stormwater and biofilter applications as outlined below.

7.5.1 Potential demand for stormwater applications

Potential demand for recycled organics in stormwater applications has been estimated based on demand for:

- Filter bales that could be used in major road works;
- Organic media demands for new kerbside infiltration systems;

- Filter bales for use at construction sites for new housing developments;
- Council stormwater projects initiated under the Stormwater Trust Grants Scheme; and
- Potential road drainage works along Sydney's major beaches.

Calculations of potential demand do not include allowance for replacement of recycled organics in the above applications due to uncertainty associated with the product lifespan. A generic lifespan can not be specified as it is dependant on the type of system, flow rate and volume of stormwater, pollutant load, and other design factors (ROU, 2002b).

Table 7-1 Estimated demand potential for stormwater applications

	OHP (m^3/year)				RO (m^3/year)			
	2003	**2004**	**2005**	**2006**	**2003**	**2004**	**2005**	**2006**
Filter bales for road construction works	570	330	270	20	280	160	130	10
Kerb infiltration systems	5,960	3,420	2,830	190	2,980	1,710	1,410	100
Housing construction projects	8,930	9,180	10,590	11,270	4,470	4,590	5,300	5,630
Stormwater applications along beaches	1,800	1,800	1,800	1,800	900	900	900	900
Council stormwater projects under Trust funding grant	560	560	560	560	280	280	280	280
Total (m^3/year)	**17,810**	**15,280**	**16,040**	**13,830**	**8,900**	**7,640**	**8,020**	**6,920**

The methodology employed for each estimation is outlined further below.

Major road works that could potentially use RO

Major RTA roadworks that could potentially utilise RO in construction and landscaping works were identified by NSW DEC in the Draft "*Assessment of Demand Potential for Recycled Organics Products in NSW: Major Developments Market Sector*" (2004a), as outlined in Section 5.5. It is assumed that these same projects present a significant potential for use of RO filter bales for control of run-off during construction works, however only projects with a known start date were taken into consideration.

A summary of the length of road works is shown in Table 7-2 below.

Filter bales that could potentially be used in major road works

Demand potential was estimated assuming a filter bale volume of 0.095m^3, with an average RO content of 50%[4]. It was assumed that 1 filter bale was allocated to every 10 m of road during construction works. The timing of construction works was assumed to take place evenly over the project duration, in accordance with the methodology applied by NSW DEC (2004a).

[4] Filter bale size based on average of available filter sock (1.8m x 0.16m x 0.3m) and filter bale sizes (0.605m x 0.485m x 0.46m and 0.605m x 0.485m *0.22m) from ANL and Soilco product manufacturer specifications. An RO content of 50% is assumed as the proportion of recycled organics in enviromedia.

Table 7-2 Summary of major NSW RTA roadwork projects

RTA Project	Region	Length of road (km)	Start	Finish
Western Sydney Orbital	GSR	40	2003	2006
F3 to Braxton	MNC	39		
Penrith to Orange upgrades	GSR	10		
Liverpool to Parramatta transit way	GSR	20		
Pacific Highway - Karuh to Bulahdelah upgrade	MNC	34		
F3 widening	GSR	6.8	2003	2004
Princes Highway - North Kiama Bypass	SE	7.8	2002	2005
Pacific higway - Bonville deviation	MNC	9.6	2003	2008
Pacific Highway - Karuh Bypass	MNC	9.4	2003	2004
Cowpasture road upgrade	GSR	10		
Bangor Bypass	GSR	6.8	2002	2004
Newcastle inner city bypass	MNC	6		
Central Coast - pacific highway	MNC	5	2003	2004
Penrith to Orange - Leura to Katoomba	GSR	5	2003	2006
Pacific Highway - Coopernook bypass	MNC	4.2	2003	2004
Hoxton park upgrade	GSR	5	2003	2005
Penrith to Orange - Lawson upgrade	GSR	5		
Pacific Highway - Taree to Coopernook	MNC	7.5	2003	2006
Windsor Road upgrade - Seven Hills to Windsor Road	GSR	5	2003	2006
Windsor Road upgrade - Roxborough road to showground road	GSR	5	2003	2006
Central coast - the entrance road	MNC	5		

Organic media demands for new kerbside infiltration systems

Kerbside infiltrations systems allow for capture and remediation of stormwater runoff from roads prior to release to groundwaters and waterways.

Installation of kerbside infiltration systems on existing roads would involve significantly higher costs compared to if the systems were installed in new roads. However, it should be noted that installation on existing roads in areas where stormwater pollution is a problem is still a potential where funds are made available.

Potential demand for kerbside infiltration systems was therefore estimated based on assuming installation along new roads or where roads were being upgraded in the RTA developments as outlined above. Typically in kerbside applications an organic media can be used to underlay grass and act as a filter prior to entrance to the main water channel, it may also be used to fill between the road base and water channel (where an artificial structure is used).

Demand was therefore estimated assuming that an average area of 0.1 m^2 was to be covered by enviromedia along each length of road based on a conservative cross sectional area of 0.3m

x 0.3m to be filled, with no additional allowance for any backfilling. Again, an average RO content of 50% was assumed for the organic media.

Filter bales for use at construction sites for new housing developments

Sandbags and straw bales are used at housing construction sites as tools for stormwater management. With an increasing shortage of sand in the Sydney region, the potential to replace sandbags with filter bales containing recycled organics is likely to increase.

Potential demand for filter bales at new housing sites was estimated based on an assumed use of 2 filter bales at each new housing development. The filter bales were again assumed to have a volume of 0.095m^3, with an average RO content of 50%.

The number of new housing developments for 2004-2006 was estimated based on historical ABS data. Future construction works were estimated using a 3-year moving average for the number of dwellings for which construction was started in each previous year. A 3-year moving average was used in order to "flatten out" the apparent change in construction activity caused by the Sydney Olympics.

Table 7-3 New dwellings in NSW by construction stage

Status of Construction	1999/00	2000/01	2001/02	2002/03	2003/04	2004/5	2005/6
Commenced	50,184	32,580	46,458	46,852	48,159	55,580	59,109
% Change in commenced	3.8%	-35.1%	42.6%	0.8%	2.8%	15.4%	6.3%

(Source: ABS, 2004)

Council stormwater projects initiated under the Stormwater Trust Grants Scheme

Almost $15 million was awarded in 2002 under Stage 4 of the Stormwater Trust grants scheme. A review of projects that received funding under the scheme was undertaken to identify those that could potentially either use RO in new urban projects, or use RO in demonstration and trial projects for stormwater management.

Three criteria were used to identify potential projects:

- Funding greater than $100,000; and
- Nature of the project (i.e. projects focused more on strategy and management initiatives were identified as less likely than those looking to develop demonstrate sites and installation of infrastructure to deal with pollution hot spots); and
- Proximity to composting sites

Of the 75 projects granted funding, it was determined that 29 of these had the potential to utilise RO material in some application. Of these 29, 27 are located within the GSR, MNC, and SE study regions.

Table 7-4 NSW Council Stormwater Projects with potential RO demand

	Number of projects	Potential use per project (m^3)	Potential demand (m^3)
GSR	15	60	900
MNC	9	60	540
SE	3	60	180
Total	29		120

The timing of the projects was assumed to occur evenly over the 2004-2006 period, therefore demand would be evenly spread over this period.

Due to uncertainty surrounding the details of each project, an average demand of only 60 m^3 of organic material was assumed, with 50% RO content (30 m^3). This is a conservative estimate based on a typical amount of material that may be required for projects such as a stormwater infiltration basin (requiring about 30 cm of organic material to cover a basin area of 20 m x 10 m). In practice, depending on available funding and resources larger projects may utilise significantly more organic material than this.

7.5.2 Potential demand — biofilters

Potential demand for biofilters is dependant on the establishment of new industrial processing facilities, or replacement of non-recycled materials in existing filters.

The volume of RO in biofilters is small compared to other potential markets for development, particularly as the RO in biofilters may only be replaced every few years.

Based on a review of major new composting and industrial developments proposed for the GSR, MNC, and SE within the next 3 years, future demand for RO in biofilters is estimated at 5,000 m^3 in the GSR, and 1,000 m^3 in the SE. These demands will be one off events in 2004 (assuming the biofilters are not replaced again until after 2006).

7.5.3 Overall potential RO demand in enviro-remediation market

Estimated total annual current demand for RO in enviro-remediation applications is approximately 3,000 m^3 across the three regions analysed in this report.

The potential demand for RO applications in the Sub market Contaminated Sites and Soils are very limited and difficult to quantify. Numerous projects exist where it could be applied yet the costs of RO are not justifiable. Based on this, an estimated annual potential demand of a nominal 1,000 m^3 is forecast for the next three years.

There are a number of different opportunities for RO applications in addressing Stormwater Purification including filter bales for road works and housing construction, kerbside underground filtration systems, and road drainage and stormwater projects. Estimated annual potential demand for RO applications in Stormwater Purification is estimated at about 9,000 m^3 over the next three years.

RO applications for Air Filtration are limited as the volumes are small for each application and are not replaced frequently. Based on these assumptions, the annual potential demand is 2,000 m^3 for the next three years.

Total potential demand for RO applications in the enviro-remediation market are approximately 12,000 m^3 per annum for the next three years. This will be concentrated in the GSR however some activity will occur outside where major coastal townships occur.

Case Study: Enviro-remediation – Biofiltration of landfill gas

Project: **Trial Biofiltration of Landfill Gas Using Recycled Materials**

Project Participants: **Bankstown City Council, University of NSW, GHD Pty Ltd, DEC**

Project Location: **Kelso Landfill**

The basic principle of biofilters is to channel gas to a single treatment location (or locations) by the creation of a mound topography, good capping works, and a network of gas drainage trenches installed under the final capping layer. The topography and landfill cap is formed such that the only outlet for landfill gas is at the peak of the mound (or peaks). A biofilter formed of compost and shredded wood is placed at the peak of the mound, and landfill gas flows through due to natural convective forces as well as gas build up (pressure) within the landfilled waste. Natural bacteria within the compost oxidises the methane as well as other contaminants within the landfill gas to form carbon dioxide and water.

Kelso Landfill

The trials are being performed by the University of NSW and GHD Pty Ltd through a Research Development Grant provided by DEC. The trial gas management system currently under construction, will comprise the following:

- 2 biofiltration test beds, each 6 m x 6 m;
- A passive landfill gas drainage system for each biofiltration bed, draining ~ 800 – 1000 m^2 of landfill. The gas drainage trenches will be constructed beneath the existing landfill cover layer. The trenches will be ~ 600 mm wide by 600 mm deep and incorporate flexible slotted polyethylene pipework to direct gas flow to the biofilter.

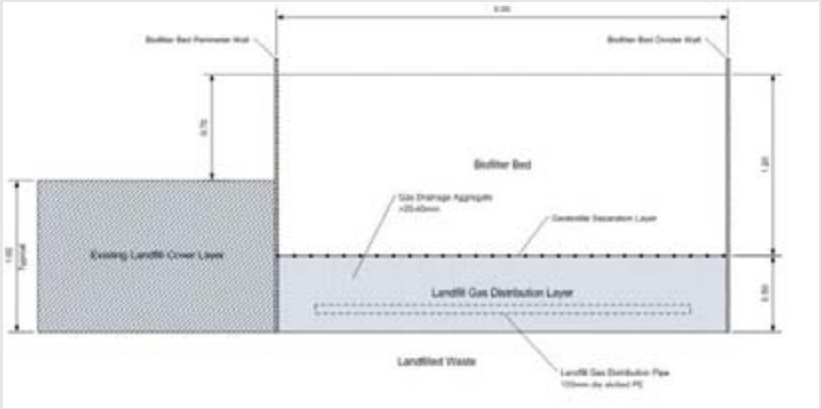
The biofiltration beds will comprise the following:

- 8 different biofilter bed materials in discrete areas;
- A 500 mm thick gas distribution (under drainage) layer, which includes a pipe distribution network located within the drainage layer (to improve the distribution of the landfill gas). It is proposed to use crushed concrete as the drainage aggregate; and
- Monitoring pits located at the corner of each bed – to allow the quantity and characteristics of the landfill gas from the drainage system to be determined.

The biofilter beds will be contained and separated using a framework constructed of timber and corrugated polycarbonate (or galvanised metal) sheeting.

Part of the research objectives is to understand which biofilter material performs best, it is proposed that a range of materials will be used in the biofiltration beds. These materials will be based on various compost and shredded wood mixes, and the performance of each bed monitored by measuring gas flow, pressure, gas composition, and surface emissions. It is also proposed to add shredded tyres to selected beds to provide an inert, stable substrate for the micro-organisms to grow on.

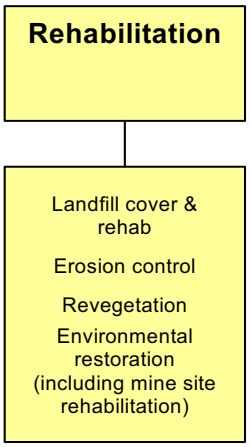
Further information regarding the landfill gas biofiltration trial is available in the project design report Biofiltration of Landfill Gas Using Recycled Waste Products prepared by the University of NSW, School of Civil and Environmental Engineering & GHD Pty Ltd, dated April 2004.



Typical cross-section of a biofilter

8 Rehabilitation

8.1 Market overview



Demand for OHP and RO for rehabilitation works including restoration and preventative maintenance of degraded or potentially degradable lands is considered within this market.

Rehabilitation sub markets are analysed under the categories of;

- Landfill cover and rehabilitation;
- Erosion control;
- Revegetation; and
- Environmental restoration (including mine site rehabilitation) and land reclamation.

Product demand and development in these markets is still considered as emerging, however the benefits of using RO are becoming more widely known and this has been reflected in the increased in demand and further increase in projected potential demand.

8.2 Factors affecting demand in the rehabilitation market

Use of recycled organics for rehabilitation works has been demonstrated to be effective through numerous trials, including those conducted under the “Healthy Parks and Gardens Program”. One of the aims of the program is to increase awareness of applications of RO for Local Governments, examples of where RO has been used in trials/remediation works through the program include:

- Use of mulches and enviro-media for landfill rehabilitation and erosion control at Tempe Reserve – Marrickville Council; and
- Use of mulches and enviro-media for water purification and erosion control at Salt Pan Creek Landfill – Canterbury Council.

There are many other ongoing projects currently examining the potential benefits of using RO in rehabilitation markets. Examples of projects currently being undertaken in this area include the use of recycled organics in catchment management, DEC and the Department of Primary Industries are examining desirable product specifications of composted materials for use to control water runoff and soil erosion on degraded sites.

8.3 Overview of current market demand and RO penetration

8.3.1 Overall OHP and RO demand

Overall existing demand for OHP in the rehabilitation market is estimated at 87,000 m^3/year, with demand for RO products constituting about 70,000 m^3/year (65% of estimated OHP demand).

OHP demand for rehabilitation works is spread throughout the GSR, MNC, and SE (as shown in Figure 8-1). There is also current demand for outside the study area for rehabilitation works including minesite rehabilitation.

The previous 1998 market studies had identified a potential demand of almost 240,000 m^3/year for the GSR and surrounding 100 km alone, therefore the current usage profile is lower than the forecast made in 1998 for the GSR.

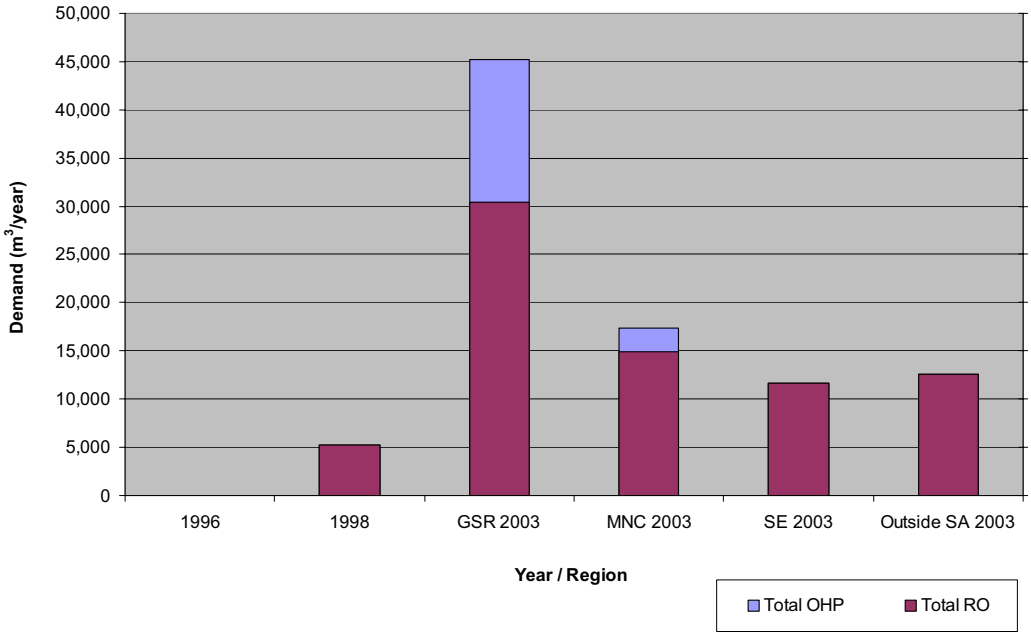


Figure 8-1 Demand in existing Rehabilitation market

8.3.2 Overall OHP and RO demand in sub-markets

Due to lack of survey data for sub-markets, demand in the individual rehabilitation sub-markets is not reported. Data for the rehabilitation market is therefore presented in aggregate however an overview of market factors in each market segment is presented below.

8.3.3 Product demand

Mine site rehabilitation has consumed significant amounts of both mulch and soil conditioner in both the southern coastal parts of NSW and the Hunter region. There is limited opportunities for rehabilitation in the GSR and is contained mainly within the areas of landfill rehabilitation.

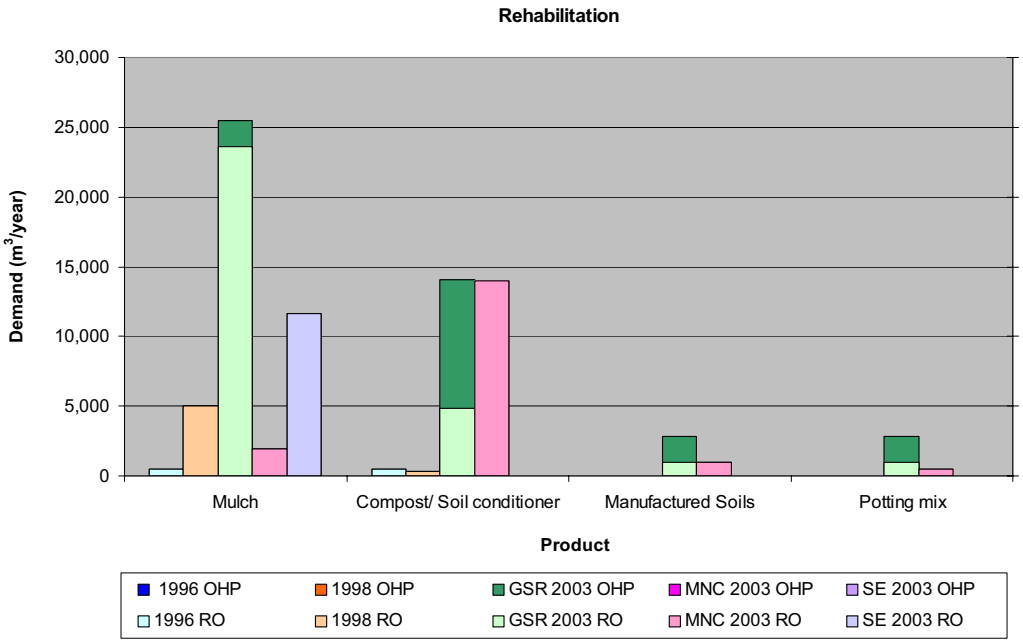


Figure 8-2 Product demand in the rehabilitation market

8.4 Demand in sub markets

8.4.1 Landfill cover and rehabilitation

There are many landfills within the study area that either currently require, or will require rehabilitation in the near future. There are approximately 85 licensed landfills in NSW, as shown in Table 8-1, there are also a number of unlicensed landfills that are not listed.

Table 8-1 Licensed landfill facilities in NSW

EPA region	No. of facilities licensed
South Coast—outside Extended Regulated Area	7
Hunter—outside Extended Regulated Area	13
Sydney—outside Sydney Metropolitan Area and Extended Regulated Area	5
North Coast	10
Central West	13
Northern Tablelands	12
Southern Tablelands	11
Murray	6
South West	8
Total	**85**

(Source: NSW EPA, 2002)

According the NSW EPA Environmental Guidelines for Solid Waste Landfills (1996), capping of landfills should commence within 30 days of completion of landfilling in that area. Final capping should consist of five parts, with the last layer being a revegetation layer of depth not less than 100 centimetres.

Other than the final revegetation layer, RO products (or blends including RO) could potentially be used for alternative daily cover or intermediate cover. Daily cover is used to cover landfilled waste at the end of each day; a minimum of 15 centimetres of cover is required in accordance with the guidelines. Intermediate cover should be applied to a depth of 30 cms over waste surfaces that will be exposed for more than 90 days.

RO products suitable for daily landfill cover should include those with little or no market value. For example, the new UR3R Global Renewables plant at Eastern Creek, once operational will be producing both a marketable organic growth media stabilised to meet Australian Standards (for wholesale/retail sale), as well as lower grade material that will be used as an alternative daily cover for landfill operations at the adjoining Eastern Creek Waste Management Facility (NECS, 2002).

Competing materials for use of alternate daily may include site soils, and excavation materials. Use of RO materials for daily cover is subject to successful demonstration that the materials meet the performance requirements as specified in the NSW EPA Environmental Guidelines for Solid Waste Landfills (1996), and granting of approval by the EPA. Advantages of using RO products could include acting as a “biofilter” to reduce landfill odours, using a material that is readily available on site (for example where garden organics are collected at site) as opposed to site soils or other suitable materials.

8.4.2 Erosion control

The EPA in the NSW State of the Environment Report 2003 has reported accelerated rates of erosion in areas of NSW. Whilst the costs of restoration works associated with erosion have not been quantified, they are estimated to be very high (NSW EPA, 2003). Soil erosion leads to substantial land degradation through:

- Loss of topsoil, organic matter, and soil nutrients from the surface;
- Degradation of soil structure; and
- Decreased water storage capacity.

The use of OHP to address these successfully address these factors has been well documented. For example research has shown that the use of compost as a soil blanket to mulch slopes or use as a berm is economically competitive yet more effective then typical technologies such as sediment fencing, straw bales, and woven blankets (R Alexander and Associates, 2003).

Composted mulch applied to slopes can reduce soil erosion by more than 90% on slopes of up to 15%. It also reduces runoff by more than 70%, therefore protecting soils from the erosive forces of wind and rain (NSW Department of Environment and Conservation, Fact Sheet b).

Extent of erosion in NSW

The extent of erosion in NSW, although not definitely known is linked to changes and intensity in land use. There are different types of erosion evident in NSW, the main ones being sheet and rill erosion and gully and riverbank erosion.

Figure 8-3 shows the estimated mean annual sheet and rill erosion rates for NSW. It is evident that high to very high erosion rates occur in large parts of the Western Slopes, Monaro, Hunter Valley, Northern and Southern Tablelands, and north-western NSW.

From the data on which Figure 8-3 is based, the NSW EPA (2003) estimated that approximately 9% of NSW experiences high to very high sheet and rill erosion, with about 17% of the area eroding at a greater rate than the State average of 2.5 t/ha/yr.

Wind erosion is also a problem in semi-arid and arid areas of NSW. Wind erodibility of soils in NSW has been estimated by the Department of Land and Water Conservation and reported in the 2003 NSW State of the Environment Report, as shown in Figure 8-4. Figure 8-4 shows areas where land is susceptible to wind erosion if the soil is dry and exposed, it does not take into account site conditions such as climate, vegetative cover, or surface roughness (NSW EPA, 2003).

The location of areas highly affected by erosion (as shown in Figure 8-3 and Figure 8-4) indicates that there may be limited potential for using OHP (and RO products) to help control erosion in these areas. Areas highly affected by erosion are generally located over 150 km from major sources of processed organics, except for some areas in the Hunter located within 100 km of compost and related facilities located in the Central and MNC (including Newcastle and Port Macquarie).

The National Land and Water Resources Audit (2001) previously estimated the extent of gully erosion in NSW. The audit estimated the area affected by moderate gully erosion was about 25,000 km^2 in north NSW, and about 50,000 km^2 in south NSW. An area of approximately 2,000 km^2 was estimated to be affected by high gully erosion in north NSW, and just over 4,000 km^2 in south NSW.

As a measure of streambank erosion, the audit examined the proportion of native vegetation removed along stream banks in river basins with intensive agriculture. The audit estimated that approximately 60% of stream banks in these areas of NSW had been cleared of native vegetation.

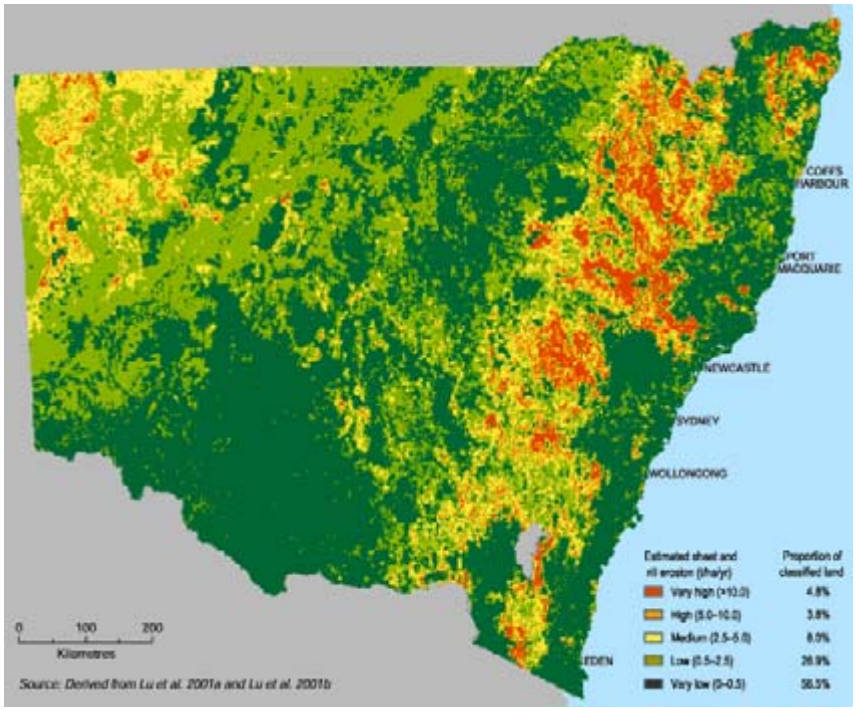


Figure 8-3 Estimated mean annual sheet and rill erosion rates in NSW

(Source: NSW EPA, 2003)

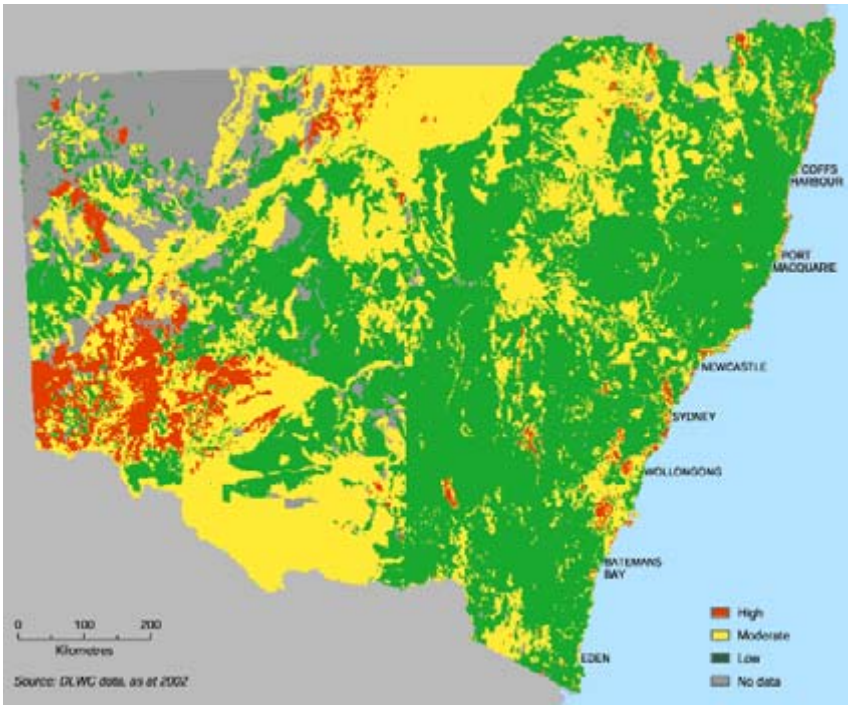


Figure 8-4 Wind erodibility of soils

(Source: NSW EPA, 2003)

8.4.3 Environmental restoration and land reclamation

Land degradation has been identified as the most serious land use affecting the state of the environment in NSW, with most land degradation being related to soils (NSW EPA, 1997).

The application and use of RO products could potentially assist in addressing some of the major causes of land degradation including:

- Soil erosion (as outlined in Section 8.4.2);
- Soil acidification;
- Acid sulphate soils;
- Chemical alterations of soil or produce; and
- Associated water quality problems.

Expenditure on land degradation protection or prevention and land rehabilitation in the agriculture and mining industries is extensive.

In 1996-97, the Australian agriculture industry alone spent approximately $96.4 million on land degradation protection or prevention (ABS, 1999)[5,6].

[5] ABS surveys on environmental protection expenditure after 1996-1997 was limited to mining and manufacturing.

[6] Agricultural industries contributing to this expenditure include fruit growing, vegetable growing, grain growing, sheep, beef, pig, and cattle farming, sugar can growing, cotton growing and other agriculture included in ANZSIC Codes 0141-2, 0151-3, 0159, 0169

ABS statistics indicate that in 2000-2001, approximately 65% of businesses in the Australian mining industry had current environmental protection expenditure (such as payments to government, private organisations, and other expenses). Of the $284 million associated with current expenditure, $98 million was due to minesite rehabilitation; a further $7.3 million dollars was spent on capital works for mine site rehabilitation (ABS, 2002).

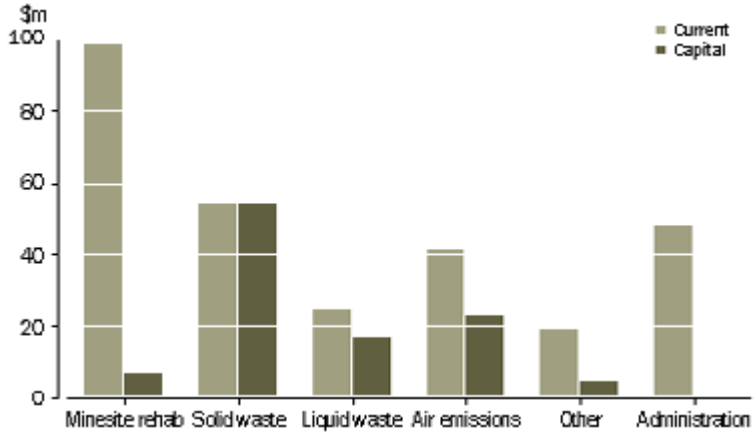


Figure 8-5 Environment Protection Expenditure, Mining Industry 2000-2001

(Source: ABS, 2002)

In 2000-2001, there were approximately 35,000 ha of mine site land under rehabilitation in Australia, with 39,347 ha of newly disturbed land, and 12, 695 ha of land area completely rehabilitated (ABS, 2002).

Market factors

One of the main factors affecting the market for RO products in land restoration and reclamation projects is the availability of materials in proximity to the rehabilitation sites, and the cost of transportation and application to these areas.

For example, only about 2% of biosolids produced by Sydney Water are used beneficially for land reclamation compared to about 81% of biosolids from Hunter Water (Sydney Water, 2003; Hunter Water, 2003). The closer proximity of Hunter Water to mine sites requiring rehabilitation compared to Sydney Water and other organics processing facilities, and the low cost and availability of biosolids from the Hunter Water sewerage treatment plants makes them a preferred organic source for this type of rehabilitation.

Figure 8-6 Stabilised overburden slopes at Macquarie Coal, Teralba

(Source: Hunter Water, 2000)

Figure 8-7 Trial native vegetation plantation at South Bulga Colliery

(Source: Hunter Water, 2000)

8.5 Potential demand

Potential demand for RO in the rehabilitation market is estimated for landfill cover and rehabilitation, and for erosion control and land restoration and environmental rehabilitation.

8.5.1 Potential demand for landfill cover and rehabilitation

Potential demand for recycled organics in landfill cover and rehabilitation is based on an assessment of current landfill activity in NSW. According to the NSW State of the Environment Report 2003, approximately 4 million tonnes of material is currently landfilled in NSW each year. Approximately half of the waste disposed to landfills in NSW is generated in the Sydney region (based on Wright, 2000).

Landfilled material should be progressively covered each day, and filled sections of landfills should be progressively recapped and revegetated. Therefore, the following approach was taken to estimate potential demand for this market segment:

- Estimate waste landfilled each year;
- Assume average landfill depth of 10 m for landfills licensed to receive less than 50,000 tonne/year, and 30 m for landfills licensed to receive greater than 50,000 t/year;
- Assume best practice landfilling techniques are in place that require compaction of waste to 650 kg/m^3 for landfills receiving less than 50,000 tonne/year, and compaction to 850 kg/m^3 for landfills receiving greater than 50,000 tonne/year;
- Determine surface area of material to be covered each year; and
- Assume average depth of recycled organics to be 0.15 m.

The depth of recycled organics that could potentially be used on landfills for cover and rehabilitation was estimated at 0.15 m based on the requirement for daily cover to be at least 0.3 cm.

Due to the nature of landfilling operations, landfill operators would attempt to stockpile and utilise any soil or similar material brought into the site rather than using RO mulch products. Therefore it was assumed that no more than 50% of daily cover (0.15 m) would likely be comprised of recycled organics.

The estimate of 0.15 cm RO cover is considered conservative as it does not take into account additional RO that could be utilised in the final vegetation and capping layer, required to be a depth of at least 1 m. Similar to daily cover, the revegetation cover would likely be a blend of materials available on site, fresh soil, and potentially recycled organics rather than 100% recycled products. The estimation also does not take into account any rehabilitation or revegetation and landscaping of land surrounding the landfill mound.

Consideration of additional RO that could potentially be used in the final vegetation layer for landfills has not been considered as the remaining life of the existing landfills within the SMR is likely to extend beyond three years[7], with the majority of revegetation works taking place after this time.

Review of the EPA public register for Environmental Protection licences under the POEO act indicated there are currently 77 licensed solid waste landfills in NSW, with 28 of these located in

[7] Remaining landfill capacity and approximate input rates for Sydney Landfills as reported in NECS 2003 indicate the shortest remaining landfill life at Belrose Landfill of approximately 3 years. The remaining landfill life at Eastern Creek was also indicated as approximately 3 years, however a proposed extension of this site is currently under review.

the GSR, 9 in the MNC, and 10 in the SE. Estimated RO potential in these regions based on the above methodology is summarised below.

Table 8-2 Estimated potential for RO in landfill cover and rehabilitation works

Region	No. of licensed solid waste landfills in operation	Ttotal waste received (Tonne/year)	Volume of compacted waste landfilled (m^3/year)	Potential RO demand (m^3/year)
GSR	28	2,000,000*	2,360,000	11,850
MNC	9	1,020,000**	1,207,000	6,300
SE	10	620,000**	773,000	5,700

*Estimate based on Wright, 2000

**Estimate based on EPA licence limits

Further potential for RO use in landfill cover and rehabilitation in the GSR is assumed from the commencement of operation of the UR3R Plant at Eastern Creek. The plant will produce approximately 60,000 m^3/year of alternative daily cover when in full operation. The UR3R plant is assumed to come online at the start of 2005; it should be operating at full capacity by June 2005.

Therefore, the overall potential for RO in the landfill rehabilitation submarket is assumed as follows.

Table 8-3 Potential RO demand in landfill sub-market (m^3/year)

Region/year	2004	2005	2006
GSR	11,850	41,850 (Includes 30,000 m^3 due to UR3R plant)	61,850 (Includes 60,000 m^3 due to UR3R plant)
MNC	6,300	6,300	6,300
SE	5,700	5,700	5,700

8.5.2 Potential demand for erosion control

Potential demand for rehabilitation works in relation to soil erosion are largely driven by Catchment Management and Landcare programs.

In 2003, The Commonwealth announced funding of $122 million for the National Landcare Program from 2003/04 to 2005/06. Funding to NSW includes $700,000 in 2003-2004 granted to Landcare Groups in the Lower Murray and Murray regions.

Landcare groups often work closely with Catchment Management Authorities to help combat local degradation issues. Therefore potential demand for RO in erosion stabilisation works has been based on a review of the Catchment management initiatives for erosion control as outlined in the Catchment Management Blueprints of each former Catchment Management Board[8].

A potential demand of approximately 127,000 m^3/year for future erosion stabilisation works has been estimated based on a review of the Catchment Management Blueprints of each former

[8] Action plans for the newly formed Catchment Management Authorities are yet to be released, however they are likely to build upon the current Catchment Management Blueprints.

Catchment Management Board. The methodology used to determine this estimate is outlined in detail in Section 8.5.3.

It should be noted that delineation between potential demand for RO in erosion stabilisation and environmental restoration submarkets may be uncertain where rehabilitation activities are targeted to achieving both these aims. For example, tree planting on slopes can combat erosion as well as improve the quality of land for increased biodiversity.

8.5.3 Potential demand for environmental restoration

Potential demand for land remediation and environmental restoration is estimated based on identified future Catchment management initiatives for revegetation and rehabilitation.

19 Catchment Management Boards were established under the Catchment Management Act 1989 and the Catchment Management Regulation 1999. From 1 January 2004, the Catchment Management Boards were dissolved and replaced by 13 statutory Catchment Management Authorities.

Each former Catchment Management Board developed a "Catchment Blueprint" which was a 10-year advisory plan to help achieve the aims of:

- Identifying critical opportunities, problems and threats associated with the use of natural resources so as to support rural production and to protect the environment;
- Identifying critical first order objectives and targets for the management of natural resources, having regard to any legislation or relevant Government policy; and
- Developing management options, strategies and actions to address the identified objectives and targets.

(Source: Department of Land and Water Conservation, http://www.dlwc.nsw.gov.au/care/cmb/#blueprints)

21 blueprints were prepared to cover the whole of NSW[9]. One of the roles of the new Catchment Management Authorities will be to prepare action plans that build upon the former blueprints, therefore potential RO usage in Catchment Management activities for erosion control and environmental rehabilitation, revegetation, and land reclamation has been estimated based on a review of these Blueprint documents.

The methodology used to determine potential demand for environmental restoration work identified for future action is outlined as follows:

- Identify catchments located in close proximity to existing organics processing facilities;
- Review of Catchment Blueprints for those catchments located such to be able to access RO products;
- Identification of potential land area to be rehabilitated in each catchment for control of either erosion or environmental restoration over 10 year period covered by the Blue Print;
- Average area to be rehabilitated each year estimated as 1 / 10th of total area for rehabilitation (due to 10 year period covered by the blueprints);

[9] Two Catchment Blueprints were prepared for the Hawkesbury-Nepean area, the Warragamba Catchment Blueprint for the upper Hawkesbury and the Hawkesbury Lower Nepean Catchment Blueprint for the lower catchment.

- Assume that at a minimum RO could potentially be applied to 5% of the land area identified for rehabilitation[10]; and
- Apply assumed RO application rates to each project.

Identification of Catchments where RO could potentially be used

Catchments identified as being located within the vicinity of organics processing facilities and within the study area for this report are indicated in Table 8-4.

Area to be rehabilitated

Targeted areas for rehabilitation were identified through review of the catchment management blueprints for those catchments identified as potentially able to utilise RO in future rehabilitation works.

In some cases, the catchment management blueprints did not clearly specify the size of the area targeted for rehabilitation. This was particularly the case with the catchment management blue prints for catchments located within the GSR.

No estimation has been made for the potential application area where the target rehabilitation area was not clearly defined.

Potential application of RO

In each case, an average depth of application of 50 mm was assumed for RO in each potential application area. This assumption is based on an assumption that composted mulch would be used for erosion control and protection of new vegetation.

For example, the Catchment Management Blue Print for the Central Coast Catchment identified a total area of 600 ha targeted for rehabilitation (via revegetation) within the next 10 years. An average rehabilitation rate of 60 ha/year was therefore calculated.

The potential demand for RO in this area is calculated as follows:

- Project areas that could potentially use RO:
  - 5% x 60 ha/yr = 3 ha/yr
- Demand for RO:
  - 3 ha x 10,000 m^2/year x 0.05 m = 1,500 m^3/yr

Table 8-4 Catchments within the vicinity of organics processing facilities

Catchment	Potential to use RO due to availability and close to processors	Region
Border Rivers Catchment	×	Outside study area
Central Coast	✓	MNC
Central West	✓	Outside study area
Gwydir	×	Outside study area

[10] This was assumed as in many cases rehabilitation works including revegetation and erosion stabilisation works are carried out by direct planting of plants directly into the existing soils. RO would only be applied in areas where there is degraded top soil or where the RO was readily available at low cost.

Catchment	Potential to use RO due to availability and close to processors	Region
Hawkesbury Nepean	✓	GSR
Hunter	✓	MNC
Lachlan	×	Outside study area
Lower Murray Darling	×	Outside study area
Lower North Coast	✓	MNC
Mid North Coast	✓	MNC
Murray	×	Outside study area
Murrumbdigee	×	Outside study area
Naomi	×	Outside study area
Northern Rivers	×	Outside study area
South East	✓	SE
Southern	✓	SE
Southern Sydney	✓	GSR
Sydney Harbour	✓	GSR
Upper North Coast	✓	MNC
Warragamba	✓	GSR
Western	×	Outside study area

Based on the methodology outlined above, the potential regional demands for RO estimated by the assessment are included in Table 8-5.

Realisation of the identified potential strongly depends on Catchment Management Authorities implementing priority projects and having sufficient funding to undertake the identified rehabilitation works.

Table 8-5 RO Potential for catchment management projects

Catchment	Region	Activity	Area for rehabilitation (ha)	Average area for rehab. each year (ha/year)	Potential RO demand (m^3/year)
Central Coast	MNC	Revegetation	600	60	1,500
Hunter	MNC	Erosion	5,550	555	13,875
Hunter	MNC	Revegetation	20,570	2,057	51,425
Lower North Coast	MNC	Erosion	5,100	510	12,750
Lower North Coast	MNC	Revegetation	10,800	1,080	27,000
Mid North Coast	MNC	Revegetation	18,820	1,882	47,050
Upper North Coast	MNC	Revegetation	1,260	126	3,150
		MNC Sub-total		**Revegetation**	**130,125**

Catchment	Region	Activity	Area for rehabilitation (ha)	Average area for rehab. each year (ha/year)	Potential RO demand (m^3/year)
				Erosion	**26,625**
		MNC Total			**156,750**
Warragamba	GSR	Erosion	40,000	4,000	100,000
South East	SE	Erosion	140	14	350

* Note: estimates for Catchments where target areas are not clearly identified are not included in the potential RO estimate, this includes the Southern, and Sydney Harbour Catchments

8.5.4 Overall potential demand in the rehabilitation market

Overall, the potential RO demand in the rehabilitation market over the next three years is estimated as shown below.

Table 8-6 Overall potential demand in the rehabilitation market*

Year	2004 (m^3/year)	2005 (m^3/year)	2006 (m^3/year)
GSR	111,850	141,850	161,850
MNC	163,050	163,050	163,050
SE	6,050	6,050	6,050

* Sum of estimated total demand for landfill cover and rehabilitation, erosion control, and environmental restoration

Case Study: Rehabilitation - Potential Mine Site Rehabilitation

Potential Project: **Mine site rehabilitation**

Project participants: **Collex Pty Ltd**

Location: **Woodlawn**

Collex has opportunity for potential use of recycled organic material at the Woodlawn former mine site located 250 km southwest of Sydney near Goulburn in the Greater Argyle local government area.

Collex, as well as operating a bioreactor waste management facility in the disused mine void at Woodlawn, is responsible for the eventual rehabilitation of the degraded areas of the mine site.

Recycled organic products may be appropriate as a mine rehabilitation material at Woodlawn, subject to endorsement by Department of Mineral Resources, EPA, and other mine rehabilitation stakeholders. Recycled organics may be especially useful in rehabilitating the tailings dams (as shown in the photos on the left).

An advantage of this end use of recycled organic material is that the organic material could be of a lower standard than, for example, agricultural use. The initial step in assessing this would be a trial using recycled organic materials on the tailings dams. The total tailings area to be rehabilitation is approximately 110 ha.

The size of the total Woodlawn property and its buffer zone from residential land use makes it potentially very attractive for siting an organics processing facility, an activity which could complement Collex's Bioreactor processing activities.

As well as the Woodlawn mine lease, Collex owns the Pylara farm adjacent to the mine lease area. As the natural soil quality is reasonably poor, this property (being operated as a commercial farm) could receive organic rich processed material to improve soil structure and nutrient content, if the material was of an acceptable standard.

The total Woodlawn site area is estimated at about 6000 ha (3000 ha mine lease + 3000 ha farm).

(Source: Development Projects Manager, Collex Pty Ltd)

Case Study: Rehabilitation – Recycled Organics in Catchment Management

Project:	**Sydney Catchment Protection Scheme**
Project participants:	**Sydney Catchment Authority and Department of Infrastructure Planning and Natural Resources**
Location:	**Sydney Catchment Area (including the Hawkesbury, Shoalhaven, Blue Mountains, Upper Nepean, Warragamba, and Woronora Catchments)**

The Sydney Catchment Protection Scheme is a joint scheme between the Sydney Catchment Authority (SCA) and Department of Infrastructure Planning and Natural Resources (DIPNR).

Under the scheme, the SCA provides support to landcare groups and provides financial assistance to landholders to treat degraded lands and encourages land managers to foster sound land management practices. DIPNR undertakes a number of erosion control projects to address land clearance and activities within rivers and on their banks.

DIPNR has been using OHP containing recycled organics including composts made from garden organics and biosolids in some erosion control projects. Recycled organics are applied in areas where there are poor soils and a lack of natural topsoil. The composts and mulches are applied to try and encourage revegetation growth in these areas.

OHP containing recycled organics is also used in a range of earthworks including soil conservation, where the recycled organics are spread and seeded with a grass seed.

Examples of erosion problems experienced throughout the State

Source: Correspondence with DIPNR

Case Study: Rehabilitation – Mine Site Rehabilitation

Project: **Nepean Quarries**

Project participants: **CORE (Centre for Organic and Resource Enterprises)**

Location: **Kurrajong, NSW**

The rehabilitation market sector has long been identified as a high volume market for recycled organics. However, penetration into this market has not kept pace with industry expectations. Research has indicated that the key barrier to market uptake has been perceived lack of affordability for recycled organics products by mine site operators and rehabilitation contractors.

Standard practice on mine site rehabilitation with poor soils has been to increase the application rate of seed, tube stock and fertiliser with the hope that at least half the plantings survive. Many of the sites where this practice was implemented have in fact experienced greater numbers of mortalities leading to poor revegetation.

The Centre for Organic and Resource Enterprises (CORE) is implementing a marketing strategy, which includes the rehabilitation action agenda program. Under this program rehabilitation sites receptive to utilising recycled organics are identified and engaged as demonstration sites. The CORE marketing network has actively pursued opportunities for members and collaborators to link with appropriate mine sites, quarries and other degraded and excavated sites throughout Victoria, New South Wales and South Australia. The program has eleven active research and development project sites demonstrating the benefits of using recycled organics in various applications.

These projects are designed to change the current practice by improving soil and growing conditions and thus increasing the survival rate. It is anticipated this will lead to a revision to future rehabilitation site plans recognising the benefits of recycled organics role and reducing elevated application rates of seed, tube stock and fertiliser. This in turn will shift proportionately budget allocations from these items and allow for a budget allocation for purchasing recycled organic products.

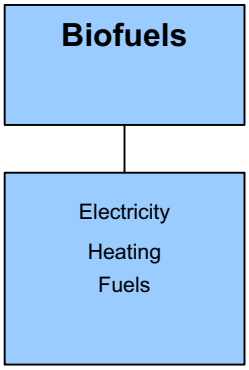
Early results are indicating positive responses from mine site and quarry operators with David Kingsell from Nepean Quarries, Kurrajong, NSW stating “The areas applied with recycled organics are displaying superior results to non-treated adjacent areas. We will definitely continue to use this material for our future rehabilitation projects.”

For more information on CORE’s Rehabilitation Action Agenda program visit www.corebusinessnet.com

Photographs from Nepean Quarries, Cobbity (courtesy of CORE)

9 Biofuels

9.1 Market overview



According to the ROU Dictionary and Thesaurus (2002) and in accordance with the previous 1998 Update Report, the market segment for biofuels refers to the energy market sector that incorporates:

- Power stations;
- Incineration;
- Gasification;
- Pyrolysis;
- Anaerobic digestion;
- Bio-reactive landfills;
- Ethanol; and
- Firewood.

Biofuel sources are organic materials derived from plants and animals. These sources can be converted to energy or fuels via a number of technological pathways as outlined above.

Whilst is it beyond the scope of this report to explore these technologies in any significant detail, an overview of the technological pathways for biofuel consumption and energy production is shown in Figure 9-1.

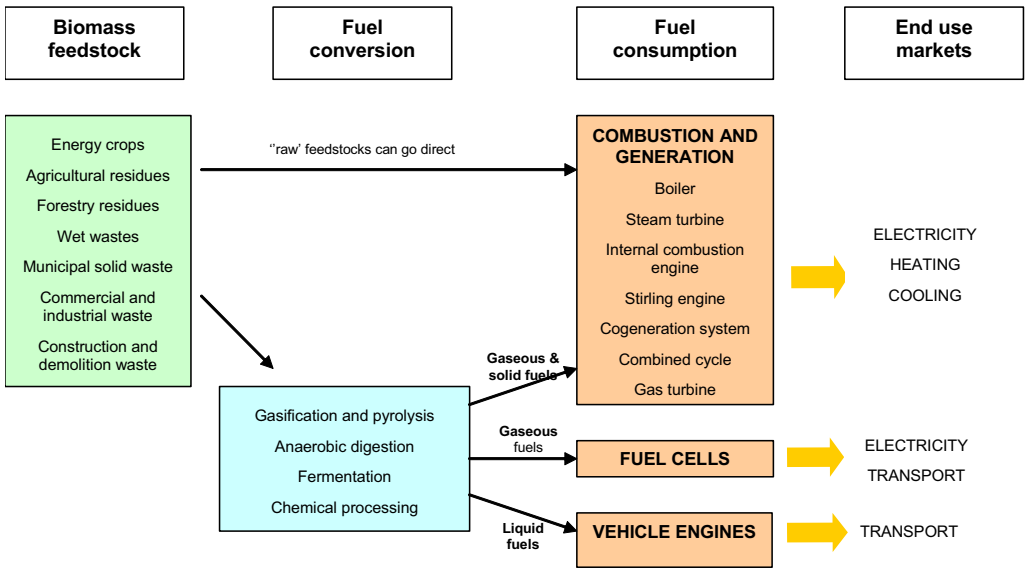


Figure 9-1 Bioenergy pathways

(Source: adapted from SEDA, 2003)

In 2000, combustible renewables and waste provided 11% of the world's total primary energy, which was significantly higher than other renewable energy sources such as hydro (2.2%), and geothermal, solar and wind (0.5%). At present Australia obtains about 3.3% of total primary energy from supplies of biomass (Saddler et al, 2004), and biomass currently supplies less than 1% of Australia's electricity requirements (SEDA, 2003).

The market for biofuels for renewable energy production is still considered to be a developing market. Australian Biofuels (2001) report that market immaturity is shown by continuing development of current demand and price signals, which is being influenced by:

1. Formation of new market for renewable energy production;
2. Effects of voluntary compliance programs for renewable energy production; and
3. Little understanding of biomass ability.

There are also a number of barriers to establishing recycled organic biomass facilities, and utilising biomass in existing operational facilities. These difficulties, which are explained further in Section 9.7, include the capital cost of establishing new technologies and facilities, quality of recycled organic materials, and transport distances.

9.2 Factors affecting demand in the biofuels market

The biofuels market in NSW is driven by three main factors;

1. Meeting the requirements of the national Mandatory Renewable Energy Target;
2. The NSW Greenhouse Gas Abatement Scheme; and
3. The Green Power initiative.

These factors are identified through both secondary and primary research source and are discussed in further detail below.

9.2.1 Australian Mandatory Renewable Energy Target (MRET)

"*Safeguarding the Future: Australia's Response to Climate Change*", announced by Prime Minister John Howard in 1997 laid the foundation for the increased push for renewable energy production in Australia. This response led to the development of the Renewable Energy Electricity Act 2000 and supporting by the Renewable Energy (Electricity) (Charge) Act 2000 and the Renewable Energy (Electricity) Regulations 2001.

The 2001 Renewable Energy regulation set the MRET of 2% of electricity generation (about 9500 GWh) to be sourced from renewable energy sources by 2010.

The overall MRET translates to individual targets for electricity producers throughout Australia. Electricity generators must accumulate sufficient Renewable Energy Credits (REC's) to demonstrate their obligations under the Act are being met. One REC is earnt for every megawatt hour of renewable energy produced.

In 2003, nearly 3 million valid REC's were registered by the Office of the Renewable Energy Regulator (the responsible authority for monitoring obligations under the Renewable Energy Electricity Act and Regulation). Of these, 29.4% were generated by bioenergy facilities, with the breakdown of the type of facility shown in Figure 9-2.

Review of the MRET

A recent review of the progress towards meeting the mandatory renewable energy target (Mandatory Renewable Energy Target Review Panel (MRET), 2003) found that growth in the renewable energy has primarily come from hydro and solar hot water sections, as well as strong growth in the smaller wind area. Generation from biomass was not as significant as expected. The current mix of biomass processing technologies used to generate REC's as at August 2003 shown in Figure 9-2.

There had been an initial optimistic outlook for biomass technologies and fuels due to that fact that they have one of the lowest development costs and compliance structures for renewable energy production – they had also been demonstrated overseas to be economically sustainable with associated environmental and social benefits (Australian Bio-Fuels, 2001). Potential barriers to growth of the biofuels market and reasons that the use of biomass may not be as high as expected are outlined in Section 9.7.

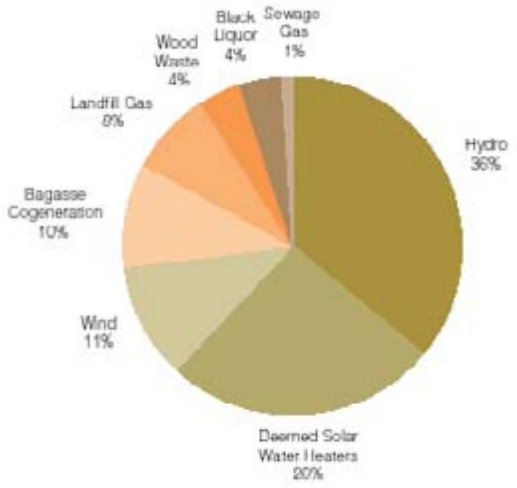


Figure 9-2 Mix of Technologies used to generate REC's (as at 18 August 2003)

(Source: MRET Review, 2003)

The market survey results showed that the majority of processors in the existing biofuels market that currently utilise RO, identified REC eligibility as a driving factor for RO demand. REC eligibility was identified by more processors as a reason for using RO compared to reasons associated with price and quality of available materials.

Table 9-1 Reasons driving demand for RO in existing biofuels market

Reason	Indicated in survey responses
REC eligibility	3 of 4
Price incentives	2 of 4
Quality	2 of 4
Higher energy content than alternatives	1 of 4
Role in sustainable practice	1 of 4
Process designed to recover organics and generate renewable energy	1 of 4

9.2.2 The NSW Greenhouse Gas Abatement Scheme

The NSW Greenhouse Gas Abatement scheme aims to decrease the emissions of greenhouse gases due to electricity consumption. Under the scheme, electricity retailers must meet mandatory greenhouse gas benchmarks. The benchmarks have been set to achieve a reduction in greenhouse gas emissions per capita (measured in terms of CO_2 equivalent) down from 8.65 tonnes in 2003, to a target level of 7.27 tonnes in 2007, continuing on until 2012.

9.2.3 Green Power

Green Power is a nationally accredited program whereby customers can purchase electricity generated from renewable energy sources. Green Power energy suppliers are audited to ensure compliance with the Green Power requirements.

The Green Power scheme differs from MRET in that rather than being obligated to provide a certain percentage of renewable energy, demand for renewable energy is driven by customers. Customers willingly accept to pay a premium for the electricity purchased under the scheme. Green Power supply of renewable electricity is not counted towards the mandatory obligations under the MRET. This approach has been chosen due to the different accreditation requirements of the programs, and to encourage production of renewable energy above and beyond the obligations of MRET.

Growth in the number of Green Power customers is a direct indication of an increasing demand for renewable energy and increased awareness of the benefits of renewable energy. As demand for Green Power in NSW increases, there is potential to further encourage and develop the use of biofuels as renewable energy sources.

Green Power customers have increased significantly since the start of the program. Between 2000 and 2002 alone, customer numbers increased by almost 20% to just under 70,000. Current customer numbers are estimated at around 75,000 (Green Power website).

Table 9-2 Green Power customers

As at	Domestic	Commercial	Total
June 2000	54,669	2,107	56,776
June 2002	64,302	2,942	67,244

(Source: Environmental Resources Management 2003 and 2001)

In February 2004, there were 13 electricity generators Green Power accredited for production of renewable energy using Biomass in NSW. Of these generators, 3 are listed as using “green waste” as a bioenergy source[11]. Two of these 3 plants are the Whytes Gully Gasification Plant, and a Green energy plant at Nowra, neither of which is currently operational. The only operational power plant accredited for Green Power from “green waste” is the Visy Pulp and Paper Plant in Tumut[12]. Other bioenergy generators in NSW utilise either landfill or sewerage gas, or bagasse (Green Power, 2004).

9.3 Overview of market changes since 1998

In the original 1996 and later 1998 market update report, no existing usage profiles for biofuels were identified. Potential demand for biofuels was estimated at 75,000 m^3/year based on the assumption that the Wollongong gasification contract (Whytes Gully) would become operational by the year 2000.

The current demand for biofuels is estimated at approximately 500,000 m^3/year, with a recycled organics content of approximately 275,000 m^3/year. The market for biofuels in NSW is estimated based on the current use of biomass in coal-fired power stations and the consumption of food waste at the EarthPower anaerobic digestion facility. No existing usage is identified for the use of biofuels in incineration, gasification, pyrolysis, bioreactor landfills, or ethanol production.

The location of existing demand for biofuels is shown in Figure 9-3.

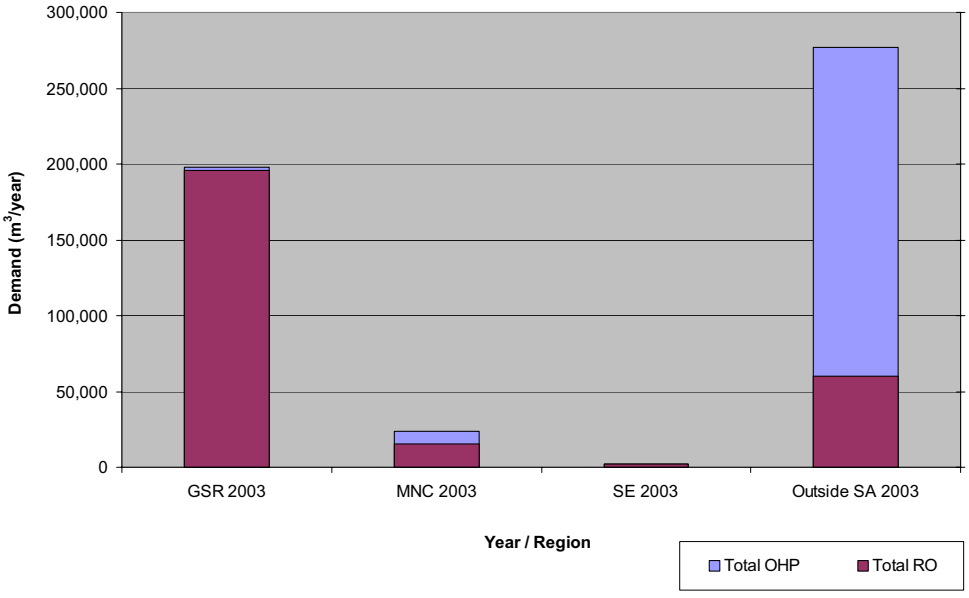


Figure 9-3 Current demand in biofuels market

[11] The term “green waste” is used as a generic term to describe waste vegetation, including grass clippings, tree trunks, branches and leaves, and woody garden materials. The Green Power use of the term “green waste” does not differentiate between municipal, commercial and industrial, and construction and demolition sources of these types of organics. Note however that in the MRET system, the term “green waste” applies only to municipal sources of garden organics ,and not those from commercial and industrial, or demolition sources.

12 The Visy Pulp and Paper plant in Tumut was listed as Green Power accredited for using forestry materials as a bioenergy source. However it is known that Visy also process garden organics and wood and timber from non-forestry sources previously destined for landfill.

These figures are explained below in descriptions of recent developments of commissioning of new plant, decommissioning of old plants and modifications to existing plant. These activities have occurred across all regions nominated in this study and also outside those regions.

Figure 9-4 shows the proportion and type of the estimated 275,000 m^3/year of RO currently demanded across different bioenergy applications.

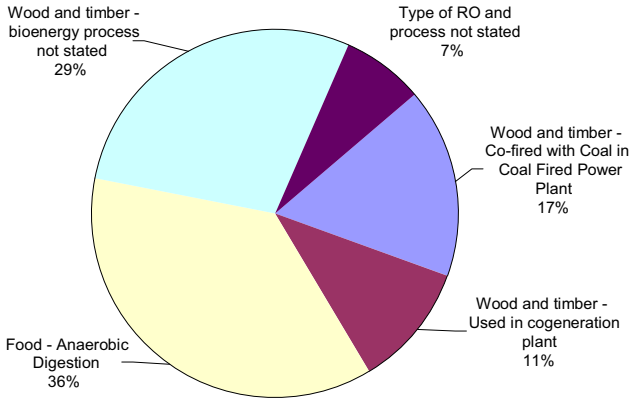


Figure 9-4 Proportion of overall RO demand in different bioenergy applications (% by volume)

9.3.1 Recent developments

The Whytes Gully gasification plant has been decommissioned since the last market study. Therefore the estimated potential for biomass reported here reflects that that biofuels will no longer demanded by this facility.

Recycled organics are currently utilised by one of NSW's three major electricity generators and as a fuel source for co-firing with coal. Recycled organics are also being used to provide an energy source to the cogeneration plant at the Visy Paper and Pulp mill. However other biomass sources are utilised at a number of other sites in NSW. These are listed in Table 9-3. Users of recycled organic bioenergy sources are highlighted in bold.

Delta Electricity, one of NSW's largest electricity generators, uses recycled wood and timber for co-firing with coal. For example Blue Mountains City Council is currently sending their garden organics from Katoomba Landfill to Wallerawang Power Station. Typically biomass can be used to provide up to 5% of the plant energy requirements normally provided by coal.

Other major power generators including Macquarie Generation and Eraring Energy, have both investigated the potential to co-fire recycled organics with coal, but have decided against this due to issues with contamination, organics quality, and fuel availability (outlined further in Section 9.7).

Macquarie Generation does co-fire biomass in the Liddell power station, however the biomass supplied for co-firing is mostly sawdust and shavings from licensed sawmills, therefore the organics are originally sourced from renewable plantations (Macquarie Generation website and personal communication).

The Visy Paper bioenergy plant is part of the Visy Paper and Pulp Mill. The mill process woodchips from the local pine plantations as well as other wood wastes including sawdust, bark,

and municipal wood waste. Black liquor from the pulpwood plant is used to fire a cogeneration plant, which has a capacity to generate 19 MW of renewable energy.

Green Pacific Energy has already commissioned a “green waste” to energy plant in Staplyton Qld, and has approval to develop further plants in NSW. Green Pacific Energy has indicated that that processing of all sort of recycled organics, included mixed urban garden organics and woody materials from commercial and industrial sources is not a problem as the process is specifically designed for that process.

EarthPower Technologies commenced operation of Australia’s first commercial scale food waste to energy plant in 2003. The anaerobic digestion plant accepts 80,000 tpa of food waste from commercial and industrial sources, processing the material to generate biogas for production of renewable energy, as well as producing a solid granular organic fertiliser.

Existing operating biomass energy plants in NSW are listed in Table 9-3. Users of recycled organic bioenergy sources are highlighted in bold.

Table 9-3 Operating biomass renewable energy plants in NSW

Owned	Location	Fuel type	Total renewable capacity* (kW)	Note
Energy Developments Ltd	Belrose	Biomass (landfill methane)	4,000	
NSW Sugar Mills Co-Op	Broadwater	Biomass (bagasse)	8,000	
EarthPower Technologies	**Camellia**	**Biomass (biogas)**	**3,500**	**1**
NSW Sugar Mills Co-Op	Condong	Biomass (bagasse)	3,000	
Sydney Water	Cronulla	Biomass (sewage methane)	497	
Energy Developments Ltd	Eastern Creek	Biomass (landfill methane)	7,000	
NSW Sugar Mills Co-Op	Harwood	Biomass (bagasse)	4,500	
Energy Developments Ltd	Jacks Gully	Biomass (landfill methane)	1,000	
Macquarie Generation	Liddell	Biomass (woodwaste)	5,000	2
Energy Developments Ltd	Lucas Heights I	Biomass (landfill methane)	4,000	
Energy Developments Ltd	Lucas Heights II	Biomass (landfill methane)	9,000	
Sydney Water	Malabar	Biomass (sewage methane)	3,000	
Delta Electricity	**Mount Piper**	**Biomass (woodwaste)**	**5,000**	**3**
AGL	Nowra	Biomass (landfill methane)	986	
Visy	**Tumut**	**Biomass (woodwaste)**	**17,000**	**4**
Delta Electricity	**Vales Point B**	**Biomass (woodwaste)**	**5,000**	**5**
Delta Electricity	**Wallerawang C**	**Biomass (woodwaste)**	**5,000**	**6**

(Source: Adapted from Australian Greenhouse Office, Operating Renewable Energy Stations)

Users of recycled organic bioenergy sources are highlighted in bold in above table.

*Assumed capacity generated from renewable sources

Notes:

1. EarthPower anaerobic digester in Sydney's west (Camelia) near Parramatta. Converts about 80,000tpa of food waste to electricity and fertiliser.

2. Liddell is cofiring coal with wood residues from sawmill operations; up to 5% of sawmill biomass (by energy content) is blended with coal (although licensed for up to 5% the plant generally operates at between 2-3%). For the purposes of this study, the use of this biomass **is not** counted as a current usage of RO as the sawmill material is sourced from plantation material.
3. Blending woodwaste into Mt Piper Coal Fired Power Station
4. Tumut pulp and paper mill power plant
5. Blending woodwaste into Vales Point Coal Fired Power Station
6. Woodwaste blended into Wallerawang Coal Fired Power Station

9.4 Existing demand in sub markets

9.4.1 Power stations

There are eight coal-fired power plants currently operating in NSW, of which 3 currently co-fire coal with recycled organic biomass. These power plants are operated by Delta Electricity. Delta Electricity utilises both sawmill residues and wood and timber previously destined for landfill as a biofuel source at three of their four power stations. Biomass was used to produce 11.4 GWh of electricity in 2003 (Delta Electricity, 2003).

Macquarie Generation also co-fires biomass at the Liddell power plant, however for technical reasons, the biomass is sourced only from nearby sawmill operations. The sawmills utilise native forests and operate under sustainable harvesting regimes accredited and audited by the Australian and New South Wales Governments (Macquarie Generation). Therefore use of material recovered from these mills is not considered a use of recycled organics for the purposed of this study.

Together these two operators (Delta Electricity and Macquarie Generation) represent about 75% of installed electricity generation capacity using coal as a fuel source[13].

9.4.2 Gasification

Gasification converts hydro-carbon material into lighter gaseous compounds in a thermal reaction with steam and oxygen. The end product is a fuel gas composed of hydrogen, carbon monoxide and carbon dioxide, and solid residuals due to inert residues that were not broken down by the process.

Numerous gasification/pyrolysis systems are in operation throughout the world particularly in Europe, the US and Japan for the treatment of separated biomass or mixed municipal solid wastes. Gasification systems are proven for homogeneous waste streams however there have been problems dealing with mixed waste streams such as municipal waste, due to variability and materials handling issues.

Gasification of wood chips can be carried out in relatively simple gasification plants specifically designed for biomass, with low emissions (European Environment Agency, 2002).

There are no gasification plants currently operating in NSW that utilise recycled organics, therefore no current usage is identified for this submarket. The Whytes Gully gasification plant

[13] Based on estimated plant capacity as reported by the Australian Greenhouse Office – Operating Fossil Fuelled Power Plants

was due to commence operation in early 2000 however the plant has since been decommissioned.

9.4.3 Pyrolysis

Pyrolysis is the range of thermal technologies where carbon rich waste is heated in the absence of oxygen to produce pyrolysis oil or syngas that can be used as a fuel or as a chemical feedstock.

Since pyrolysis requires a homogenous dry feedstock it is not suitable for processing wet organic materials. Significant energy requirements and costs are involved in drying the material prior to processing. Woody garden organics that are relatively dry have been successfully processed using this technology. The gases produced can be used to generate electricity,

There are no currently operating pyrolysis plants that utilise organics in NSW and therefore no current usage of recycled organics is identified for pyrolysis processes.

9.4.4 Anaerobic digestion

The EarthPower food waste to energy plant commenced operation in Camelia NSW in 2003. It is the only commercial scale energy plant of this type in NSW. The plant utilises food waste sourced from commercial food and food processing activities as a feedstock to the anaerobic digestion process. The process utilises food biomass to generate renewable electricity, and a solid product that can be used as a compost or input to fertiliser/compost production.

The UR3R Global Renewables plant is due to commence operation in late 2004, with full operation in 2005 (Global Renewables website). The UR3R plant is designed to process mixed municipal wastes and urban garden organics to recover the organic content of the waste stream and generate biogas (and hence renewable energy) through the recovery process. The process utilises an anaerobic digestion process to process the putrescible fraction of the waste stream.

No anaerobic digestion plants in NSW utilise recycled garden organics as a sole feedstock to the anaerobic digestion process. The anaerobic digestion process can accept a mix of organic waste including food waste and garden organics. However anaerobic digestion is not generally suitable for processing a separated garden organics stream alone as materials high in lignin, (such as woody garden organics / large branches) are not sufficiently degraded by the process (Eunomia Research and Consulting).

9.4.5 Bioreactor landfills

Bioreactor landfills are a relatively new waste treatment process which is yet to be proven commercially in Australia. The first commercial bioreactor landfill is being constructed by Collex at the abandoned Woodlawn mine near Goulburn.

Bioreactors use the recirculation of leachate, and controlled infiltration of rainwater and/or groundwater to accelerate biodegradation of waste, whilst maximising methane recovery. Enhancing the microbiological activity within the landfill can result in stabilisation of organic waste within 5 to 10 years, as compared to 30 years + achieved within conventional landfills (Pacey, 2000).

Materials disposed of in bioreactor landfills are the same as per conventional landfills, however biosolids may also be added to provide an additional wet organic waste source and thus further promote decomposition of organics. Woody materials such as large branches of garden organics are not as suitable as food organics for this type of process, as bioreactor landfilling is

essentially an anaerobic digestion process, carried out in the ground instead of in a mechanical digester.

No existing usage of recycled organics is identified for bioreactor landfills as there are none currently operating in NSW. The Collex bioreactor at Woodlawn is due to commence operation in late 2004.

Initially no organic materials will be recovered from the Woodlawn bioreactor, they will all be landfilled as part of a mixed waste stream with the purpose of generating renewable energy. Collex have indicated that a potential organics recovery system may be established at the Woodlawn facility, however the establishment of a recovery process is unlikely to occur prior to 2005-2006. Until establishment of an organics recovery facility, the process of landfilling and generation of biogas for renewable energy production is considered similar to that for conventional landfilling, therefore no additional potential for RO usage is counted in this study.

9.4.6 Ethanol

Production of ethanol via fermentation of organic materials is a well-developed technology for processing organic materials high in carbohydrates such as corns, wheat and potatoes into alcohol. However the use of input waste streams including municipal organics, sewage sludge and agriculture wastes as feedstocks to the process is a relatively new concept.

Fermentation technology has not been proven commercially or environmentally for these waste streams, and there is no identified usage or potential for usage of recycled organics for this process within the near future.

It should be noted that even with further development, fermentation processes (like anaerobic digestion) are not suitable for processing woody recycled organics, as the lignin in wood is not susceptible to biological degradation.

9.4.7 Firewood

The use of organic biofuel sources as firewood is known to occur throughout NSW. No estimation has been made as to the current or potential usage of recycled organics for this purpose.

No estimation has been provided as use of organics as firewood is not carried out on a large scale at any single facility where it is easily measurable. The use of recycled organics for this purpose is more likely limited to small quantities used by residents or industry for small scale heating applications or for burning as a form of waste disposal.

9.5 Product demand in sub markets

Demand for recycled organics in the existing biofuel market segment is limited to demand for chipped woody organics (for co-firing in power stations) and food waste (for anaerobic digestion).

9.6 Product decisions

Consumers of biofuels were asked a series of questions relating to how material choices are made. The results shown here are based on comments made by stakeholders currently active in the biofuels market segment. Due to the nature of the emerging market and the limited

number of operators, the number of survey responses was limited to only five. This limitation should be taken into account when reviewing the following information.

9.6.1 Sources of information

Unlike other market segments where stakeholders identified a number of information sources relating to obtaining product information, survey responses from the biofuels segment indicated only two main avenues for data acquisition:

- Chemical analysis; and
- Trials.

These information sources are consistently identified as important for obtaining product information in all market sectors, however this result for the biofuels market indicates that electricity generators have a greater reliance on chemical and scientific data for analysing potential use of RO compared to markets such as amenity and agriculture.

These latter markets have a greater number of stakeholders compared to the electricity industry, thus potential consumers and processors of RO are also driven by information provided in publications such as magazines and supplier brochures, as well as word of mouth from industry and business.

The increased reliance on scientific and technical information in the biofuels market also indicates the increased importance of ensuring RO usage is compatible with process technology and meets the requirements for most efficient economic operation in the competitive electricity generation market. These information sources are also those most suitable for determining information on contamination, moisture content, and energy content – identified as important product decisions for the biofuels industry, as outlined in further detail below.

9.6.2 Product decisions

Table 9-4 summarises the findings of the market survey in relation to identification of issues taken into consideration when investigating potential choice of products.

In total, 7 product decisions were identified in the four surveys completed by operators in the biofuels market, with 17 comments being made overall. The three most frequently identified product decisions related to:

- Contamination (identified in all four valid survey responses);
- Moisture content; and
- Energy content.

Table 9-4 Product decisions in biofuel market

Product decision	Identified in number of surveys
Level of contamination	4 of 4
Moisture content	3 of 4
Energy content	3 of 4
Trial	2 of 4
Must comply to standards - AS or otherwise	2 of 4

Product decision	Identified in number of surveys
Low value by-product of other process or available waste stream	2 of 4
In-house research	1 of 4

The importance of contamination is reflected in the barriers identified as preventing increased usage of RO in the biofuels market. Further development of the biofuels market will require that contamination management strategies be successfully implemented such that biofuels operators are confident in the use of recycled fuel sources.

The energy content and moisture content of biofuels are also important in ensuring that the recycled organics can be economically and efficiently processed. Energy and moisture content can impact on process operations including materials handling and transport costs.

Whilst price was not directly identified as a determining factor in product decisions in the biofuel market, 2 out of the 4 survey respondents indirectly identified price as important due to availability of a fuel source with an otherwise low value as a by-product or waste stream. It is understood that supply of oversize by composters, and supply of wood and timber is a low value source of income for the composting industry (compared to landscaping products). Therefore oversize from composting facilities could potentially be made available to biofuels markets at a relatively low cost, therefore further encouraging further development and growth of the biofuels market.

9.7 Barriers to RO usage

The main barriers to increased RO usage in the biofuels market segment are identified as:

- Fuel source availability and transport distances;
- Processing technology;
- Quality and availability of RO material; and
- Funding and development of new processing sites.

These barriers have been identified through the market survey and literature review of secondary data sources. These barriers are explained further below.

9.7.1 Fuel source availability and transport distances

The MRET review report (MRET, 2003) identified access to fuel sources as an “important challenge confronting the industry” and one of the reasons that current production of renewable energy from biofuels was less than had been previously expected.

Existing coal fired power plants that can potentially use recycled organics to replace coal sources would do so only where biomass fuel sources are available and economical to use. Power stations are unlikely to pay more than $40 per dry tonne for conventional coal/fuel sources (SEDA, 2003). Therefore where transport costs are less than this for biofuel sources it may be economical to use biomass. For example, the cost of transporting green forestry residues has been estimated at about 10 c per tonne, or 20c per dry tonne per kilometre. Therefore the cost of using these biomass sources becomes prohibitive as transport distances approach 200 km (SEDA, 2003).

Depending on the type of bioenergy conversion process and technology used, the cost of using biomass fuels in electricity production may be offset by sale of any by-products from processes (for example solid materials suitable for composts and fertilisers from anaerobic digestion), renewable energy credits (where eligible) and income from gate fees for waste disposal.

The cost associated with transport and processing of biomass limit the potential usage of the fuel source on a large scale. The optimum size of dedicated biomass power stations (to minimise costs) is usually much smaller than the economical size of a coal-fired power station due to transport costs increasing as more fuel in required. The low calorific value of wood and wood chips, combined with their low bulk density makes them relatively expensive to transport in their raw form. Biomass fuels better suited for transport are wood pellets, and liquid or gaseous high calorific value fuels (Saddler et al, 2004).

9.7.2 Processing technology

Existing energy processes in NSW that could potentially utilise biofuels may be limited by the processing technology in place. For example, the Bayswater power station although able to co-fire biomass under the current licence conditions, does not due to the nature of the existing technology on the plant[14]. Personal communication with a Macquarie Generation representative indicated that significant capital expenditure would be required to upgrade the facility to successfully carry out co-firing, and to-date these costs have been prohibitive.

In general, depending on the electricity production process, low value and variable quality biomass fuels can be difficult to process within conventional power plants. There are particular issues identified with materials storage and handling, and quality and contamination. Use of certain biofuel sources can create uncertainty on plant availability and commercial risks for power stations in the competitive market (Australian Bio-Fuels, 2001).

Processing technology is identified as a barrier for existing power stations and energy generation processes, but is not necessarily a problem for new projects and initiatives that are designed to process recycled organics. For example, Green Pacific Energy have already commissioned a “green waste” to energy plant in Staplyton Qld, and have approval to develop further plants in NSW. Green Pacific Energy has indicated that that processing of all sort of recycled organics, included mixed urban garden organics and woody materials from commercial and industrial, and building and demolition sources is not a problem as the process is specifically designed for these types of feedstock.

Therefore, technology and processing barriers are mainly limited to utilising existing energy generation infrastructure. Increased use of RO as biofuel sources would therefore be encouraged through establishment of new processing sites specifically designed for recycled organic fuel sources.

9.7.3 Quality and availability of RO

Organics waste streams which are potentially most suitable for use as a biofuel sources, such as dry woody wastes from construction and demolition works, can be unsuitable for use of biofuels due to quality and health issues.

SEDA (2003) identified a barrier preventing use of wood from construction and demolition as a feedstock to bioenergy process is the fact that a large amount of this waste stream is likely to be

[14] Note: Cofiring of biomass was carried out at Bayswater in 2000-2001, but has since ceased.

treated. Combustion of treated wood products could release toxins in bioenergy process (SEDA, 2003). Products such as pallets and similar wooden packaging materials, although seemingly a good source of bioenergy, were identified as potentially unsuitable due to the failure to adequately screen and remove any nails and plastic that might be present.

Contamination and particle size were identified by the market survey as barriers preventing further usage of RO in existing power plants. Power plant operators indicated that recycled organics are often not available at a standard suitable for economic and efficient processing. Power plant operators indicated a desired particle size of less than 50 mm for chipped/mulched and screen organic sources. However, even where these size requirements are met, the handling of green materials was still found to be problematic leading to blocked equipment such as hoppers and loaders and hence process disruptions.

The quality of RO biofuels was not identified as a great barrier where the energy generator had specific fuel supply contracts in place with biofuel suppliers, and where there were strict monitoring and control mechanisms in place. Rigorous monitoring and screening process allow for the incoming fuel supply quality to be closely monitored and for problems with fuel quality to be quickly identified and discussed with fuel suppliers.

Availability of RO was identified as an issue in terms of “availability of material of a required quality”. A number of electricity generators (those utilising coal-fired power plant technology) indicated that been approached by numerous groups wanting to know if they could process biomass waste streams from various sources, however the amount of material available at the required quality standard was not sufficient to meet requirements.

9.7.4 Funding and development of new processing sites

The capital cost of establishing a dedicated wood waste bioenergy facility has been estimated at about $2 million per MW of installed capacity (for facilities of 25-35 MW capacity) (Townsend, 2003). This cost is considerably higher compared to traditional fuel power stations, and obtaining funding for new developments under current market conditions has been identified as a factor affecting further potential development of the market.

For example, the Australian Greenhouse Office, in the report *Renewable Energy Commercialisation in Australia* (2003), showcases the Re-OCC biomass to energy project as an innovative project under development in Australia. The Re-OCC project involved processing of urban garden organics into renewable electricity, commercial-quality charcoal, and clean-burning briquettes as a firewood substitute. The project had received a significant financial grant under the Renewable Energy Commercialisation Program in 2003[15], but was later scrapped due to lack of private sector financial support for the project[16].

The latest MRET review (2003) also identified the cost of funding and development of new sites as a reason for anticipated decline in investment in renewable energy plants. The report found that due to the high-levels of up-front capital required, the required payback period for projects under the restrictions of the current MRET program (which limits when REC’s will be available) were unlikely to meet most company requirements. The review panel put forward a number of changes to the existing scheme, recommended to encourage increased investment in the renewable energy market.

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[15] Government funding for renewable energy projects is available under the federal government’s Renewable Energy Industry Development program – about $1 million was granted to renewable energy projects under the scheme in 2003. In all, the program has a budget of $6 million to be provided over 4 years.

[16] Personal communication with Dr Stephen Joseph from Biomass Energy Services and Technology Pty Ltd

Under the refinements proposed to the MRET system, the estimated share of renewable generation by fuel (under the proposed changes) in 2020 is shown in Figure 9-5. Compared to the existing situation (refer Figure 9-2), this figure shows the contribution of wood waste more than doubling (from 4% to 10%), and municipal solid waste (less than 1% to 4%) to REC's over the next 15 years.

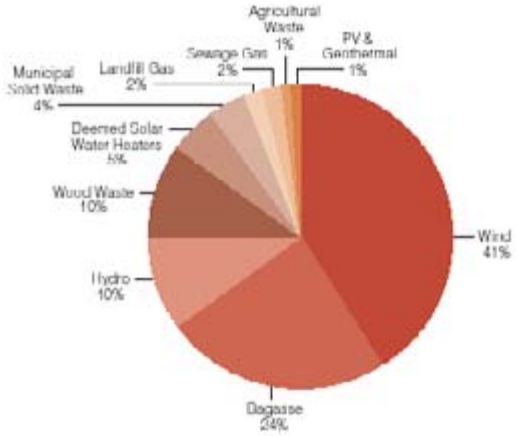

Figure 9-5 Share of renewable generation by fuel, under proposed settings 2020

(Source: MRET Review, 2003)

Note: In the above figure, the definition of municipal solid waste includes waste materials sourced from domestic garbage collections, waste materials delivered by domestic residents to licensed landfills or transfer stations; and waste materials from other council operations such as street sweeping, roadside tree pruning, and clearances from other council litter bins. It therefore includes the "green" garden organics component of MSW and any wood or timber delivered to waste facilities by domestic residents.

The term "wood waste" relates to the eligible renewable energy wood source as outlined in Part 2 of the Renewable Energy (Electricity) Regulations 2001, and includes wood biomass produced from non-native environmental weed species, manufactured wood product or a by-product from a manufacturing process (such as packing cases, pallets, recycled timber), waste products from the construction of buildings or furniture, including timber off-cuts and timber from demolished buildings, sawmill residue; or wood from plantations or forestry operations that meet the criteria specified in the Regulations.

9.8 Potential demand

The current and potential generation capacity from bioenergy in NSW has been estimated by SEDA (2003), as shown in Table 9-5.

Table 9-5 Potential generation capacity in NSW

Feedstock	Current generation capacity	Approximate potential generation capacity
Agricultural residues	17.5 MW (bagasse)	2,000 MW
Energy crops	None	160 MW
Plantation forest residues (includes sawmill wastes)	4 MW	80 MW
Sawmill wastes (from native forest sawlog production)	16 MW	30 MW
Wet wastes	23 MW	40 MW
Municipal, industrial and commercial, building and demolition wastes*	29 MW (landfill gas)	100 MW
TOTAL	**89.5 MW**	**2,410 MW**

(Source: SEDA, 2003)

* Municipal, commercial and industrial, and building and demolition wastes include garden organics, food organics, wood and timber from these sources

The potential generation capacity as estimated by SEDA, indicates that the greatest potential for increased usage of organics as biofuel sources in the agricultural field. The SEDA study also indicates significant potential to increase the use of biofuels sourced from municipal waste and energy crops.

Australian Bio-fuels (2001) had predicted a market demand of biomass fuels (including agricultural organics) of around 500,000 - 1,000,000 tonnes per annum by 2004/2005, sufficient to generate some 500-800 GWh of renewable electricity. These predicted demands however include consideration of agricultural residues are usually ploughed into the land or burnt on the property which are not included within the scope of this study.

For the purposes of this study, the potential use of RO in the biofuels market segment has been estimated based on a review of proposed biomass renewable energy plants in NSW, and the potential to increase co-firing of biomass in coal fired power stations. Potential is also identified for anaerobic digestion process technology due to commencement of the Global Renewables UR3R plant at Eastern Creek. No opportunities for the use of RO in proposed gasification, incineration, pyrolysis, or fermentation processes is identified for the next three years.

As biofuels can be sourced from landfills and resource recovery facilities as well as organic processing facilities (such as oversize from mulching operations), the potential demand for biofuels includes an examination of potential demand outside the GSR, MNC, and SE.

There are a number of project biomass energy projects proposed for NSW. Of the proposed projects, those that represent potential usage of RO materials are summarised in Table 9-6. The projects identified as having potential for RO usage are those that do not propose to use either bagasse, landfill gas, or agricultural crops which would previously otherwise most likely have been directly ploughed into the land or burnt on the property, i.e. only those projects where organics would previously have ended up in landfill have been considered.

Of the biomass projects proposed for NSW as shown in Table 9-6, the establishment and operation of the UR3R plant at Eastern Creek (in the GSR) presents opportunity for increased use of RO within the short-term (within the next three years).

Development of green energy plants at Nowra (in the SE) and Somersby (in the GSR) by Green Pacific Energy also present potential opportunity for increased demand for RO, however the timing of this increased demand is uncertain[17]. Recycled organics that would potentially be processed at these plants include garden organics and wood and timber from commercial and industrial sources as well as building activities.

Other potential uses of RO include increased co-firing of biomass with coal at currently operating coal-fired power stations or in new proposed coal-fired power plants.

Table 9-6 Proposed biomass renewable energy plants in NSW

Owned	Location	Plant type	Feedstock	Total capacity (kW)	Notes
Forest Products Ass/ National Power	Bulahdelah	Wood fired co-generation plant	Timber from forestry operations	30,000	1
Forest Products Ass/ National Power	Grafton			30,000	1
Forest Products Ass/ National Power	South Moruya			30,000	1
Global Renewables	Eastern Creek UR-3R	Anaerobic digestion plant	Municipal solid waste (including municipal garden organics)	5,000	2
Green Pacific Energy	Nowra	Fluidised bed combustion	Woody and garden organics from municipal and industrial sources	5,000	3
Green Pacific Energy	Somersby			20,000	4
Green Pacific Energy	Hyogle			10,000	4
Green Pacific Energy	Camden			10,000	4
Green Pacific Energy	Sutherland			10,000	4

(Source: adapted from Australian Greenhouse Office, Proposed Renewable Energy Stations)

Notes:

1. $30M wood fired generators proposed for the Bulahdelah, Grafton, and South Moruya areas – the plants would potentially use timber nearby forestry operations as a fuel source
2. The $70M waste to energy project will process 175,000t/year of municipal waste. Construction is due to begin in early 2003 and is due to be operational in mid-2004. Biofuel materials would be produced from the residuals of the process.
3. 5 MW green energy project. Proposed to take up to 30,000 tpa of woody and garden organics from Municipal and Industrial sources in Nowra. Project has already been granted development approval.
4. Green Pacific Energy has a number of green energy projects planned for NSW. These projects are still in development phase and are yet to be granted development approval. Discussions with company representatives indicate that primary intention is to commence development of larger scale plants ie. Somersby, as soon as possible.

[17] Note, that whilst the establishment of a green energy plant in Nowra has been granted development approval, Green Pacific Energy has indicated that the timing of this proposed development is not yet decided. Green Pacific Energy has also indicated that it plans to go ahead with the proposed green energy plant at Somersby, however this development is still in the planning stage and requires development approval.

9.8.1 Power stations

Existing power plants

The potential to increase use of RO in the already operating plants is limited by licence conditions (typically limit use to 5%). There are eight coal-fired power plants currently operating in NSW, with a further three proposed for future development (Australian Green House Office, Fossil Fuel Power Stations). Of the eight currently operating fossil fuel power stations, 3 of them are already co-firing with biomass, however only 2 plants use recycled organics.

The opportunity to co-fire recycled organics in the existing plants which currently do not use RO is dependant on overcoming the contamination and handling issues identified as barriers to current usage of recycled organics. Extensive testing and trials of recycled biomass materials has already been conducted by operating electricity generators, prior to them indicating that existing material is unsuitable or not of sufficient quality and quantity to meet requirements.

Potential demand for currently operating power stations is estimated at assuming about 50% of the allowable 5% of biomass at the Liddell Power Station (currently using sawmill residues) is replaced by recycled organics. Fuel replacement is assumed to occur over the next 2 years[18]. It also assumes that the proportion of recycled organics co-fired by Delta Electricity is increased to 100% immediately by making more recycled materials available to replace the sawmill biomass component currently used in power stations.

These assumptions assume that some of the quality issues of recycled organics are overcome through targeted fuel supply programs. No potential for RO usage within the next 3 years is identified for either Eraring or Bayswater power stations as the infrastructure, process technology, and/or licensing requirements are not in place for co-firing of biomass at these stations.

Proposed power plants

The combined capacity of proposed coal fired power plants represents approximately 20% of the currently installed coal-fired power capacity (Australian Greenhouse Office – Operating and Proposed Fossil Fuel Fired Power Plants). The planning and development times of the proposed new plants will extend beyond 2005-2006 and therefore the potential for RO use in those plants is not included in this study.

9.8.2 Bioreactor landfills

As outlined in Section 9.4.6, no further potential for RO is assumed from the commencement of operation of the Woodlawn Bioreactor.

9.8.3 Anaerobic digestion

The UR3R Global Renewables plant is due to commence operation in late 2004, with full operation in 2005 (Global Renewables website). 175,000 tonnes/year of mixed municipal waste will initially be processed through the facility, with a potential to increase capacity to 260,000 tonnes/year in the future. Organics are assumed to comprise approximately 55% of the mixed waste stream – based on an average composition of 28% garden organics, and 27% food waste (NECS, 2002).

[18] i.e 25% replacement in 2004-2005, scaled up to 50% replacement by 2005-2006

The mixed municipal waste will be blended with a small component of structural garden organics to allow for optimum process conditions. For the proposed initial start-up capacity of 175,000 tonnes/year, approximately 5,000 tonnes/year of structural garden organics will be added to the process (NECS, 2002).

9.9 Estimated further RO potential

Based on the explanation provided above, the following RO potential is estimated for the biofuels market segment.

Table 9-7 Potential RO demand for biofuel processes (m^3/year)

Future potential	2004	2005	2006	Comments
Power stations	23,000	73,000	123,000	Assumed increase RO usage and replacement of sawmill residues for cofiring in Delta and Macquarie generation power stations to 5% equivalent total energy
Green power plants				No future projects identified [19]
Incineration				No future projects identified
Gasification				No future projects identified
Pyrolysis				No future projects identified
Anaerobic digestion		128,000	239,000	Assume UR3R online start of 2005, full capacity by June 2005
Bio-reactive landfills				Current technology proposed for Woodlawn not considered a market/use of recycled organics.
Ethanol				No future projects identified
Firewood				No future projects identified
Total	**23,000**	**201,000**	**362,000**	

The above estimated demand is broken into the geographic regions of the study area as follows.

Table 9-8 Potential demand for biofuels (m^3/year)

Region	2004	2005	2006
GSR	0	128,000	239,000
MNC	7,500	7,500	7,500
SE	0	0	0
Outside	15,500	65,500	115,500
Total	**23,000**	**201,000**	**362,000**

[19] Note, that whilst the establishment of a green energy plant in Nowra has been granted development approval, Green Pacific Energy has indicated that the timing of this proposed development is not yet decided. Green Pacific Energy has also indicated that they plan to go ahead with the proposed green energy plant at Somersby, however this development is still in the planning stage and requires development approval.

9.10 Ways to improve use of RO

Suggestions on how RO could be improved to encourage further use in the biofuels market segment were identified as:

- Better sorting of waste streams at source;
- Better control over contamination;
- Develop on-line testing to detect priority contaminants (such as lead paint and asbestos); and
- Product analysis that meets requirements.

The issue of contamination is a strong factor restricting further use of RO in the biofuels market segment. Strong comments were received from biofuel operators indicating the need to continue to develop and refine standards for RO materials, for example, it was suggested by one operator that the “work done on quantifying quality (of RO) for compost should be extended to biofuels”.

It was also noted that under the current waste to energy legislation, there appears to be little discretion about the difference of burning contaminated waste compared to burning verified products.

Recycling of treated timber in biofuel energy recovery processes is also still limited due to presence of additives in treated timber, which should not be burned. Treated timber can include preservatives such as cooper chrome arsenic solution (CCA), ammoniacal quaternary, creosote and organic solvents such as copper naphthalene. In particular, timber products treated with CCA are not suitable for combustion for energy recovery[20], yet CCA is the most widely used wood preservative in Australia (National Timber Development Program, 2004).

[20] According to the National Timber Development Program Technical Report Issue 5 May 2004, use of sawdust or woodchips (mulch) is also not recommended because of the uncertainty surrounding the release of CCA components in mulched environments or where CCA may end up in the long term.

Case Study: Biofuels - Green Pacific Energy Green Energy Plants

Project: **Energy plants powered by recycled organics**

Project Participants: Green Pacific Energy

Project Location: Operating 5 MW plant in Staplyton Qld, further plants proposed for NSW

Green Pacific Energy recently opened of Australia's first fluidised bed combustion plant that operates on green organics sourced from municipal and commercial sources, as well as timber and wood waste from commercial activities and construction and demolition projects.

The plant, located in Staplyton QLD, has a rated 5 MW capacity and is expected to consume 30,000-40,000 tonnes of municipal garden organics annually. The plant was officially opened in March 2004.

Green Pacific Energy also own the intellectual property over a further 20 green energy development projects, 5 of which are in NSW, with the Nowra facility already approved for development.

GPE Plants proposed for NSW	Capacity	Stage of Development
Nowra	5 MW	Development approved
Somersby	20 MW	In various stages of development
Hyogle (cogeneration plant)	10 MW	
Camden	10 MW	
Sutherland	10 MW	

Green Pacific Energy utilise fluidised bed combustion technology that can operate on a wide range of materials including branches, tree trimmings, and waste wood. Garden organics are used due to its low cost, ease of availability and low by-product and emissions rate. Other fuel sources that are under investigation include:

- Waste paper by products from paper manufacturing plants;
- Wood off-cuts from timber yards and joinery factories;
- Waste vegetable oil from food processors;
- Sawdust or chipped timber pallets;
- Non-recyclable waste paper; and
- Agricultural products such as straw, sugar cane, and rape seed.



Pictures from the Staplyton Plant, Qld

(Source: Green Pacific Energy, www.greenpacific.com.au)

Case Study: Biofuels – Delta Electricity Co-firing of Biomass

Project: **Co-firing of construction and demolition wood waste with coal**

Project Participants: **Delta Electricity and various recycling centres**

Project Location: **Mt Piper and Wallerawang power stations near Lithgow, Vales Point power station near Wyong**

Delta Electricity is pursuing renewable energy projects including the co-firing of biomass with coal at three of its four power stations.

In 2003/2004, approximately 25,000 tonnes of biomass was co-fired with coal, of which about 14,000 tonnes was construction and demolition wood waste diverted from landfill. The remaining biomass is sourced from radiata pine sawmill residues. A combined output of over 26 GWh of renewable energy is produced from the co-firing of biomass at the three power plants.

Wood waste used at the power plants is sourced from recycling and waste management centres. The material is chipped, sampled and analysed prior to transportation to the power stations for ease of transport and to meet Delta's operating requirements.

Co-firing of recycled wood and timber with coal has the environmental benefits of:

- Recovery of energy that would otherwise have been lost;
- Reducing the volume of material sent to landfill; and
- Reducing greenhouse gas emissions.

As well as the environmental benefits of co-firing biomass, the consumption of organic resources previously destined for landfill is providing a market for material that is otherwise considered as having little value. This encourages recyclers to provide facilities for better sorting of wood and timber for recovery and reuse.

The lack of suitable materials has prevented Delta from co-firing greater quantities of biomass. It is important that wood and timber used in the power plants is free of contamination, and is of a suitable moisture and energy content for co-firing with coal.

Vales Point Power Station

(Source: Delta Electricity, 2003)

10 Prioritisation of Market Segments

10.1 Overview

Potential RO demand is considered by region in this chapter. Within each region, potential demand is broken down by market segment to provide information on growth opportunities. The estimated tonnages are not broken down by RO product when prioritising each market segment.

To satisfy this potential demand, RO processors will need to produce appropriate products at prices acceptable to consumers.

Each region has different market segment opportunities over the next three years and processors within these regions should identify what opportunities are appropriate to their production capacity and anticipated revenue stream. All opportunities will require accurate matching of products produced to market needs.

10.1.1 Potential RO demand in the GSR

In the GSR, urban amenity continues to provide strong growth in demand over the next three years. However the two big opportunities lie in the rehabilitation and biofuels markets.

As State and Federal environmental legislation increase their control and demands for contamination management and alternative energy sources, the role of RO in these areas will continue to offer significant growth areas.

Table 10-1 Greater Sydney Region – Potential RO Demand (m^3/year)

Market Segment	2004	2005	2006
Urban Amenity	**30,700**	**30,700**	**30,100**
Intensive Agriculture	1,930	3,860	5,790
Rehabilitation	111,850	141,850	161,850
Biofuels	0	128,000	239,000
Enviro-remediation	11,300	11,300	11,300
Total	**155,780**	**315,710**	**448,040**

Figure 10-1 shows the existing demand for RO in market segments in the GSR, and summarises the estimated potential demand for RO between 2004- 2006.

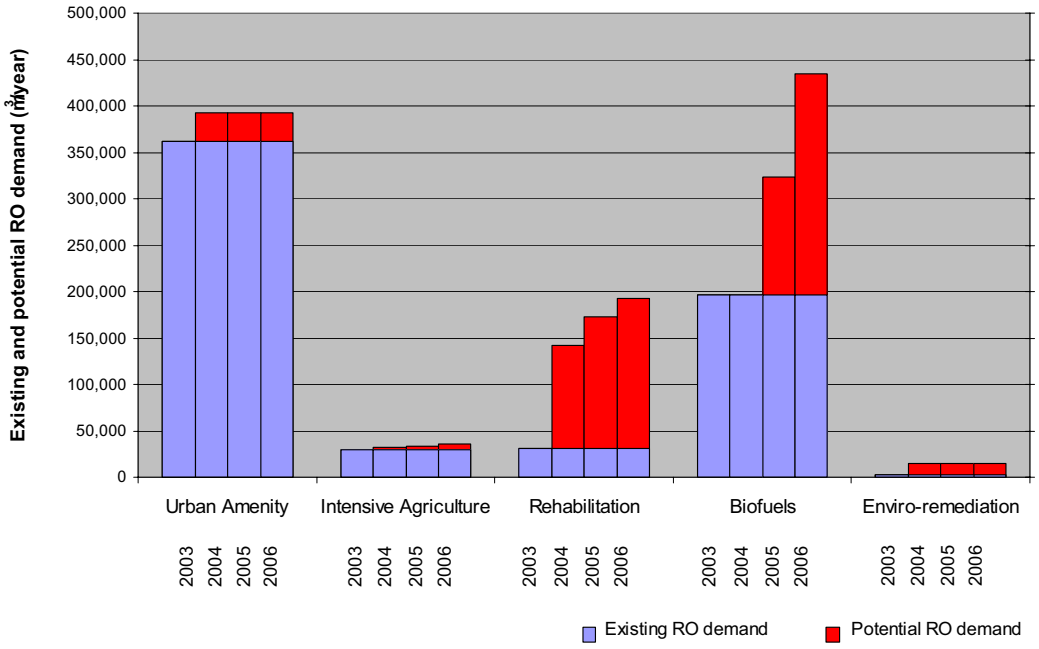

Figure 10-1 Overview of existing and potential demand for RO in market segments in the GSR

10.1.2 Potential RO demand in the MNC

The Mid North Coast region, in contrast to the Greater Sydney Region, offers potential demand opportunities not in the urban amenity market but in the intensive agriculture and rehabilitation markets, as well as (to a lesser extent) the biofuels market.

There is significant potential RO demand for rehabilitation of contaminated sites and old landfills. Intensive agriculture offers more opportunities in the rural areas for application of RO and should also demonstrate good growth.

Table 10-2 Mid North Coast Region – Potential RO Demand (m^3/year)

Market Segment	2004	2005	2006
Urban Amenity	21,800	21,800	9,300
Intensive Agriculture	34,200	34,200	34,200
Rehabilitation	163,050	163,050	163,050
Biofuels	7,500	7,500	7,500
Enviro-remediation	500	500	500
Total	**227,050**	**227,050**	**214,550**

Figure 10-2 shows the existing demand for RO in market segments in the MNC, and summarises the estimated potential demand for RO between 2004- 2006.

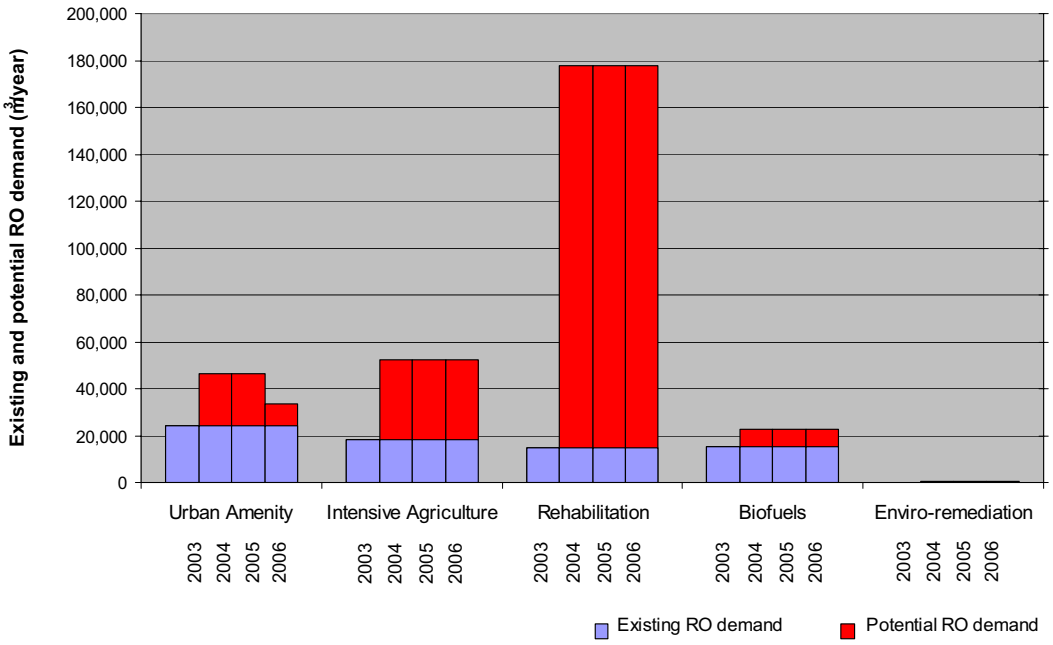

Figure 10-2 Overview of existing and potential demand for RO in market segments in the MNC

10.1.3 Potential RO demand in the SE

The South East region offers opportunities in the rehabilitation market segment and urban amenity. The other market segments indicate limited potential demand opportunities.

Table 10-3 South East Region – Potential RO Demand (m^3/year)

Market Segment	2004	2005	2006
Urban Amenity	**3,700**	**3,700**	**2,200**
Intensive Agriculture	1,000	1,000	1,000
Rehabilitation	6,050	6,050	6,050
Biofuels	0	0	0
Enviro-remediation	200	200	200
Total	**10,950**	**10,950**	**9,450**

Figure 10-3 shows the existing demand for RO in market segments in the SE, and summarises the estimated potential demand for RO between 2004- 2006.

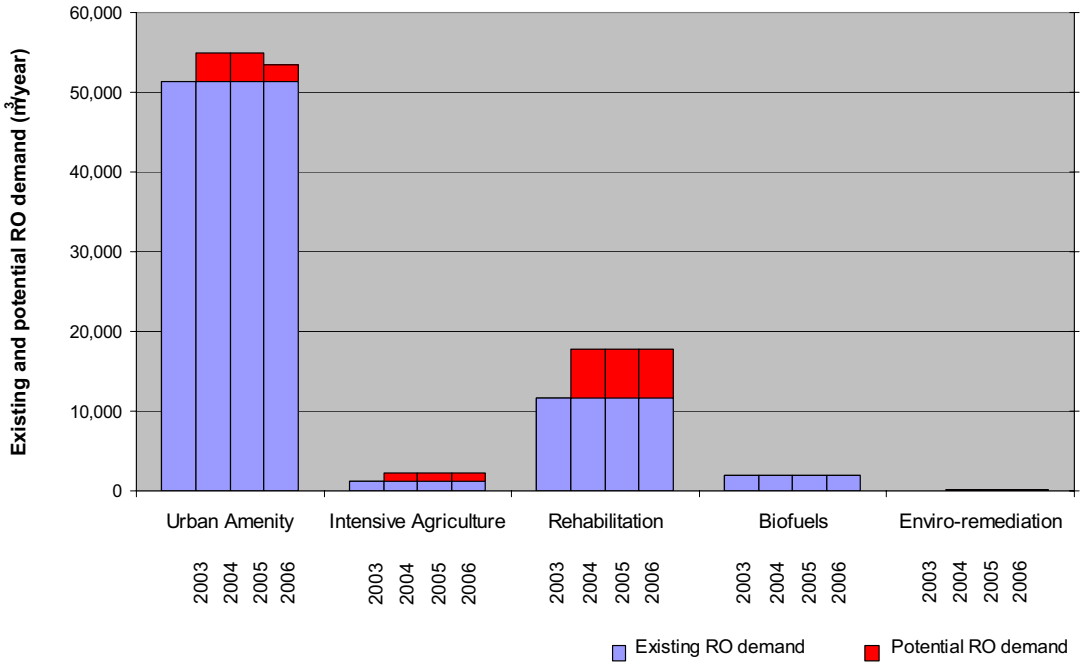

Figure 10-3 Overview of existing and potential demand for RO in market segments in the SE

10.2 Summary of existing and potential demand in the study area

Figure 10-4 summarises the existing and potential demand for RO in the study area based on the existing demand shown in Figure 4-8, and the additional demand identified for each market segment in each region as outlined above.

Figure 10-4 indicates significant potential growth in the biofuels market in the GSR, with potentially demand for biofuels exceeding current demand in the urban amenity market in this region. Growth in the biofuels market, however, is dependent on successful operation of technology, compliance with stringent environmental licence conditions and securing required levels of feedstock.

Figure 10-4 also indicates significant potential growth for RO demand in rehabilitation works in the GSR and MNC and. Realisation of this potential strongly depends on Catchment Management Authorities implementing priority projects and obtaining sufficient funding to undertake the identified rehabilitation works.

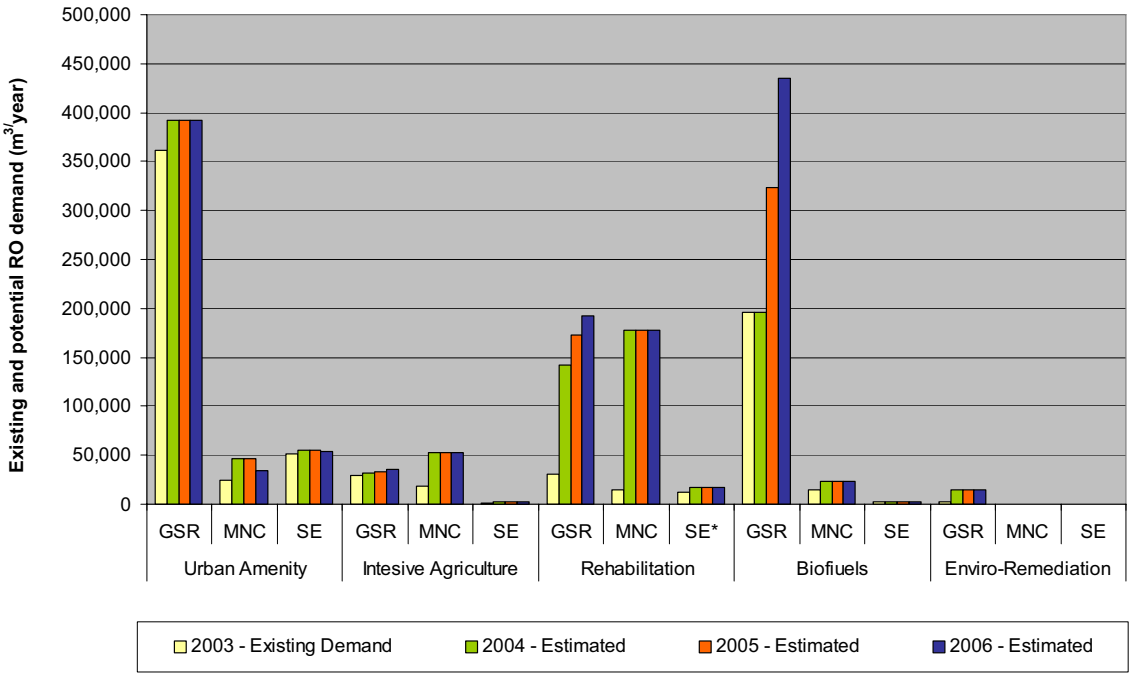

Figure 10-4 Comparison of estimated RO demand across markets and regions

Significant potential demand for RO is also likely to exist outside the study area, particularly in the Murrimbidgee region for the purposes of intensive agriculture (namely orchard growing as outlined in Section 6.5.1), and in the Hunter and Central West for biofuels (as outlined in Section 9.9). The potential demand located outside the GSR, MNC, and SE, may be determined from further market studies that include a wider geographic study area.

11 Conclusions

The key markets for RO have changed significantly since the last assessment was undertaken in 1999. At that time, site rehabilitation and intensive agriculture were seen as the major growth areas for RO, with the highest unrealised potential demand.

Traditional markets such as urban amenity and intensive agriculture were strong in 1999 and are still strong, but their future growth is limited. Renewable energy on the other hand, is currently a significant sector that was not previously identified as a key area for growth. Based on the findings of this study, the biofuels and rehabilitation markets present the greatest potential demand for RO out of all the sectors examined in this study.

The NSW Waste Avoidance and Resource Strategy 2003 has nominated aggressive targets for resource recovery in both the municipal and industrial waste streams. The continued success of recovery of RO through source separation and the introduction of more sophisticated processing systems such as AWT will continue to deliver greater quantities of RO to the market place.

Growing the production of RO beyond the current level of 860,000 m^3/year in NSW in a sustainable manner will require careful product development and capturing of the appropriate feedstock by RO processors. Less industry assistance should be required as demand for RO increases, due to increased awareness and higher costs of alternative virgin materials used in production of OHP.

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Appendix A

Survey Instrument – Processors

Survey sent to processors of recycled organics

Producer Survey
Analysis of Markets for Recycled Organic Materials

Background

The NSW Department of Environment and Conservation, through its Sustainability Program Division (formerly Resource NSW) has engaged GHD to conduct a review of market trends for recycled organic (RO) products in NSW.

Purpose of Data Collection

This survey has been sent to stakeholders identified as producers of organic horticultural products (OHP) and /or biofuels. Such producers can (or could potentially) use organic materials as a raw material to their production process. This survey will be used to complement other research currently being undertaken to analyse the existing and potential supply and demand for recycled organic (RO) materials in various markets throughout NSW.

This market study will be used to update previous assessments undertaken in 1996 and 1999 for COMMPOST NSW and the NSW Waste Boards respectively, determine current market penetration of RO products in mature markets, assess barriers to usage of RO products in mature and emerging markets, and assess demand potential and future supply and demand for RO materials in mature and emerging markets.

The results of this study will assist the NSW Government with strategy development.

Confidentiality

GHD and the Department of Environment and Conservation will hold company details and all survey responses as confidential information. Survey responses will not be disclosed outside of the Department of Environment and Conservation and once the data has been collected, the page identifying the respondent will be stored separately from the survey response.

Data from the survey responses will be collated for research and reporting purposes, and data in this aggregated form may be disclosed by the Department of Environment and Conservation.

Reference Period

The reference period for this survey is for the financial year 1 July 2002 to 30 June 2003.

Due Date of Survey Form

Please return this survey form by the 19th of March 2004.

Surveys should be returned by mail to:

David Playle, Waste Management Group

GHD Pty Ltd

10 Bond Street

Sydney NSW 2000

Or fax to: 02 9239 7196, marked to the attention of David Playle.

Thank you for taking the time to complete this survey.

Please provide any additional comments at Question 14 of this survey, or feel free to contact David Playle during business hours on (02) 9239 7245.

Contact Details

Company Name:

……

Respondents Name:

……..……..

Respondents Position:

……..……...

Phone Number: ……

Fax: ……..

Email: ……..

Postal Address:

Street/PO Box: ……..……

……..……

Suburb: ……...……

State: ……..……

Postcode: ……..……..

Survey terms and definitions

Definitions of terms used in this survey are included on Page 10-11. Please refer to these definitions as required when completing the following questions.

Operation

1. What is the nature of your business?

2. Where are your production facilities located? (please specify the local government area and postcode)

3. To which regions do you distribute / supply products? (tick as appropriate, where products are supplied to more than 1 region please provide indication of proportion sold to each region.

Midnorth Coast	☐	Sydney Surrounds	☐
Hunter	☐	Illawarra	☐
Central Coast	☐	South East NSW	☐
Sydney Metro	☐	Other:_____.	☐

Production

4. Please specify total annual production of products and average recycled content across product range

	Total Annual Production	Average Recycled Content[21] across product range
Organic Horticultural Product	**m^3/year**	**% by volume**
Mulch		
Compost / Soil conditioner		
Soil blend		
Top dressing		
Potting mix		
Playground surfacing		
Biofuels		
Other : (please specify)		

Comments:

[21] Recycled organic content means percent by volume of: garden organics, food organics and wood/timber (from municipal, commercial, and construction/demolition sources). It does not include forestry materials. For further explanation of what is considered recycled organics please refer to page 10.

5. Please select the product market which best describes where your overall products are sold, and the approximate quantity of material sold to each market. Please specify units as either tonne/year or m^3/year.

Market	Product	Mulch	Compost/ Soil cond.	Soil blend	Top dressing	Pottin g mix	Play- ground surfacing	Biomass fuel sources	Other – please specify	Total
Urban Amenity	Landscape									
	Local Government									
	Nurseries – Retail									
	State Government									
	Sport and Leisure									
	Other– please specify									
Total sold to Urban Amenity										
Intensive Agriculture	Nurseries – production									
	Nurseries – wholesale									
	Market Gardening									
	Fruit & Orchard Growing									
	Cut Flowers									
	Viticulture									
	Turf Grass Growing									
	Other– please specify									
Total sold to Intensive Agriculture										
Extensive Agriculture	Pasture Farming									
	Broadacre farming									
	Forestry farming									
	Landcare									
	Other– please specify									
Total sold to Extensive Agriculture										
Rehabilitation	Landfill Cover & Rehab.									
	Erosion Control									
	Revegetation									
	Enviro. Restoration									
	Other – please specify									
Total sold to Rehabilitation										

Enviro-remedia-tion	Contaminated Sites									
	Storm Water Purification									
	Air Filtration									
	Other– please specify									
	Total sold to Enviro-Remediation									
Biofuels	Electricity									
	Heating									
	Fuels									
	Other – please specify									
	Total sold as Biofuels									

Raw Materials and Use of Recycled Organics

6. Please describe the reasons why you currently use recycled organic materials (for example, price, quality, results, environmental reasons, etc).

7. Are there any barriers stopping you from using more recycled organics in your products? (for example price of obtaining recycled organics, quality of final product, physical/chemical properties, etc)

8. How do you currently obtain information about the potential benefits/impacts of using recycled organic materials in production?

9. Primary sources of recycled organic raw materials that you currently use for production.

Please provide a percentage estimate (%) of the amount of raw materials received from the following areas

Recycled Organic Raw Material[22]	**Sourced from household kerbside collections, waste transfer stations or material recovery facilities (%)**	**Sourced from commercial businesses (%)**	**Sourced from building or demolition activities (%)**	**Sourced from other reprocessors (%)**	**Other: please specify (%) ……..**
Agricultural organics	%	%	%	%	%
Biosolids	%	%	%	%	%
Food organics	%	%	%	%	%
Garden organics (not including wood and timber)	%	%	%	%	%
Timber/wood waste	%	%	%	%	%
Forestry based organics	%	%	%	%	%
Other material: please specify: …….……..	%	%	%	%	%

10. What are the primary sources of <u>non-recycled organic raw materials</u> currently used for production?

11. Have any of your customers requested or inquired about whether or not your products contain recycled organic content?

Yes / No

[22] Definitions of recycled organic materials are listed on page 10.

12. If yes, what has been the nature of their enquiry? For example, have they interested to know as they would like to purchase material containing recycled content, or they need to know as they do not want products containing recycled organics, etc

13. Are you interested in finding out more about the use of recycled organics?

    If so, please outline your particular interest and reasons for this interest (for example, usage of food waste in production of compost to increase nutrient value of material by non-chemical means, etc)

Other Comments

14. Please provide any additional comments regarding the use of recycled organic materials and/or market demand for products containing recycled organic content.

Thank you for completing this survey.

It would be appreciated if you could please attach a product brochure and price list to this survey.

Please return the survey and product list to GHD.

Definitions used in this survey

Table 4 Recycled Organic (RO) Sources

RO Source	Definition to be applied*
Agricultural organics	Any residual organic materials produced as by-products of agricultural operations, including: ◗ Animal manures ◗ Cereals/grains/straw ◗ Mushroom compost ◗ Animal mortalities
Biosolids	Organic solids or semi-solids produced by municipal sewage treatment processes.
Food organics	Food organics derived from domestic or commercial and industrial sources including: ◗ Fruit and vegetables ◗ Meat and poultry ◗ Fats and oils ◗ Seafood (including shellfish, excluding oyster shells) ◗ Dairy solids and liquids ◗ Bread, pastries, flours, etc ◗ Food soiled paper products The definition does not include grease trap waste.
Garden organics (not including wood and timber)	Garden organics derived from domestic or commercial and industrial sources including: ◗ Putrescible garden organics (grass, clippings) ◗ Non-woody garden organics ◗ Woody garden organics ◗ Trees and limbs ◗ Stumps and root balls
Timber/wood waste	Wood and timber wastes derived from domestic, agricultural, commercial and industrial sources that may be contaminated or uncontaminated, treated or untreated, solid or composite and that includes: ◗ Off-cuts; ◗ Crates; ◗ Pallets and packaging; ◗ Saw dust; and ◗ Timber shavings.
Other	Other organic matter of animal or vegetable origin including paper.
Forestry based organics	Organic waste matter from forestry operations including weeds, wood chips, etc

* based on definitions from the ROU Dictionary and Thesaurus (2002)

Table 5 Organic horticultural products (OHP)

OHP	Definition to be applied*
Mulch	Any pasteurized organic product (excluding polymers which do not degrade, such as plastics, rubber and coatings) that is suitable for placing on soil surfaces. Mulch has at least 70% by mass of its particles with a maximum size of greater than 15 mm.
Playground surfacing	The surface of a playground from which the use of the equipment. Solid surfacing includes compounds formed into sheets, tiles or mats, or wet pour substances that set on site.
Potting mix	A growing medium suitable for the establishment and development of a wide range of plants in containers.
Soil blend	General-purpose soil derived from blending two or more of: sand, natural soil material or organic materials and having a bulk density of greater than 0.7 kg/L and an organic matter content of between 3-15% by mass.
Compost / Soil conditioner	Any composted or pasteurized organic product, including vermicast, manure and mushroom compost, that is suitable for adding to soils. This term also includes 'soil amendment', 'soil additive', 'soil improver' and similar terms, but excludes polymers which do not biodegrade, such as plastics, rubber and coatings. Soil conditioners may be either'composted soil conditioners' or 'pasteurized soil conditioners'. Soil conditioner has not more than 15% by mass of particles with a maximum size above 15 mm.
Top dressing	A soil which is suitable for surface application to lawn.

* based on definitions from the ROU Dictionary and Thesaurus (2002), AS 4454 (2003) Composts, Soil Conditioners, and Mulches , AS 4419 (2003) Soils for landscaping and garden use, AS 3743 (2003) Potting Mixes, and AS 4422 (1996) Playground Surfacing

Biofuels

According to the ROU Dictionary and Thesaurus (2002), the market segment for biofuels refers to the waste to energy market sector which incorporates:

- Power stations
- Incineration
- Gasification
- Pyrolysis
- Anaerobic digestion
- Bio-reactive landfills
- Ethanol
- Firewood
- Biomass fuel sources consist of plant material, vegetation, or agricultural waste that can be used as a fuel or energy source.

Appendix B

Survey Instrument – Consumers

Survey sent to consumers of OHP and biofuels

Consumer Survey
Analysis of Markets for Recycled Organic Materials

Background

The NSW Department of Environment and Conservation, through its Sustainability Program Division (formerly Resource NSW) has engaged GHD to conduct a review of market trends for recycled organic (RO) products in NSW.

Purpose of Data Collection

This survey has been sent to stakeholders identified as consumers of organic horticultural products (OHP) and /or biofuels. Such consumers can (or could potentially) use products containing recycled organic materials in the operation of their business. This survey will be used to complement other research currently being undertaken to analyse the existing and potential supply and demand for recycled organic materials in various markets throughout NSW.

This market study will be used to update previous assessments undertaken in 1996 and 1999 for COMMPOST NSW and the NSW Waste Boards respectively, determine current market penetration of RO products in mature markets, assess barriers to usage of RO products in mature and emerging markets, and assess demand potential and future supply and demand for RO materials in mature and emerging markets.

The results of this study will assist the NSW Government with future strategy development.

Confidentiality

GHD and the Department of Environment and Conservation will hold company details and all survey responses as confidential information. Survey responses will not be disclosed outside of the Department of Environment and Conservation and once the data has been collected, the page identifying the respondent will be stored separately from the survey response.

Data from the survey responses will be collated for research and reporting purposes, and data in this aggregated form may be disclosed by the Department of Environment and Conservation.

Reference Period

The reference period for this survey is for the financial year 1 July 2002 to 30 June 2003.

Due Date of Survey Form

Please return this survey form by the 21st of March 2004.

Surveys should be returned to:

David Playle, Waste Management Group

GHD Pty Ltd

10 Bond Street

Sydney NSW 2000

Or fax to: 9239 7196, marked to the attention of David Playle.

Thank you for taking the time to complete this survey.

Please provide any additional comments at Question 23 of this survey, or feel free to contact David Playle during business hours on (02) 9239 7245.

Contact Details

Company Name:

……

Respondents Name:

……..……..

Respondents Position:

……..……...

Phone Number: ……

Fax: ……..

Email: ……..

Postal Address:

Street/PO Box: ……..……

……..……

Suburb: ……...……

State: ……..……

Postcode: ……..……..

Survey terms and definitions

Definitions of terms used in this survey are included on Page 13-14. Please refer to these definitions as required when completing the following questions.

Operation

1. What is the nature of your business?

2. Where are your operations located? (please specify the local government area and postcode)

3. Please identify the market segment which best describes the market/s in which you operate. Where you operate in more than one market please specify the proportion of your operations in each market.

Market Area	Market Segment	Proportion of operations (%)
Urban Amenity	Landscape	
	Local Government	
	Nurseries – retail	
	Special Projects	
	State Government	
	Sport, recreation & leisure	
	Other urban amenity – please specify	
Intensive Agriculture	Nurseries – production	
	Nurseries – wholesale	
	Market gardening	
	Fruit & Orchard growers	
	Cut Flowers	
	Viticulture	
	Turf Grass	
	Other intensive agriculture – please specify	
Extensive Agriculture	Pasture Farming	
	Broadacre farming	
	Forestry farming	
	Landcare	
	Other extensive agriculture – please specify	
Enviro-remediation	Contaminated Sites & Soils	
	Storm Water Purification	
	Air Filtration	
	Other enviro-remediation – please specify	
Rehabilitation	Landfill Cover & Rehab	
	Erosion Control	
	Revegetation	
	Environmental Restoration	
	Other rehabilitation – please specify	
Bio-fuels	Electricity	
	Heating	
	Fuels	
	Other bio-fuels – please specify	
Other	Please specify:	

Use of products

4. Please describe the process involved in investigating potential choice of products and in determining which products to purchase.

5. How do you currently obtain information about the potential benefits/impacts of using different products (particularly those containing recycled organic content)?

6. What is your current annual consumption (purchase) of the following products?

	Total Annual Consumption / Purchase
Organic Horticultural Product	**m^3/year**
Mulch	
Compost / Soil conditioner	
Soil blend	
Top dressing	
Potting mix	
Playground surfacing	
Biofuels	
Other : (please specify)	

7. Do you currently purchase any products containing recycled organic materials?

Yes / No / Don't know

→ If No (or Don't know), proceed to question 15.

Use Products containing Recycled Organic Materials

8. Please specify <u>total annual purchase/consumption</u> of products containing recycled organic materials, and the type of recycled organic material that they contain (if known). An example is shown for the case where 10,000 t/year of soil conditioner is bought which was produced using a mix of organic materials including biosolids and garden organics.

Product containing Recycled Organics	**Total Annual Consumption/Purchase**		**Please specify recycled organic content (if known)**
	tonne/year	**m^3/year**	
Mulch			
Compost / Soil conditioner	*(Eg. 10,000 t/year)*		*Eg. biosolids (5%), garden organics(20%)*
Soil blend			
Top dressing			
Potting mix			
Playground surfacing			
Biofuels			
Other : (please specify)			

9. Please describe the reasons why you currently use products that contain recycled organic materials: (eg, price, availability, quality, results show increased plant growth, environmental reasons, etc).

10. Do you purchase organic horticultural products that comply with existing Australian Standards such as AS 4454 (Composts, Soil Conditioners and Mulches), AS 4419 (Soils for Landscaping and Garden Use), AS 3743 (Potting Mix),or AS 4422 (Playground surfacing)?

    If so, what percentage of total annual purchases comply with standards (in terms of $ value)?

11. What are the benefits of using products containing recycled organic content compared to equivalent organic products that do not contain recycled organic content? (eg, ease of delivery, storage, transportation, observed results, etc)

12. Are there any barriers stopping you from buying products with greater recycled organic content? (for example: not enough information on recycled content available, certain quality of product required for particular use, or customers have requested a particular product be used, etc)

13. How much do you pay for products containing recycled organics compared to the equivalent product that does not contain recycled organics?

1. Pay more for equivalent products with RO content
2. Pay the same for products with or without RO content
3. Pay less for equivalent products with RO content

Comment:

14. How could products containing recycled organics be improved?

Consumers that currently do not use products recycled organics

Consumers that have completed questions 10-14, please go to question 23

15. Have you considered purchasing products containing recycled organic content?

Yes / No

16. If Yes, what reasons were there for deciding to not purchase products containing recycled organic content? (eg price, availability of products, no relationships with suppliers, etc)

17. Are you aware of any advantages / disadvantages of using products containing recycled organic content? Please provide examples.

18. Are you aware of equivalent products available (to those you currently use) that contain recycled organics?

19. Are there barriers to using products containing recycled organic content? (eg customers request certain products that do not contain RO, available products do not meet requirements for certain tasks, cost, etc)

20. Under what conditions would you consider using products that contain recycled organics? (eg, if products were cheaper, if the quality was different, if more products were available, etc)

21. How much do you think you should pay for products containing recycled organics compared to the equivalent product that does not contain recycled organics?

    1. Pay more for equivalent products with RO content
    2. Pay the same for products with or without RO content
    3. Pay less for equivalent products with RO content

Comment:

22. Are you interested in finding out more about the use of products containing recycled organics?

    If so, please outline your particular interest and reasons for this interest (for example, usage of products made from organic sources as opposed to chemical, etc)

Other Comments

23. Please provide any additional comments regarding the use of products containing recycled organic materials and/or demand for these products.

Thank you for completing this survey.

Please return the survey to GHD.

Definitions used in this survey

Table 6 Recycled Organic (RO) Sources

RO Source	Definition to be applied*
Agricultural organics	Any residual organic materials produced as by-products of agricultural operations, including: ◗ Animal manures ◗ Cereals/grains/straw ◗ Mushroom compost ◗ Animal mortalities
Biosolids	Organic solids or semi-solids produced by municipal sewage treatment processes.
Food organics	Food organics derived from domestic or commercial and industrial sources including: ◗ Fruit and vegetables ◗ Meat and poultry ◗ Fats and oils ◗ Seafood (including shellfish, excluding oyster shells) ◗ Dairy solids and liquids ◗ Bread, pastries, flours, etc ◗ Food soiled paper products The definition does not include grease trap waste.
Garden organics (not including wood and timber)	Garden organics derived from domestic or commercial and industrial sources including: ◗ Putrescible garden organics (grass, clippings) ◗ Non-woody garden organics ◗ Woody garden organics ◗ Trees and limbs ◗ Stumps and root balls
Timber/wood waste	Wood and timber wastes derived from domestic, agricultural, commercial and industrial sources that may be contaminated or uncontaminated, treated or untreated, solid or composite and that includes: ◗ Off-cuts; ◗ Crates; ◗ Pallets and packaging; ◗ Saw dust; and ◗ Timber shavings.
Other	Other organic matter of animal or vegetable origin including paper.
Forestry based organics	Organic waste matter from forestry operations including weeds, wood chips, etc

* based on definitions from the ROU Dictionary and Thesaurus (2002)

Table 7 Organic horticultural products (OHP)

OHP	Definition to be applied*
Mulch	Any pasteurized organic product (excluding polymers which do not degrade, such as plastics, rubber and coatings) that is suitable for placing on soil surfaces. Mulch has at least 70% by mass of its particles with a maximum size of greater than 15 mm.
Playground surfacing	The surface of a playground from which the use of the equipment . Solid surfacing includes compounds formed into sheets, tiles or mats, or wet pour substances that set on site.
Potting mix	A growing medium suitable for the establishment and development of a wide range of plants in containers.
Soil blend	General-purpose soil derived from blending two or more of: sand, natural soil material or organic materials and having a bulk density of greater than 0.7 kg/L and an organic matter content of between 3-15% by mass.
Soil conditioner	Any composted or pasteurized organic product, including vermicast, manure and mushroom compost, that is suitable for adding to soils. This term also includes 'soil amendment', 'soil additive', 'soil improver' and similar terms, but excludes polymers which do not biodegrade, such as plastics, rubber and coatings. Soil conditioners may be either'composted soil conditioners' or 'pasteurized soil conditioners'. Soil conditioner has not more than 15% by mass of particles with a maximum size above 15 mm.
Top dressing	A soil which is suitable for surface application to lawn.

* based on definitions from the ROU Dictionary and Thesaurus (2002), AS 4454 (2003) Composts, Soil Conditioners, and Mulches , AS 4419 (2003) Soils for landscaping and garden use, AS 3743 (2003) Potting Mixes, and AS 4422 (1996) Playground Surfacing

Biofuels

According to the ROU Dictionary and Thesaurus (2002), the market segment for biofuels refers to the waste to energy market sector which incorporates:

- Power stations
- Incineration
- Gasification
- Pyrolysis
- Anaerobic digestion
- Bio-reactive landfills
- Ethanol
- Firewood

Biomass fuel sources consist of plant material, vegetation, or agricultural waste that can be used as a fuel or energy source.

Appendix C

Attitudes of Consumers and Processors – Survey Responses

Overview

This appendix contains a summary of qualitative survey responses received from processors and consumers to the written survey disseminated by GHD in 2004 on behalf of DEC.

Attitudinal responses to various questions are analysed to attempt to make generalisations about opinions and reasoning behind the production and consumption of recycled organics. However, due to the limited response rate for the survey, the results presented below should be considered with caution when attempting to generalise the results to all processors and consumers of OHP.

Current use of RO

Reasons why processors use RO in production processes

The range of responses from processors to this open-ended question can be attributed to the types of businesses that they operate and why they have ended up processing RO. Some organisations have made an active decision to process RO and some have ended up by default. As alternative waste technology uptake increases, more organisations will become involved in the processing of RO.

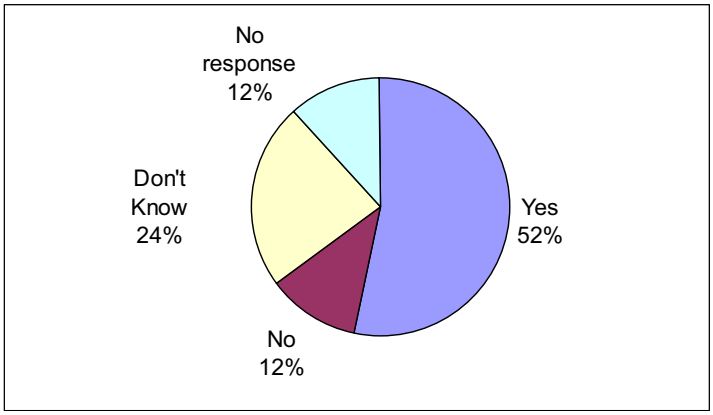
Almost 30% of all processor responses indicated that one of the reasons for processing RO was that the actual production process was designed to recover organics from MSW, or that recovery of organics was a by-product of their process.

Conserving environmental resources such as sand and soil, and increasing recycling were also identified as reasons for processing RO. Availability of RO and contract conditions were noted as other reasons for processing RO, as was product quality.

Consumers that currently utilise products containing RO

Of the 17 consumer survey responses, 9 consumers indicated that they used RO, the remaining respondents were either unaware or uncertain if they did.

The high proportion of “Don’t Know” response (24%) indicates awareness of RO is poor or labelling of product origin is not clear. Some products may be a blend and not indicate the contents.



Consumer awareness of using RO (source - GHD survey 2004)

Of those consumers that were aware of using RO – the main reasons provided for using RO included price/cost incentives, environmental reasons (general benefits and role in sustainable practices), quality, availability, and REC (biofuels only) eligibility.

Other reasons included performance reasons such as:

- Increased performance
- Increased plant growth
- Increased water holding
- Increased fertility
- Improved soil health
- Products meet end use needs
- Required structure of material
- Results from previous work
- Higher quality / energy content than alternatives (biofuels only)

Process and logistical reasons were also identified as reasons for using RO products. These reasons included service, guarantees, and availability of materials for use in local works (such as onsite landscaping) or processing with local waste stream.

Consumers were also asked to identify the benefits of using products containing RO compared to using equivalent products (that do not contain RO). The perceived benefits of using RO included:

- Price
- Higher energy content
- Availability
- Effectiveness
- Biological richness
- Less toxic to humans in some cases
- Market response from clients
- Ease of delivery from supplier
- Deals with potential pollutant
- Contributes to sustainable practice
- Environmental benefits

Barriers

Barriers identified by processors

Barriers to increased RO usage were similar across all markets, and therefore they are presented here in summary, rather than explicitly for each market. Barriers to usage in the biofuels market, which are very different to soil applications, are discussed in the Biofuels Chapter of the main report.

The main barrier to processing greater quantities of RO as identified by processors was contamination. The issue of contamination is also linked to the second most common barrier identified by processors, which was that there is currently a not sufficient price incentive to encourage source separation of materials, especially where transporters and collectors of waste are looking for cheapest disposal options.

Other barriers identified by processors included:

- Operating capacity;
- Lack of regional groupings of Councils to tender waste processing;
- Absence of framework for "environmental services transactions", eg carbon credits, "sustainable resource certificates";

- Guideline limits are restrictive in some cases – for example the copper limits were viewed as too low by one processor who processed biosolids; and
- Can't track all waste sources - might have phylloxera.

Customer enquires of processors relating to use of RO

When asked to identify if customers had made enquiries relating to the use of RO, about half the processors indicated that enquiries had been made. The nature of the enquiries related mainly to the quality and characteristics of the product, as well as the type of testing that was undertaken, and the type of products (blends) available to customers. A summary of identified customer enquiries is listed below.

- Community interest - health reasons
- Consistency of RO products
- Does product contain biosolids?
- Nutrient levels
- Sampling method - compost tea liquid run off method?
- Does product meet guidelines for outdoor use?
- Types of micro-organisms
- Make specified blends for special customers?
- Product quality vs price?
- Does product contain seeds or contaminants?

Consumer perceptions

Consumers that currently use RO indicated that barriers to using more RO were generally related to quality, insufficient availability, price, and information (in that order). To achieve further market penetration and overcome these barriers, processors of RO need to clearly explain the benefits of using RO and also the manufacturing standards that are attained in producing RO.

Specific quality and contamination barriers, and information barriers are listed below.

Quality and contamination issues:	Information barriers
◗ Satisfactory screening of source organic inputs	◗ Specifications do not include products
◗ Sampling procedures for analysis	◗ Not enough information on recycled content
◗ Available quality and standard	
◗ Consistency	
◗ Particle size	
◗ Suitable RO product analysis/composition for farming requirements	

Consumer opinion on how RO products could be improved

Customer responses indicate that overcoming contamination is perceived as the most important issue in improving RO products. This perception was evident by suggestions for improvement that included:

- Better control over contamination;
- Better sorting of waste streams at source;

- Better screening to control weed growth;
- Undertaking trials of different sources of organics to monitor contamination and product quality;
- Ensuring consistent quality; and
- Having sufficient product analysis to ensure that products meet process requirements including potentially on-line testing for some processes to detect priority contaminants.

Other suggestions for improvements included promoting greater RO availability, promoting the added beneficial characteristics of organisms, and creating price incentives for the using RO products.

Reasons for not using RO

Consumers of OHP who do not currently purchase RO products identified unclear product information, low awareness, price and availability (through existing suppliers) as reasons for not purchasing RO. Product quality issues such as process disruptions and technical difficulties when using RO were also identified for consumers in the biofuels market. Failure to meet required standards was also identified as a reason for not using RO.

Whilst consumers who currently do not purchase RO products were able to provide reasons for their purchasing decisions (as outlined above), they were also able to identify specific advantages and disadvantages for the use of RO products. Perceived advantages related mainly to environmental issues such as recycling and minimising waste. Perceived disadvantages, related to reasons for not using RO related to contamination and difficulties in processing.

Non-RO Consumers analysis of RO products

Advantages	Disadvantages
Environmental reasons	Careful processing required for hygiene reasons
Organic source	Not knowing if heavy metals are in products
Recycled source	Major problems in the past
Minimise green waste	Process disruptions
Minimise disposal costs	Contamination

The majority of consumers of non-RO products indicated they were not aware if there were equivalent products containing RO on the market.

Customers that do no use products containing RO were asked to identify under what conditions would they consider using products that contain RO. Their responses included the following:

- Price
- Available through supplier
- Clear information about what is in the products
- More products available

Due to the limited number of survey responses, it is difficult to identify which of the above reasons were the main factors preventing customers changing product purchasing habits to use more RO.

Information sources

Processors

Processors were asked to identify how they "currently obtain information about the potential benefits/impacts of using RO materials in production?".

Answers provided to this question are summarised below, and they indicate that many processors learn from a variety of internal and external sources. In-house experience and research is identified as particularly important sources of information for processors.

Information sources for RO processors

Information source	Count	Percent of responses	Rank
Experience – inhouse	3	25%	1
Internet	2	17%	2
Internal research – inhouse	2	17%	2
Business and industry network	2	17%	2
Media	1	8%	5
Department of Environment and Conservation	1	8%	5
Learnt from international experience	1	8%	5

Customers

Consumers were asked what process is involved in the investigation of potential choice of products and determining which products to purchase. The range of responses is varied with no clear reference source for information of this nature.

Processes for investigation products and determining product choices as identified most commonly by respondents included:

- Undertaking trials;
- Review product quality (in terms of complying with certain standards (AS or otherwise), contamination, moisture content, energy content (biofuels));
- Price; and
- Determining further information either via word of mouth, the manufacturer, or company representatives.

Other ways consumers investigate products prior to determining which ones to purchase relate to purchasing arrangements under contracts, review of information in the media, discussions with suppliers, and conducting their own research. These are outlined below.

Product requirements	Contract/tender arrangements
From phylloxera exclusion zone	Selection from tender specifications
Products must have analysis of showing contaminants and heavy metals	Government contract
Products must be approved by NSW Dept. of Agriculture	Budget allocations
Internal processes	**Media**
Product decisions based on prior knowledge	Horticulture Magazine
Telephone enquiries	Follow up on advertised material
Existing Supplier	Internet research
Management decisions	Outdoor design source journal
Factors to be considered	
Availability	
Delivery time	
Effectiveness	
Potential use of products	
Quality	
Guarantee	
Service	

Further information which processors would like to receive

Processors indicated that they were interested in receiving further information on the:

- Use of food waste, potential chemical levels
- Biosolids taskforce - what is happening on a legislation level?
- Government initiatives for education and promotion of recycled products to the public

Consumers

5 out of the 17 valid consumer responses indicated that conducting trials and testing was a method of obtaining information about the potential benefits/impacts of using different products (particularly those containing recycled organic content)?

The range of consumer responses is provided below. These responses show that consumers can approach the trial and use of RO in a scientific and methodical manner. Processors should prepare information to satisfy these type of consumers.

Also important, is that processors are in themselves an information source for consumers – over 50% of processors indicated that consumers had enquired about the use of RO in their products.

Inhouse	Sales Network
Conduct trials/testing	Manufacturer
Staff knowledge	Supplier
Chemical analysis (or from external source)	Sales Representatives
External	**Media**
Field days	Horticulture Magazine/Publication
RO agents	Advertised material
Seminars	Internet
Word of mouth	Brochures
	Industry Journals

Appendix D

Potential RO Demand in Major RTA and Landcom projects

Major Landcom Projects

						Est. annual demand mulch (m^3/year)			Est. annual demand soil conditioner (m^3/year)			Total RO demand (m^3/year)		
Project	**Region**	**Total mulch demand (m^3)**	**Total soil conditioner (m^3)**	**Project start**	**Project complete**	**2004**	**2005**	**2006**	**2004**	**2005**	**2006**	**2004**	**2005**	**2006**
Greenway Park	GSR	691	780	2002	2006	173	173	173	195	195	195	368	368	368
Macarthur RC	GSR	2338	2640	2004	2011	292	292	292	330	330	330	622	622	622
Newbury	GSR	3825	4320	1999	2006	956	956	956	1,080	1,080	1,080	2,036	2,036	2,036
Park Central	GSR	850	960	2002	2006	213	213	213	240	240	240	453	453	453
Seconds Pond	GSR	6375	7200	1995	2009	911	911	911	1,029	1,029	1,029	1,939	1,939	1,939
Rouse Hill	GSR	2550	2880	2004	2015	319	319	319	360	360	360	679	679	679
Interciti	GSR	3000	2400	2003	2010	375	375	375	300	300	300	675	675	675
Bagnall Beach	MNC	1034	1128	1992	2007	207	207	207	226	226	226	432	432	432
Woodlands	SE	6375	7200	1999	2007	911	911	911	1,029	1,029	1,029	1,939	1,939	1,939
Total		**27038**	**29508**			**4,356**	**4,356**	**4,356**	**4,788**	**4,788**	**4,788**	**9,143**	**9,143**	**9,143**
Totals by region	GSR	19600	21200			3200	3200	3200	3500	3500	3500	6800	6800	6800
	MNC	1000	1100			200	200	200	200	200	200	400	400	400
	SE	6400	7200			900	900	900	1000	1000	1000	1900	1900	1900
	Total	**27000**	**29500**			**4300**	**4300**	**4300**	**4700**	**4700**	**4700**	**9100**	**9100**	**9100**

Major RTA Projects

						Est. annual demand mulch (m^3/year)			Est. annual demand soil conditioner (m^3/year)			Total RO demand (m^3/year)		
Project	**Region**	**Total mulch demand (m^3)**	**Total soil conditioner (m^3)**	**Project start***	**Project complete***	**2004**	**2005**	**2006**	**2004**	**2005**	**2006**	**2004**	**2005**	**2006**
Westlink	GSR	42200	8300	2003	2006	14,067	14,067	14,067	2,767	2,767	2,767	16,833	16,833	16,833
Penrith to Orange – other upgrades	GSR	2305	520	2003	2006	768	768	768	173	173	173	942	942	942
Liverpool to Parramatta Transitway	GSR	4610	1040	2003	2006	1,537	1,537	1,537	347	347	347	1,883	1,883	1,883
F3 Widening	GSR	1302	211	2003	2005	651	651		106	106	106	757	757	106
Cowpasture Rd Upgrade	GSR	2305	520	2003	2008	461	461	461	104	104	104	565	565	565
Bangor Bypass	GSR	1435	282	200	2008	287	287	287	56	56	56	343	343	343
Penrith to Orange – Leura to Katoomba	GSR	2873	465	2003	2006	958	958	958	155	155	155	1,113	1,113	1,113
Hoxton Park Rd Upgrade	GSR	1153	260	2003	2008	231	231	231	52	52	52	283	283	283
Penrith to Orange – Lawson upgrade	GSR	2873	465	2003	2006	575	575	575	93	93	93	668	668	668
Windsor Road upgrade – Seven Hills to Windsor Road	GSR	1153	260	2003	2006	231	231	231	52	52	52	283	283	283
Windsor Road upgrade – Roxborough Rd to Showground Rd	GSR	1153	260	2003	2008	231	231	231	52	52	52	283	283	283
F3 to Braxton Connection	MNC	37343	6045	2003	2006	12,448	12,448		2,015	2,015	2,015	14,463	14,463	2,015
Pacific Highway – Karuh to Bulahdelah Upgrade	MNC	7837	1768	2001	2007	1,306	1,306	1,306	295	295	295	1,601	1,601	1,601
Pacific higway – Bonville Deviation	MNC	5515	893	2001	2007	919	919	919	149	149	149	1,068	1,068	1,068
Pacific Highway – Karuh Bypass	MNC	5400	874	2001	2007	900	900	900	146	146	146	1,046	1,046	1,046
Newcastle Inner City Bypass	MNC	3798	747			1,266	1,266	1,266	249	249	249	1,515	1,515	1,515
Central Coast – Pacific Highway	MNC	1153	260			288	288	288	65	65	65	353	353	353

						Est. annual demand mulch (m^3/year)			Est. annual demand soil conditioner (m^3/year)			Total RO demand (m^3/year)		
Project	**Region**	**Total mulch demand (m^3)**	**Total soil conditioner (m^3)**	**Project start***	**Project complete***	**2004**	**2005**	**2006**	**2004**	**2005**	**2006**	**2004**	**2005**	**2006**
Pacific Highway – Coopernook bypass	MNC	2413	391	2001	2007	402	402	402	65	65	65	467	467	467
Pacific Highway – Taree to Coopernook	MNC	1729	390	2001	2007	288	288	288	65	65	65	353	353	353
Central coast – The Entrance Road	MNC	1153	260			384	384	384	87	87	87	471	471	471
Princess Highway – North Kiama Bypass	SE	4481	725	2003	2006	1,494	1,494		242	242	242	1,735	1,735	242
Total		**134184**	**24936**			**39,690**	**39,690**	**25,098**	**7,333**	**7,333**	**7,333**	**47,024**	**47,024**	**32,431**
Totals by region	GSR	63400	12600			20000	20000	19300	4000	4000	4000	24000	24000	23300
	MNC	66300	11600			18200	18200	5800	3100	3100	3100	21300	21300	8900
	SE	4500	700			1500	1500	0	200	200	200	1700	1700	200
	Total	134200	24900			39700	39700	25100	7300	7300	7300	47000	47000	32400

C = Commenced P = Detailed proposal stage

*** Project start and complete data based on project expenditure over 2003 – 2010 as estimated in DEC, 2004a**

Appendix E

Evaluation of Stormwater Trust Grants and Potential Projects that could use RO

Evaluation of Stormwater Trust Grants

Lead organisation	Project title	Description	Grant up to	Grant no.	Location	Proximity to composting sites	Grant over $100,000	Project may use RO	Potential
Blacktown City Council	Demonstrating Opportunities for a Water Sensitive Western Sydney ("Do WS2")	Blacktown Council will develop a series of sites demonstrating grassed swales, rainwater tanks, and other best practice features to test their performance and disseminate the information to stormwater managers throughout NSW.	$482,200.00	SR/G4122	GSR	Yes	Yes	Yes	Potential
Blue Mountains City Council	Stormwater Pollution Reduction Program for Business.	Council will target industry within the Blue Mountains region to minimise their impact on urban stormwater and improve the water quality in the World Heritage area.	$100,000.00	SR/G4017	GSR	Yes	No	No	No
Campbelltown City Council	Full Circle. Full Cycle (FC2)	Campbelltown Council will develop a multi-faceted education program including the community and council to raise the awareness of stormwater pollution and minimise its impact on the Upper Georges River Catchment.	$204,500.00	SR/G4098	GSR	Yes	Yes	Yes	Potential
Gosford City Council	Central Coast Beaches and Waterways Stormwater Clean-up Project	Gosford Council will install a series of pollution traps at Avoca and Ettalong Beaches and Gosford CBD coupled with an education campaign targeting summer visitors to these areas, to minimise the negative impact of stormwater pollution	$331,000.00	SR/G4102	GSR	Yes	Yes	Yes	Potential
Gosford City Council	Focussed Improvements in Stormwater Management from Gosford's Industrial Estates	Gosford Council will undertake a series of environmental audits targeting the automotive industries to lead to focussed improvements in stormwater management from Gosford's Industrial Estates.	$75,000.00	SR/G4103	GSR	Yes	No	No	No
Hurstville City Council	Catchment Care at Hurstville - School and Council Stormwater Action	Hurstville Council will involve 15 primary schools and council staff in developing an integrated School and Council Stormwater Action Project which will have significant environmental benefits on the Cooks River.	$103,685.00	SR/G4160	GSR	Yes	Yes	No	No
Hurstville City Council	Environmental Audit of Peakhurst Industrial Area - Impact of Land Use Operations on Lower Georges River Catchment	This project will undertake an environmental audit of all premises within the Peakhurst Industrial Area to minimise the impact of the premises on the Lower Georges River.	$82,000.00	SR/G4161	GSR	Yes	No	No	No

Lead organisation	Project title	Description	Grant up to	Grant no.	Location	Proximity to composting sites	Grant over $100,000	Project may use RO	Potential
Kogarah Municipal Council	Immobilising Pollutants from Mobile Polluters: Kogarah Stormwater Awareness And Action Project - Stage 2	The Kogarah Council Stormwater Awareness and Action Project, will target pollution from mobile businesses such as carpet cleaners, dog washers, and garden services to minimise their impact on local waterways.	$68,700.00	SR/G4095	GSR	Yes	No	No	No
Ku-ring-gai Council	Blackbutt Creek Stormwater Improvement and Community Education Program	Ku-Ring-Gai Council will rehabilitate Blackbutt Creek to minimise erosion entering the Lane Cove River and undertake a complementary community education program.	$112,100.00	SR/G4071	GSR	Yes	Yes	Yes	Potential
Lane Cove Council	A Demonstration Stormwater Outlet Project to Develop a Catchment Wide Approach	Lane Cove Council will undertake a review of current practices and develop a series of best management practice guidelines for improved stormwater management to protect the Lane Cove Catchment.	$124,500.00	SR/G4065	GSR	Yes	Yes	No	No
Leichhardt Municipal Council	The Leichhardt Stormwater Smart Tour and 'I Can Do That' Demo Site	Leichhardt Council will develop a Smart Tour for best stormwater practice to raise the local community's awareness through an 'I Can Do That' Demo Site Tour to minimise stormwater pollution entering the Sydney Harbour Catchment.	$61,700.00	SR/G4062	GSR	Yes	No	No	No
Manly Council	Balgowlah & Manly Corso Precinct Treatment Train & Balgowlah Industrial Estate Stormwater Improvement Project & reuse.	Manly Council will undertake environmental audits and conduct an education campaign along the Manly Corso to minimise the amount of pollution entering Manly Beach. The project will be supported by a sophisticated monitoring program.	$292,753.00	SR/G4064	GSR	Yes	Yes	No	No
Marrickville Council	Newtown, Enmore and Erskineville Environmental Improvement Program	Marrickville and South Sydney Councils will work together to undertake an assessment of all businesses in Newtown and Enmore to ensure that they have minimal impact of the environment, coupled with a community education campaign.	$850,000.00	SR/G4050	GSR	Yes	Yes	No	No
Mosman Municipal Council	Lawry Plunkett Reserve Stormwater Rationalisation and Rehabilitation Project	Mosman Council will install three gross pollutant traps, undertake rehabilitation of local creek banks and develop a community education program to minimise the impact of stormwater discharges from Lawry Plunkett Reserve to Sydney Harbour.	$303,412.00	SR/G4085	GSR	Yes	Yes	Yes	Potential

Lead organisation	Project title	Description	Grant up to	Grant no.	Location	Proximity to composting sites	Grant over $100,000	Project may use RO	Potential
North Sydney Council	Capacity Building Model for Stormwater Management in the Middle Harbour Catchment	North Sydney, Willoughby, Warringah, Mosman, Manly and Ku-Ring-Gai Councils will work together to coordinate their stormwater activities and identify improved stormwater practices throughout all levels of councils.	$150,000.00	SR/G4052	GSR	Yes	Yes	No	No
North Sydney Council	An Investigation of Options to Reduce the Economic and Environmental Costs Associated with GPT Spoil.	North Sydney and Willoughby Councils will undertake a study to investigate options to reduce the economic and environmental costs associated with waste generated from pollution traps with benefits to stormwater managers throughout NSW.	$97,500.00	SR/G4053	GSR	Yes	No	No	No
Pittwater Council	Keeping the Soil on the Land: Cooperative Catchment Management for Sediment Erosion Control on Scotland Island	Pittwater Council will use cooperative catchment management techniques and soft engineering principles to improve erosion control on Scotland Island, Hawkesbury River.	$130,000.00	SR/G4149	GSR	Yes	Yes	Yes	Potential
Pittwater Council	Across the Landscape: A Program for Park Neighbours Improving Water Quality in the Catchment	Pittwater Council will target local land practices at Ingleside and construct demonstration sites and conduct workshops with residents to lead to better local practices and improve stormwater quality in local waterways.	$95,840.00	SR/G4150	GSR	Yes	No	Yes	No
Rockdale City Council	Rockdale City Council Parks and Pupils Stormwater Education Project	Rockdale Council project will involve local pupils in a stormwater education project to minimise the generation of pollution and its impact on the Cooks River.	$82,000.00	SR/G4056	GSR	Yes	No	No	No
Ryde City Council	DARVALL PARK RYDE: Blue Gum High Forest/Rainforest Demonstration Stream Restoration, Stage2	Ryde Council will undertake Stage 2 of the Darvall Park Blue Gum High Forest Demonstration Project to restore the degraded riverbank and minimise erosion entering the Lane Cove River.	$130,550.00	SR/G4066	GSR	Yes	Yes	Yes	Potential
Strathfield Municipal Council	Cooks River Foreshores Riverbank and Restoration and Education Project	Strathfield, Marrickville and Canterbury Councils will work together to undertake an education campaign targeting the community, schools, and council, coupled with riverbank restoration to improve the impacts of stormwater on the Cooks River.	$550,000.00	SR/G4124	GSR	Yes	Yes	Yes	Potential

Lead organisation	Project title	Description	Grant up to	Grant no.	Location	Proximity to composting sites	Grant over $100,000	Project may use RO	Potential
Sutherland Shire Council	Water Sensitive Urban Design (WSUD) for On-Site Stormwater Retention and Reuse in Sutherland Shire	Sutherland Council will incorporate Water Sensitive Urban Design elements including rainwater tanks, porous pavement, infiltration trenches and landscaping into a new development to act as a demonstration for all new developments in the area.	$207,277.00	SR/G4016	GSR	Yes	Yes	Yes	Potential
Sutherland Shire Council	Environmental Assessment & Education of Vehicle-Related Businesses in Sutherland Shire Targeting Water Quality & Waste.	Sutherland Council will undertake an environmental assessment and education program targeting vehicle-related businesses in the Shire to minimise pollution entering the Hacking and Lower Georges River Catchments.	$200,000.00	SR/G4058	GSR	Yes	Yes	No	No
The City of Sydney	Clean Harbour Partners Program (Stage2)	Sydney City Council will extend its successful Clean Harbours Program to residents within the CBD targeting polluting behaviours to minimise the amount of pollutants entering Sydney Harbour.	$270,000.00	SR/G4049	GSR	Yes	Yes	No	No
The Council of the City of Botany Bay	Hillsdale Stormwater Awareness Program - "Spring into Action"	This project will target non-English speaking groups within the residential, commercial and industrial areas to improve stormwater practices. The project will be coupled with council training to integrate stormwater best practices.	$113,000.00	SR/G4022	GSR	Yes	Yes	No	No
The Council of the Municipality of Hunters Hill	Tarban Bay Environmental Walk - Linking Hotspots with Values	This project will link stormwater hotspots surrounding Tarban Bay through an environmental walk. The walk will raise community awareness about local stormwater issues and help protect the Lower Lane Cove River from stormwater pollution.	$140,000.00	SR/G4023	GSR	Yes	Yes	Yes	Potential
The Council of the Municipality of Hunters Hill	Water Sensitive Urban Design Demonstration Sites in the Lower Parramatta River Catchment	Hunters Hill, Ashfield, Burwood, Canada Bay, Leichhardt, Marrickville and Ryde Councils will cooperatively develop three water sensitive urban design demonstration sites in the Lower Parramatta River Catchment.	$74,600.00	SR/G4069	GSR	Yes	No	Yes	No
The Council of the Shire of Baulkham Hills	Water Sensitive Urban Design Capacity Building Program for Sydney	This project aims to build the capacity of the 46 local councils (including elected representatives, and all levels and relevant sections) in the Sydney Region to promote implement WSUD through training experience and technical guidelines.	$325,000.00	SR/G4063	GSR	Yes	Yes	No	No

Lead organisation	Project title	Description	Grant up to	Grant no.	Location	Proximity to composting sites	Grant over $100,000	Project may use RO	Potential
The Council of the Shire of Hornsby	Hornsby Creek Integrated Stormwater Education and Best Practice Campaign	This project will install 90 pit traps and investigate technology to prevent oils and grease entering waterways, coupled with community education and council best practice to minimise pollution entering Cowan Creek.	$355,845.00	SR/G4120	GSR	Yes	Yes	Yes	Potential
The Council of the Shire of Hornsby	Water Sensitive Design, Reuse and Education Project for Hornsby Shire Council's Nursery and Parks Depot	Hornsby Council will install stormwater reuse and pollution control techniques coupled with education as a demonstration to minimise the impact of nursery's on the environment.	$199,800.00	SR/G4121	GSR	Yes	Yes	Yes	Potential
Waverley Council	Visitor Impacts in the Coastal Zone	Waverley Council will target all visitors to Bondi Beach in an effort to minimise the litter left generated by these groups. The project will provide valuable information to all stormwater managers on polluting behaviours of visitors.	$245,500.00	SR/G4047	GSR	Yes	Yes	No	No
Willoughby City Council	Willoughby Waters - Community Participation in Sustainable Stormwater Management in Middle Harbour Catchment	Through this project Willoughby Council will foster community participation in sustainable stormwater management by the installation of a pollution trap and education and hence minimise stormwater pollution into Middle Harbour.	$315,000.00	SR/G4072	GSR	Yes	Yes	Yes	Potential
Wollondilly Shire Council	Werriberri Creek Stormwater Project for The Oaks	Wollondilly Council will install a pollution trap and construct a wetland. This integrated project will complement an education strategy being funded by Council and Sydney Catchment Authority to protect Sydney's drinking water supply.	$206,447.00	SR/G4032	GSR	Yes	Yes	Yes	Potential
Wollondilly Shire Council	Wollondilly Shire Stormwater Education Project	Wollondilly Council will develop a multifaceted education program including industry awareness, schools education, resident action, and an environmental trade show to minimise stormwater pollution entering the Upper Nepean River catchment.	$82,350.00	SR/G4031	GSR	Yes	No	No	No
Woollahra Municipal Council	Evaluation of the Benefits of Source Control and Integrated Council Operations and Management	This project will install over 150 pollution baskets within existing street drainage pits and trial a combination of education and enforcement to minimise the impact of stormwater pollution into Sydney Harbour.	$141,800.00	SR/G4158	GSR	Yes	Yes	Yes	Potential

Lead organisation	Project title	Description	Grant up to	Grant no.	Location	Proximity to composting sites	Grant over $100,000	Project may use RO	Potential
Wyong Shire Council	McColl Park Wetland	Wyong Council will construct a wetland system, develop a community education program and integrate council's stormwater program to minimise the impact of stormwater pollution on the Tuggerah Lakes catchment.	$213,000.00	SR/G4027	GSR	Yes	Yes	No	No
Coffs Harbour City Council	Caring for our Creeks Program. A Non Structural Integrated Stormwater Strategy.	Coffs Harbour Council will undertake a series of integrated strategies including community education, environmental assessments and council capacity building to minimise the stormwater pollution entering the Solitary Islands Marine Park.	$200,000.00	SR/G4034	MNC	Yes	Yes	Yes	Potential
Grafton City Council	Combined Clarence Valley Council's Stormwater Improvement Strategy	Grafton, Maclean, Copmanhurst, and Pristine Waters Councils will work together to undertake a community education program and coordinate planning and council practices to improve urban stormwater entering the Lower Clarence River.	$221,000.00	SR/G4041	MNC	Yes	Yes	Yes	Potential
Grafton City Council	Transformation of See Park Ornamental Ponds into a Stormwater Treatment System to Improve Water Quality in Grafton, NSW	Grafton Council will transform the local See Park Ponds into a stormwater treatment system through the introduction of aquatic plants and pumps to improve the water quality from Grafton township entering the Clarence River.	$50,380.00	SR/G4043	MNC	Yes	No	No	No
Greater Taree City Council	Urban Stormwater Pollution, Apprehension and Education, Phase 2 of Greater Taree City Council's USP Implementation.	Taree Council will install two pollution traps and undertake a schools and community education program to undertake their project Urban Stormwater Pollution, Apprehension and Education, to minimise the impact of stormwater pollution on the Manning River.	$227,650.00	SR/G4101	MNC	Yes	Yes	Yes	Potential
Hastings Council	Team Up to Sweep & Mop - An Integrated Solution to Hastings Urban Stormwater Pollution	Hastings Council will undertake a multifaceted stormwater project including the installation of pollution traps, community education, industrial assessments and council capacity building to reduce the impact of stormwater on the Hastings River.	$309,575.00	SR/G4035	MNC	Yes	Yes	Yes	Potential
Hunter Region Organisation of Councils	Sustainable Stormwater Management Capacity Building Program. A Package for Councils and Catchment Managers.	The Hunter Region Organisation of Councils will lead seven local councils in developing a sustainable stormwater management capacity building program. This package will have significant benefits for councils and stormwater managers in NSW.	$229,000.00	SR/G4086	MNC	Yes	Yes	No	No

Lead organisation	Project title	Description	Grant up to	Grant no.	Location	Proximity to composting sites	Grant over $100,000	Project may use RO	Potential
Kempsey Shire Council	South West Rocks CBD Stormwater Quality Management Scheme	Kempsey Council will target a series of stormwater pollution hotspots in the South West Rocks CBD, through the development of an integrated program of pollution traps, education, enforcement and rehabilitation.	$176,000.00	SR/G4094	MNC	Yes	Yes	Yes	Potential
Lake Macquarie City Council	Sustainable Stormwater Management for Salts Bay - "Save the Rainforest from the Rain"	Lake Macquarie Council will undertake a series of measures including rainwater tanks, infiltration trenches, grassed swales to minimise polluted runoff entering Lake Macquarie. The project will also work with the community to maintain pollution traps.	$256,753.00	SR/G4136	MNC	Yes	Yes	Yes	Potential
Newcastle City Council	Kotara Roof to Creek Project - an Urban Water Cycle Management Demonstration Project	Newcastle Council will work with local residents to install water sensitive design features such as rainwater tanks and swales to minimise the amount of stormwater generated within the catchment. The project will include significant monitoring.	$155,500.00	SR/G4154	MNC	Yes	Yes	Yes	Potential
Newcastle City Council	Black Duck Catchment - Living Sustainably with Urban Creeks	This project will focus on sediment control, remnant vegetation values and community education in the Black Duck Creek Catchment, to develop a program of Living Sustainably with Urban Creeks.	$302,300.00	SR/G4155	MNC	Yes	Yes	Yes	Potential
Newcastle City Council	Warabrook Estate Wetlands - Building Sustainable Business & Community Catchment Connections	Newcastle Council will install a series of pit entry baskets, sand filters, gravel beds and grassed swales to protect the Warabrook Estate Wetlands from urban stormwater. The project will build sustainable business and community catchment connections.	$368,100.00	SR/G4157	MNC	Yes	Yes	Yes	Potential
Armidale Dumaresq Council	Community and Council Education for Sustainable Stormwater Management in Armidale	Armidale Council will install two gross pollutant traps, undertake riverbank erosion control, develop a community education program and improve council responses to stormwater issues to minimise the impact of stormwater pollution on the Macleay River.	$216,000.00	SR/G4025	Outside Study Area	No	Yes	Yes	No
Ballina Shire Council	Bundjalung Nation Urban Stormwater Education Project	Ballina, Byron, Kyogle, Richmond Valley, Lismore and Tweed Councils will develop an Aboriginal stormwater education program together with local indigenous groups, utilising local messages to minimise the impact of stormwater pollution in the region.	$363,960.00	SR/G4084	Outside Study Area	Yes	Yes	No	No

Lead organisation	Project title	Description	Grant up to	Grant no.	Location	Proximity to composting sites	Grant over $100,000	Project may use RO	Potential
Berrigan Shire Council	Berrigan - Implementation of Stormwater Re-Use Scheme and Community Education Campaign to Improve Stormwater Quality.	Berrigan Council will implement a stormwater re-use scheme and develop a community education campaign to improve stormwater quality to minimise the impact of urban stormwater pollution on the Murray River.	$35,500.00	SR/G4138	Outside Study Area	No	No	Yes	No
Bourke Shire Council	Culturally Creative Stormwater Education Program	Bourke Council will conduct a culturally creative stormwater education program with local Aboriginal Groups to foster stormwater awareness and build on local knowledge to reduce the urban stormwater entering the Darling River.	$130,250.00	SR/G4037	Outside Study Area	No	Yes	No	No
Bourke Shire Council	Stormwater - Industry, Training and Education (SITE) Program	Bourke Council will install a gross pollution trap and undertake an industry training and education program to minimise urban stormwater pollution entering the Darling River.	$177,250.00	SR/G4038	Outside Study Area	No	Yes	Yes	No
Byron Shire Council	Far North Coast Combined Councils: Commercial/Industrial Areas Stormwater Assessment and Education Project	Six north coast councils will work together to undertake audits of over 2000 commercial and industrial areas, to minimise the stormwater impact on the Tweed and Richmond River Catchments. The project builds on past work and includes community education.	$961,100.00	SR/G4014	Outside Study Area	Yes	Yes	Yes	Potential
Coonabarabran Shire Council	Integrated Approach to Coonabarabran S/W Management: Installing a GPT at Mary Jane Cane Bridge & Community Education	This project will adopt an integrated approach to Coonabarabran stormwater issues through the installation of a pollution trap at Mary Jane Cane Bridge, community education and workshops to improve council practices.	$60,000.00	SR/G4131	Outside Study Area	No	No	Yes	No
Deniliquin Council	Deniliquin Litter Trap and Community Education Program	Deniliquin Council will install a litter trap and undertake a community and council education program to minimise pollution entering the Edward River.	$55,000.00	SR/G4046	Outside Study Area	No	No	Yes	No
Dubbo City Council	"Auto Alley" Education (at Source Treatment), Myall Street GPT and Swale (End of Line Treatment)	This project will integrate community industry and council education, with the installation of pollution traps and grassed swales to address stormwater pollution hotspots in Dubbo before they enter the Macquarie River.	$133,100.00	SR/G4108	Outside Study Area	No	Yes	Yes	No

Lead organisation	Project title	Description	Grant up to	Grant no.	Location	Proximity to composting sites	Grant over $100,000	Project may use RO	Potential
Dubbo City Council	'Adopt a Place' Stormwater Education Program for High-School Students, for Stage 4 Science.	Dubbo, Bourke, Brewarrina, Wellington, Narromine, Warren and Gilgandra Councils will work together to undertake a schools stormwater education program through the region.	$127,137.00	SR/G4110	Outside Study Area	No	Yes	No	No
Glen Innes Municipal Council	Wetland Construction and Community Education Program	Glen Innes Council will construct a wetland and undertake a community education program to minimise the impact of urban stormwater on local waterways.	$160,692.00	SR/G4075	Outside Study Area	No	Yes	No	No
Gloucester Shire Council	Reducing the Impact of Urban Stormwater on the Gloucester Billabong	Gloucester Council will reduce the impact of urban stormwater on the Gloucester Billabong and the Manning River through the installation of a pollution trap, education, and regulation.	$73,936.00	SR/G4089	Outside Study Area	No	No	Yes	No
Lismore City Council	Urban Drainage and Bushland Reserve Remediation and Education Project	This project will stabilise and revegetate eroding river banks at five degraded sites as well as undertake community education and workshops to improve council practices to minimise the impact of urban stormwater on the Richmond River.	$67,615.00	SR/G4128	Outside Study Area	Yes	No	Yes	No
Lithgow City Council	Stormwater Projects for Greater Lithgow	Council will undertake a broad education program with the community to minimise the amount of pollution entering the Cox's River.	$60,000.00	SR/G4134	Outside Study Area	Yes	No	No	No
Moree Plains Shire Council	Demonstration Project: Moree Council Providing Leadership to Improving Stormwater Management	Moree Plains Council will undertake a demonstration project including environmental audits of businesses, training of council staff and pollution traps to provide leadership to improve stormwater entering the Gwyder River.	$125,300.00	SR/G4111	Outside Study Area	No	Yes	Yes	No
Richmond Valley Council	Beech Street, Evans Head - Stormwater Initiatives	Richmond Valley Council will install twelve pollution traps along Beech Street, Evans Head, to minimise the impact of stormwater pollution generated from the local shops on a local wetland.	$153,350.00	SR/G4148	Outside Study Area	Yes	Yes	Yes	Potential
Uralla Shire Council	Removal of Gross Pollutants from Uralla Creek by Construction of Gross Pollutant Traps	This project will install six gross pollutant traps and restore a creekline with native vegetation to minimise the amount of litter and sediment entering the Gwydir River. These components will be supported by an education program for the community.	$135,000.00	SR/G4007	Outside Study Area	No	Yes	Yes	No

Lead organisation	Project title	Description	Grant up to	Grant no.	Location	Proximity to composting sites	Grant over $100,000	Project may use RO	Potential
Weddin Shire Council	Emu Creek Stormwater Education and Pollutant Reduction Project	Weddin Council will install a pollution trap and undertake a community, council and commercial education project to minimise the impact of urban stormwater on the Lachlan River.	$59,750.00	SR/G4143	Outside Study Area	No	No	Yes	No
Yallaroi Shire Council	Prevention of Stormwater Pollution in Warialda Reedy Creek within Warialda Town Limits	This project will install four gross pollutant traps and restore a creekline with native vegetation to minimise the amount of litter and sediment entering local waterways. These components will be supported by an education program for the community.	$150,000.00	SR/G4011	Outside Study Area	No	Yes	Yes	No
Yass Shire Council	Yass Sedimentation and Litter Control Projects	Yass Shire Council will construct minor projects as a demonstration to the community as to how some aspects of waterway protection can be effectively implemented around Bango Creek and Yass River.	$106,000.00	SR/G4147	Outside Study Area	No	Yes	Yes	No
Bega Valley Shire Council	Merimbula - Tura Beach Stormwater Project	This project will incorporate aspects of water sensitive design through the installation of stormwater basins and ponds and undertaken an education campaign, to act as a demonstration to minimise the impact of future development in the Shire.	$260,000.00	SR/G4001	SE	No	Yes	Yes	No
Eurobodalla Shire Council	Eurobodalla Stormwater Action Campaign	Eurobodalla Council will install three gross pollutant traps, undertake a community education program and improve council responses to stormwater issues to minimise the impact of stormwater pollution on the Moruya River.	$394,500.00	SR/G4024	SE	Yes	Yes	Yes	Potential
Goulburn City Council	Blackshaw Road Catchment - Targeting CBD Businesses, Customers and Stormwater Discharge, Mulwaree River	Goulburn Council will integrate the installation of a pollution trap with community education targeting CBD businesses and customers to minimise the impact of stormwater discharges on the Mulwaree River.	$196,460.00	SR/G4083	SE	Yes	Yes	Yes	Potential
Shellharbour City Council	Little Lake Catchment Caretakers	Shoalhaven Council will develop a multifaceted education program focusing on schools, council, businesses, council and the wider community to raise stormwater pollution awareness in the Shellharbour Region.	$85,100.00	SR/G4082	SE	Yes	No	No	No

Lead organisation	Project title	Description	Grant up to	Grant no.	Location	Proximity to composting sites	Grant over $100,000	Project may use RO	Potential
Shoalhaven City Council	Sportsfield Car Park Erosion Remediation	This project will install sediment traps at seven park areas, undertake planting and develop a community education program to mitigate erosion and minimise the impact of stormwater in the Shoalhaven Region.	$65,900.00	SR/G4080	SE	Yes	No	Yes	No
Snowy River Shire Council	Best Practice Stormwater Management in the Snowy Monaro Region	Snowy River, Cooma-Monaro and Bombala Councils with the Southern Region NPWS will work cooperatively to educate staff and integrate best practice to minimise the stormwater impact of new development within this region.	$338,500.00	SR/G4019	SE	No	Yes	No	No
The Council of the Municipality of Kiama	Kiama Catchment Caretakers	This project will integrate the installation of pollution traps, stormwater reuse and education targeting schools, tourists and council to minimise the impact of stormwater pollution on the local waterways.	$251,480.00	SR/G4133	SE	Yes	Yes	Yes	Potential
Tumut Shire Council	Tumut Urban Sportsground Creek Remediation and Rehabilitation	Tumut Council will undertake a rehabilitate a series of eroded riverbanks near the Tumut Urban Sportsground, and undertake community education to minimise stormwater pollution entering the Tumut River.	$46,000.00	SR/G4116	SE	No	No	Yes	No

Total	**75**	**GSR**	**36**	**GSR + Potential**	**15**
Potential	**29**	**MNC**	**11**	**MNC + Potential**	**9**
No Potential	**46**	**SE**	**8**	**SE + Potential**	**3**
		Outside Study Area	**20**	**Outside Study Area + Potential**	**2**
		Total	**75**	**Total**	**29**