Shoalhaven City Council

Two Bin Recycling Collection Trial

March - July 2009

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1.0 Executive Summary

An innovative residential kerbside waste collection system was trialed for the Shoalhaven City Council using the township of Greenwell Point over a 3month period from March to June 2009.

This presented the residents with a completely new approach to a 2 bin waste collection system which assisted them in recycling food and garden organics as well as the normally accepted recycling of plastics, glass, steel, aluminium and paper products.

In fact, what this innovative system did, was to present only two recycling collection bins to the residence and no waste collection bin.
This was part of an wholistic approach to change the way we view waste. The new system facilitates sustainable behavior change and incorporates appropriate low technology solutions to address our future waste challenges today. It sent a clear message to the Community,

- that more than 75% of the waste from a household is recyclable or reusable and
- with their help, and only with their help, Council could recycle and reuse their waste and greatly reduce the amount sent to landfill (less than 25%).

If this were achieved, this would not only be a great win for the residents; a win for Council; a win for the environment; offer potentially substantial financial saving and potential new and emerging job opportunities in the Green Jobs area…but, could it work? What would be the level of acceptance and participation from the community? How could Council ensure the greatest success for the trial?

Environmental Consultants were engaged to manage the Project and their duties included

- Work under the direction of the Waste Services Manager to achieve the scope of the trial;
- Work with Council Waste Education Officers to develop a community engagement strategy;
- Work with local business to facilitate their waste needs during the trial;
- Liaise and work with the Council's Waste Collection provider;
- Liaise and work with the Council's Materials Recovery Facility (MRF) provider;
- Manage the composting operation at the West Nowra Landfill trialing two composting methods and,
- Undertake auditing of the kerbside bins, the MRF and the compost facility.
- Provide face to face Customer Service with the residents.

Based on previous domestic kerbside waste audits and experience, it was envisaged that a conservative and realistic recovery rate for the trial would be 68% i.e. 68% of the waste collected from Greenwell Point will be either composted or recovered for recycling at the materials recovery facility. The remaining 32% would be buried in the landfill.

The results far exceeded any expectations with the achievement of a fortnightly diversion rate of over 80% for the duration of the trial. This higher than expected result can be attributed to the community engagement strategy. This included an innovative approach to proactive customer service, community consultation, transparency of Council operations, a collaborative approach empowering the Community, and engagement of the MRF operator and Collection provider. Further to this, the ease with which the composting systems were able to be implemented and the flexible approach of the MRF Operator were critical in the successful conduct of the trial.

2.0 **Background**

The trial provided an opportunity to respond to a number of the waste management challenges for the residential collection, processing, recycling and disposal of waste to landfill in the Shoalhaven. Considerations included:-

- The large geographic size and location of the LGA, questioning the introduction of a 3rd bin due to distances travelled by trucks and the resultant greenhouse gas effects
- Response to the targets set by Waste Avoidance and Resource Recovery Act (WARRA, DECC NSW Government)
- How to maximise recovery and minimise landfill
- Rising landfill costs including the NSW State Government Levy (currently $57/t and rising to $110/t in 2014)
- Conservation of landfill space to extend landfill life expectancy
- Community expectation for recycling of organics
- Introduction of a Carbon Pollution Reduction Scheme

2.1 Guiding Principles

In this era where we are re-evaluating the way we live including the use of the earth's finite resources, waste is a key area where individuals can make significant personal changes.
The trial was based on consideration of the Principles of Ecological Sustainable Development and application of the Resource Use Hierarchy.

The Local Government Act directs Councils to conduct business and make decisions based on the principles of Ecological Sustainable Development, "with due to consideration to social integrity, ecological integrity, financial viability, natural capital and biodiversity." These considerations formed the basis of our decision making framework in scoping the trial.

Application of the Resource Use Hierarchy (Please refer Appendix 2.1)
The future of waste management challenges current habits that form the fabric of our society. It has become clear that communities need to overcome the issues created by mass production, over consumption and mass generation of waste. These happen both individually and collectively at home, in the work place, at places of education and out in the community.

If the focus of our energy and time concentrates on our greatest resources – our human resources, we will be able to empower the community to take action leading to sustainable behavior change. It will be necessary to undertake a social marketing and community engagement strategy to provide families and individuals with the information and skills necessary to bring forth this change.

Humans are both the problem and the answer. If we do this effectively, the result is the use of low technology that supports sustainable behaviour changes and achieves the greatest resource conservation. **The technology must only assist the behavior change, not guide it**. The changing behaviour of individuals will influence their role at home, their attitudes at work and/or at school and overflow into the community. (More information is contained in the Appendix)

The opposite result is to seek a technological solution to overcome the lowest level of community attitudes and personal responsibility. These high technological solutions, present substantial ongoing financial cost to the community, with little behaviour change. This resides at a low level in the waste hierarchy and will not lead to a sustainable future.

More emphasis is now being placed on the waste producer to responsibly manage, minimise, reduce, recycle and dispose of the waste they generate. The Greenwell Point Waste Collection System is at the forefront of this approach.

Questions for Consideration

- What mechanisms, education and social engagement do we need to put in place to bring about the greatest positive behaviour change during the course of the trial?
- What do we need to do to overcome the community's natural resistance to change?
- How can we walk with the community during the trial; be visible and available?
- What implications will this have for future employment, job opportunities and small business opportunities?
- What additional technology and labour will be necessary to safely, efficiently and effectively process and recover materials for recycling and composting?
- Will the system be able to cope with residents who place incorrect materials in the bins?
- If successful, what impact will it have on future Alternative Waste Technologies (AWT) for the Region?

How can we maximize recovery of resources in the residential waste stream and maintain a two bin system?

1. The composition of the domestic (residential) waste stream was investigated to identify the materials (resources) we wanted to recover and recycle. (refer Table below)
2. These were moved around to test which of the 2 bins the material would be best suited to.
3. Finally, a bin and presentation method was found for residual waste .

Although this is summarised in 3 points, this process took sometime to gain agreement on the location of all the materials.

Listed below is the breakdown of the residential waste streams for the Shoalhaven LGA .

Table 2.1 Waste Breakdown and Possible Redirection (Source- Audits 2007)

Red Lid Waste Bin			**Yellow Lid Recycling Bin**		
Material	%	Redirected to	Material	%	Redirected to
Food	30 %	Organics	Paper, cardboard	46 %	recycling
Vegetation	14 %	Organics	Glass	37 %	recycling
Contaminated paper	7 %	Organics	Plastic	7 %	recycling
Nappies	7 %	Organics	Steel Cans	3 %	recycling
Untreated timber	2 %	Organics	Aluminium cans	1 %	recycling
Cooking Oil	1 %	Organics	Liquid Paper Board	1 %	recycling
Mixed recycling	15 %	recycling	Contamination	5 %	landfill
Other plastic, glass	9 %	landfill			
Textiles, clothing	3 %	recycling			
Stones, concrete, soil	7 %	3.5 % organics 3.5 % landfill			
Hazardous	2.5 %	landfill			
Electrical	1 %	landfill			
Miscellaneous	2.5 %	landfill			
Potential Diversion	79.5 %		Potential Diversion	95 %	

The outcome is a system that maintains 2 bins, both for recycling with no bin specifically for garbage. The system separates the organic component (food, garden, pet manure, other) of the residential waste stream into one bin and the remainder into one other bin (Recycling and dry residual bin). The concept of this system is fundamentally different from the current 2 bin and 3 bin collection systems, as one has to start to think in terms of resource recovery and residual to landfill rather than contamination e.g. in the Dry Recycling Bin we are asking residents to place dry waste, either bagged or loose with the normal yellow bin recycling. Therefore, if they are following the system correctly, these materials are not contamination but dry residual waste that will be sent to landfill.

2.2 The System

For the duration of the trial, the residents of Greenwell Point were asked to put away their existing red and yellow lid bins and instead use two new 240litre mobile recycling bins with different coloured lids. White was chosen as the lid colour for the Organics Bin to further differentiate it from green waste bins other Councils provide. The dry recycling bin lid was coloured orange – a mix of yellow and red!

Orange Lid Dry Recycling Bin
White Lid Organics Recycling Bin

The bin with the orange lid was used to put all the material that would normally be placed in the yellow recycling bin as well as dry packaging and bagged residual items. The other bin had a white lid and was used to place all organic materials (things that could be composted) including food, garden prunings, grass, seafood, soil, potting mix, animal manure & pet bedding material and nappies.

Residents were also supplied with a bench top kitchen caddy and a supply of biodegradable corn starch bags.
These had been used during the Shoalhaven Council Compost Trial and had been proven as an effect way to capture and manage food waste. The corn starch bags were also shown to break down quickly in a compost system.

Orange Lid Bin Material

This was collected weekly and taken to Shoalhaven Recycling's MRF in Bomaderry, NSW, for processing. The process here was to first remove bagged material (residual) then allow the rest of the material to be processed as normal recycling to separate the dry garbage (remaining residual) and loose recycling.

White Lid Bin Material

This was collected fortnightly and delivered to a specially prepared composting area at the West Nowra landfill. The material was first litter picked and then composted in one of two systems.

1. Effective Micro-organism (EM) Inoculated Compost System
2. Forced Aeration Compost System

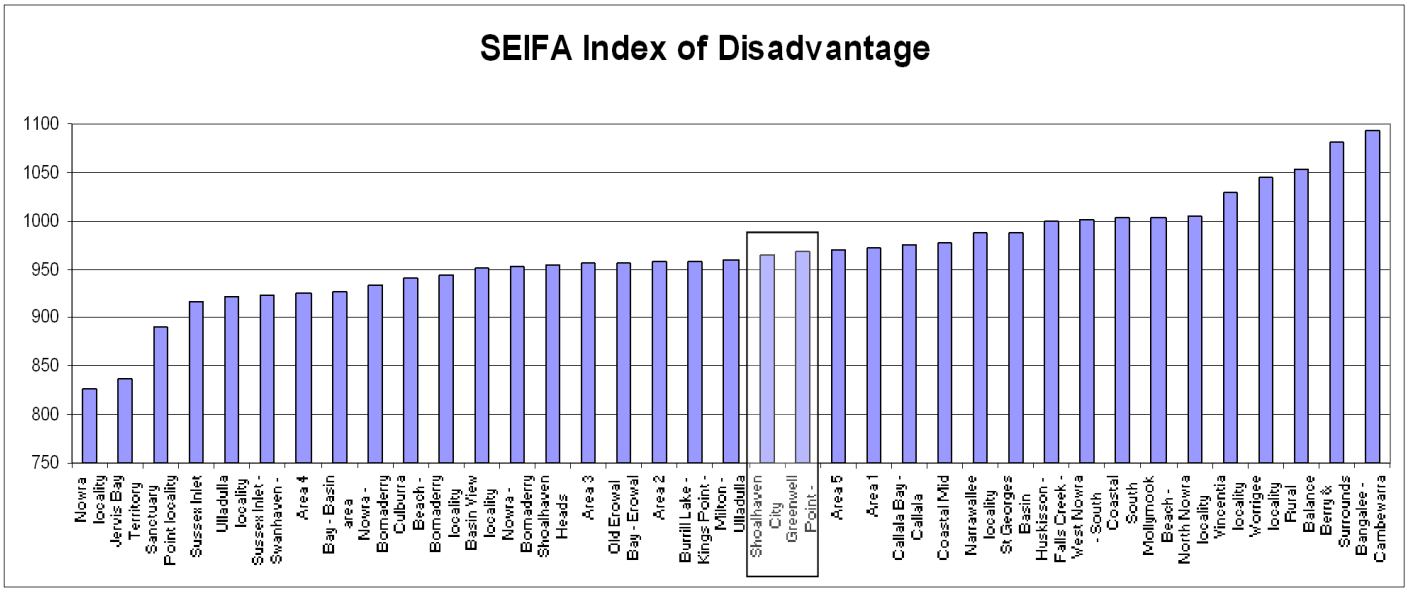
The idea of trialing these composting systems was to compare the performance of two systems using low technology that could be used in the future.

2.3 Selection of Greenwell Point as the Trial Site

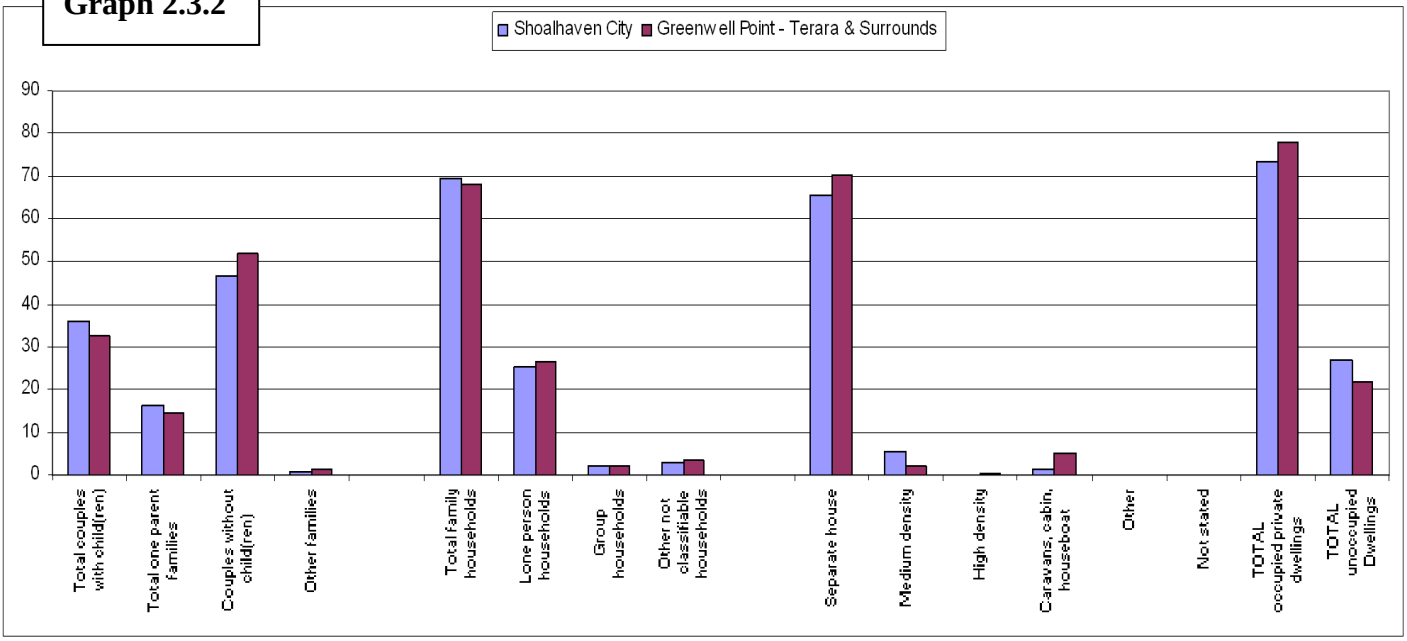
Greenwell Point is a small riverside fishing village of about 1400 people located in close proximity to Nowra, NSW, the major town of the Shoalhaven LGA. Geographically, it is separated from other towns and located within a short travelling distance to the West Nowra Landfill and the Bomaderry MRF.

It has approximately 720 residential waste collection services with about 200 that belong to holiday houses, rentals, businesses and holiday accommodation. Greenwell Point most closely mirrors the demographics of the composition of the broader Shoalhaven population by age, family units / individuals; household demographics, accommodation type and level of financial advantage/disadvantage. (Seifa Index, Graph 2.3.1, Graph 2.3.2)

Graph 2.3.1



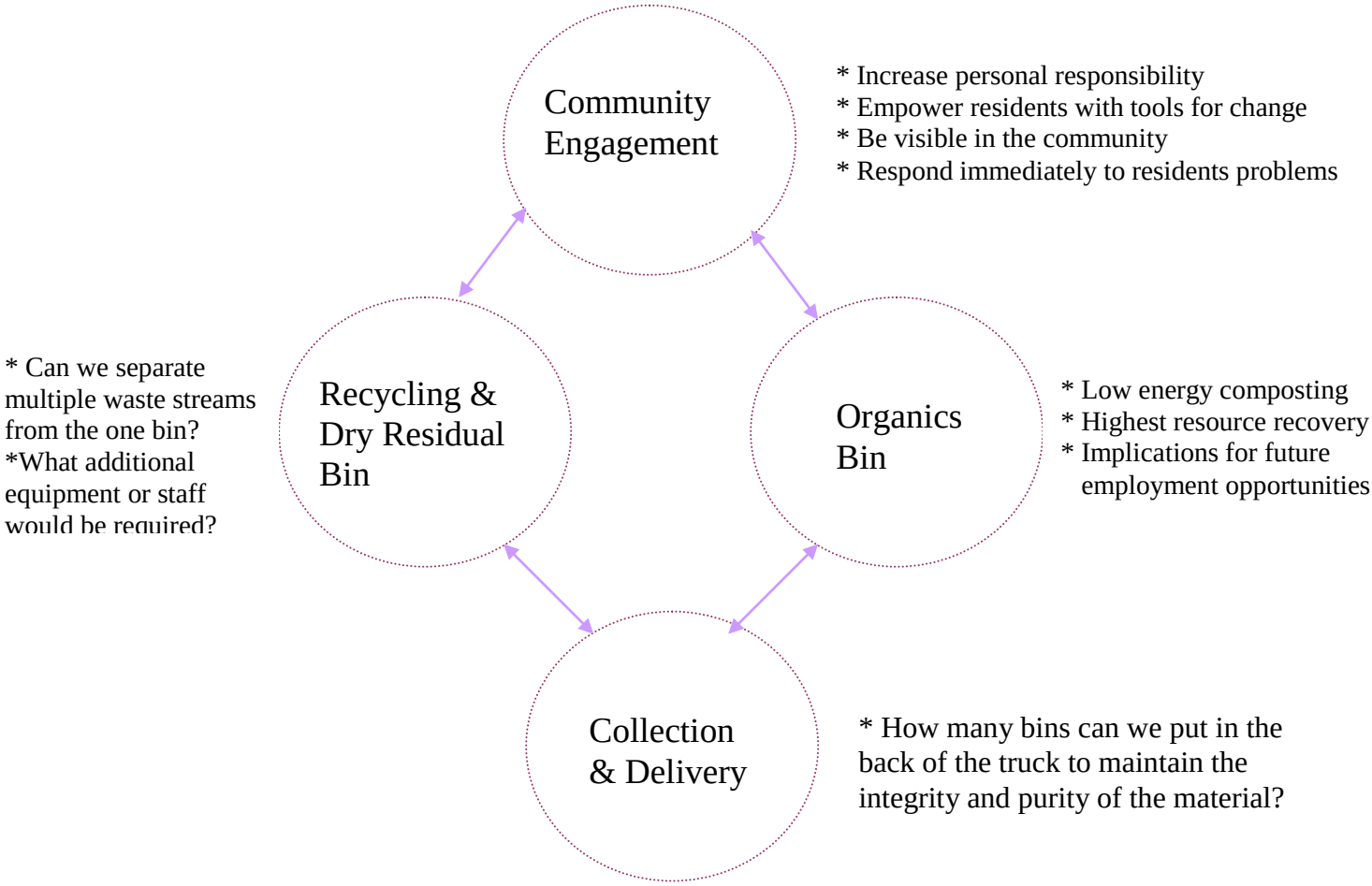
Graph 2.3.2



2.4 Reporting

Organisation and reporting of the trial can be divided into 4 broad areas. These are:

- Community Engagement (Residential and Business)
- Dry Recycling and Residual Waste Processing
- Organic (Food, green) Waste Processing
- Collection and delivery of kerbside waste to processing facilities



2.5 Data Collection and System Assessment

Kerbside audits were conducted weekly on the Orange Lid Recycling Bin and fortnightly for the White Organics Bin prior to collection on Monday morning. Auditors recorded the percentage full for both bins; obvious contamination; the volume of bagged waste; presence of biobags and houses requiring further education.

Material at the MRF was audited fortnightly to observe percentage composition of bagged waste from the Orange Lid Recycling Bin. During the course of the trial a more comprehensive audit of the MRF was conducted to look at the breakdown of the material and residual to landfill. The MRF operator, Shoalhaven Recycling, provided a weekly spreadsheet of the processed material.

At the composting facility, separated materials were divided into residual to landfill, recycling & textiles. These were aggregated as a total percentage of the total received.
During the course of the trial a more comprehensive audit of the White Organic Bin was conducted. Bins from 20 houses were randomly selected and a full audit of their contents was completed. Results are contained in the Organics section of the report.

3.0 Community Engagement

Public Meeting 19th February to introduce system to the community.

Sandwich board indicating the "Shopfront" is open. These were held 3 days per week.

This trial is as much about the innovative approach taken by the Council Waste Education Officers and the Project Team in engaging and educating the community as it is about the innovative 2 bin collection system itself.
This was a key opportunity for Council to take a fresh approach in engaging the Community with Council employees being open, understanding, available, visible, proactive, consultative, responsive, problem solving and collaborative. A key objective was to empower residents with a level of personal responsibility, pride and the tools to be successful.
This was based on the precept that the success of the trial system was a collaboration between the residents and Council, and that the success was highly dependant on this relationship.
It was important to demonstrate this precept in action rather than just talk. This lead to the Waste Education Team designing a community engagement process to achieve this.

Below is a summary of the actions that facilitated this.

- **Partnered with the "Get to the Point"** (GTTP) **Community Group** – This is Council's Community consultative body. Council staff met with this group to gain their support for the trial and to use their monthly meeting as a forum to engage the Community.
- **Regular Updates** of the Trial at the GTTP Monthly Meeting
- **Community Meetings** – these were held prior to and midway during the trial
- **Shopfronts** – The Greenwell Point Community Hall was used as a venue for the Shopfronts. These provided a means for the Community to come and ask questions to clarify the use of the system; how things were going; to give immediate feedback on how the system was affecting them; opportunities for the Consultant to follow up problems and difficulties and supply corn starch bags to residents. This occurred initially 3 times a week and reduced to 2 times a week later in the trial.
- **Greenwell Point Gazette Community Newsletter** – Council provided updates and education information via this newsletter throughout the trial. This is delivered monthly to all permanent residence and many non-permanent residents.
- **Home Visits to answer complaints and difficulties with the system**- The Consultant made appointments to meet with any unhappy residents to discuss their problems.
  This was done with an attitude,
  to listen first,
  learn of unforeseen challenges,
  ask them "how the system could be improved",
  take the opportunity to improve the system and,
  finally make suggestions and work towards a solution together with the resident.

In the majority of cases, a successful result was achieved most of the enquiries ended up being misunderstanding of the system of the aim of the trial.

- **Be Pro-active, on the front foot, to respond to phone enquiries and complaints** – The Consultant offered to meet the resident and this took place within 24hours of their enquiry.

- **Council Employees Greenwell Point Resident Liaison Group** – Those Council employees who are residents of Greenwell Point were approached to be part of a feedback group. For those that agreed to do this, we asked their opinions informally during the course of the trial and made a presentation of the results towards the end. We received valuable and honest appraisal of the system and were able to collect their feedback and suggestions for the system.

- **Letter box updates, invitations and information** – Beyond using the Shopfronts, Greenwell Point Gazette and the GTTP Monthly meetings, Council also letter boxed residents in a timely manner to invite them to meetings, results from the trial and ongoing education material.

- **Non-permanent resident letters and updates** – The Education Team acknowledge this group of residents as significant (approx 27%). Therefore it was important to communicate with them to ensure there was an opportunity for them to both participate effectively when they were "in residence" and to provide avenues for feedback. Non-permanent residents were included in all communications with the Greenwell Point community.
- **Local Business engagement and regular follow up** – Businesses in Greenwell Point using a Council kerbside collection service were identified. The Consultant then visited those businesses to determine their waste needs and design a system that would suit their needs. Businesses included a Seafood Restaurant, Motel, Supermarket, Fish and Chip Shop, Fuel and General Store, Chemist, School, Real Estate, Butcher, Fishing Lodge and Cabin Accommodation. These businesses were visited weekly during the trial to work through any difficulties.

- **Audit officers** performed community engagement and education whilst conducting weekly audits.

- **Recycling Facility, Landfill and Composting Site Tours** – There were 3 tours conducted during the trial which gave residents a first hand account and experience of the waste challenge at the landfill and how the material from their bins was being processed into compost and recycled at the MRF.

- **Feedback sheets and Surveys** – These were provided at the mid-trial Public Meeting and at the end of the trial to all permanent and non permanent residents.

3.1 Community Engagement Dates
Some Highlights

Get to the Point (GTTP) Executive support
In early February, a meeting was arranged with the GTTP executive to explain the trial, its expected outcomes and Council's philosophy for such an undertaking. It was critical to form this partnership in order to gain support from the local community.

GTTP February 2009 meeting
As arranged with the GTTP executive, Council officers attended the mid-February GTTP meeting to explain the trial to residents. The meeting had an overwhelming attendance, with over 100 residents

curious to hear Council's proposal. Not all those attending were entirely supportive, with many voicing their skepticism at the ability of such a system to succeed, especially given the absentee landlords and the holiday nature of their town. The Shoalhaven consists of 49 towns, all of which have, to varying degrees, absentee landlords and holidaymakers. It is acknowledged that this demographic will continue to remain as one of waste management's greatest challenges.

"Drop-in" 23/03/09 – 28/05/09

"Drop-in" sessions were scheduled for 3 days per week for the first half of the trial, then reduced to 2 sessions per week. Each "drop-in" session was for a 2 hour duration and was held at the Greenwell Point Hall.

The "drop-in" was resourced with examples of the bins and the kitchen tidy, extra bio-bags, a poster display and copies of all communications with the Greenwell Point community. A sandwich board advertising the opportunity to"drop-in" was placed prominently at the front of the building during each session.

For the community, the purpose of the "drop-in" was to provide an accessible, quiet, non-threatening environment for them to access information about the trial they possibly had missed, confirm correct use of the new bins, re-stock bio-bags and enquire about any other aspects of the trial. For Council, the "drop-ins" have provided valuable information about the education and communication methods adopted as well as how the trial was perceived by the community. Most importantly it allowed one-on-one communication and direct and immediate feedback, which in turn allowed Council to observe a pleasing level of acceptance of the new bins over the life of the trial.

Nearly 100 residents attended the "drop-ins". Their enquiries are summarized below:

- How to use the bins - these questions were very common at first with residents a little confused about what goes where
- Plastic bags v organic bags what was the difference and where do plastic bags go
- Replacement of bags for kitchen tidy bins.
- Concerns about the smell of the white bin (this was in the early weeks of the trial)
- Many suggestions about the bin being picked up more often
- Questions about pet poo and which bin to use
- Towards the end of the trial, most residents came to pick up bags and say how easy it was to use the system
- Lots of questions about what happens next and can they (the residents) keep using this new system

Easter Fair 11/04/09

Council attended the annual Easter Fair on the Easter weekend at the Greenwell Point Hall. The staffed display provided another opportunity to engage with residents as well as capture some of the absentee landlords and holiday makers.

"Tip Tours" 28/04/09, 12/05/09, 9/06/09

Tip Tours were arranged for residents to visit the waste processing sites. 42 residents came on the 3 tip tours organised for the West Nowra Landfill, the compost site and the MRF at Bomaderry.

11/5/09

A Mid-trial presentation at the Bowling Club was attended by 62 people and three staff. Surveys were completed by residents.

18/05/09

Presentation to the Greenwell Point Senior Citizens – 15 people attended - and then most of this group joined the final tip tour

Survey Feedback Sheets

Survey posted to all residents (inc absentee landlords or holiday house owners) for feedback – 230 surveys returned – more than 30% of the community

17th September 2009

Presentation of the final results of the Trial to the Greenwell Point Community and GTTP Executive as part of the GTTP Monthly Meeting. 25 people attended.

3.2 Business Engagement

The consultant made visits to all the businesses that use a Council Waste Service i.e. those collected along with the household bins. There are a diverse range of businesses in Greenwell Point which include a Seafood Restaurant, Motel, Supermarket, Fish and Chip Shop, Fuel and General Store, Chemist, School, Real Estate, Butcher, Fishing Lodge and Cabin Accommodation. Many of these businesses were supplied with larger bio-bags to line their internal bins or agreed to use the biobins and bags. The motel, caravan park residents & cabins and other holiday cabins all used the biobins and bags.

Systems were designed to meet the needs of the seafood restaurant, supermarket, petrol station general store, butcher, seafood take away and the chemist. In the case of the Chemist they have no organic waste and were supplied with only Orange Lid Bins. This increased their capacity to recycle more waste on a weekly basis compared to the red/yellow bin system.

Initially, the timing of collection of the white lid organics bin for business was fortnightly, the same as the householders. In the fortnight before the first white lid organics bin collection, the owner of the seafood restaurant contacted the consultant and discussed the need for a weekly collection of their organics bin which mainly consisted of seafood.

They had observed an increase in the smell emanating from the bins and the attraction of flies. This was easily rectified with a weekly collection provided by the consultant. A masking agent was also trialed with the bins. The owner and staff of the Seafood Restaurant appreciated that the food waste was being recycled and expressed that they would be disappointed if the service was removed. This same serviced was later provided to the Supermarket and General Store.

The success of the system trialed in the Motel, Caravan Park and Cabins was directly dependant on the interest and commitment of the Management and /or the cleaning maintenance staff. The Motel made a great effort which included making their own signs that were placed above the biobins. These signs were tailored to direct guests where to place the known types of wastes generated in the Motel rooms.

Through their efforts and with the support of the cleaners they achieved an excellent result equal to that of the best performing households. They were also grateful to be able to put their garden waste in the organics bin. Previously, this would have been placed in the Red Bin or taken to the local waste depot.

The seafood takeaway used biobag liners in their preparation area and placed bins in the public use area. These had reasonable success and it was noted that the sticker with many graphics was not suitable for this area – unlike a householder, the customer would benefit from a few simple messages of how to use the bins. Individual stickers with large lettering indicating a few key wastes to be placed in

the bin were trialed (e.g. Food, paper, seafood for the Organics bin & cans bottles, plastic cutlery for the Orange Lid Bin. These did improve the use of the bins in the public areas.

The most challenging business was the RSL Fishing Lodge. This has no local manager and is administered from a RSL in Sydney. In the end the easiest solution was to remove the organics bins and provide Orange Lid Bins only. In this case general waste was bagged and recycling was loose. Recycling was the largest component of the waste stream from this premises.

In rolling out this system City wide, it would be necessary to have dedicated Education Officers to engage and work with business to ensure success. On the whole, businesses were supportive of the system and many took pride in being able to recycle more waste. Engaging the on - ground staff was key to the daily success of the system. Regular visits from the consultant and his willingness to work with the business to fine tune their waste system was important.

The biobin liners for businesses had reasonable success. These proved to be less physically robust than general plastic bin liners and they are more expensive. They worked for most businesses but the Seafood Restaurant had to return to using heavy duty garbage bags. This is not a problem if the material inside are free of contamination. Bags can easily be split as part of a pre-sort at the composting facility. This fact should be noted for consideration by any potential tenderer for the Composting Facility.

There exists an excellent opportunity and a willingness from business to separate their waste if the appropriate supporting collection service and education is provided. The addition of food organics from businesses would benefit the composting process and increase volume produced.

3.3 Education & Communication Materials

Branding created for the Trial

To ensure information for the Trial was easily identifiable, branding was created and used on all publications. An information brochure, fridge calendar, bin stickers for the lid and body as well as a mid trial education brochure were produced. They all used the branding logo as well as invitations to the Community Meetings and other letterboxed information This clearly differentiated them from junk mail.

Information Brochure

A double side A4 information brochure was prepared for the beginning of the trial. The layout was an A5 booklet. Information was relayed in the form of questions and answers. These included:-

- Background to the Trial
- Why was Greenwell Point Chosen?
- How often will the orange and white lid bins be serviced?
- How to use the kitchen tidy bin and the biobags?
- How to use the white lid and orange lid bins?
- Information on the drop-ins, tours of the composting site and the MFR and a contact number for more information.

A copy of this can be found in the Appendix.

Calendar

An A5 Fridge Magnet style calendar was prepared, detailing collection dates; dates for the drop-ins and tip tours; and a general guide for the use of the bins incorporating simple images. On the reverse side there was a comprehensive list of the correct material for each bin. A copy of this can be found in Appendix xx

Bin Stickers

Bin stickers were produced for both bins incorporating graphics with simple text explanation for each. An A4 sticker was attached to the body of the bin and an A5 to the lid. As the trial was only for a 3 month period, a sticker was chosen to last this period. These however, faded and also came off some bins during the trial. Feedback on these sticker ranged from "great and easy to follow" and "too much information and confusing". A copy of the stickers can be found in Appendix xx

Mid Trial Education Brochure

This was designed in response to ongoing misunderstandings residents had which had been identified from observations during the weekly audits of the orange & white lid bins. The layout was presented as questions and answers concerning a series of real photos taken of waste from Greenwell Point residents' bins. A copy can be found in the Appendix

3.4 Summary of the Survey Results

Of the 720 household provided with a survey, 220 (31%) of residents returned the survey. 202 surveys were entered onto the database for analysis. Surveys were mailed out to the residents who do not live permanently at Greenwell Point and a letter box drop was made to all households using the trial service. A full report of all responses is available.

This report is a preliminary report and highlights some of the issues raised. Residents were asked to provide qualitative and quantitative responses. The volume of qualitative information provided by the residents is both encouraging and useful. Residents took time to answer the questions thoughtfully and, in most cases, provided constructive and positive responses. Residents were encouraged at the beginning of the trial and during the trial, to be vocal, to provide feedback and raise any issues or concerns they had about the system, the information provided or the trial generally.

The quantitative information has been divided into the areas which were of most concern to residents or provided the most quantitative data or feedback.

The %'s are the response to the question, the %'s are not how many residents responded. Some residents ticked more than one response e.g. a large number of residents ticked easy to use and going well and then provided more than one comment. It is important to read all of the information received from the residents not just this preliminary report.

Are you finding the use of the white organics bin and the orange dry recycling waste bin system easy to use?

□ Easy to understand and implement	(105)	47%
□ Going well.	(68)	30%
□ Still have a few questions but are using the system.	(36)	16%
□ Need more information	1	
□ Confusing, but are giving it a go.	(13)	
□ Don't understand, using bins like the red and yellow.	(1)	

Residents found the system - easy to understand and implement and going well - 77%

Issues with the white (organics bin):

Residents were adamant that the bin would need to be collected weekly and not fortnightly as was originally proposed for the trial. The reason for this is the perceived problem with the large amount of seafood consumed at Greenwell Point -oysters, crabs, fresh fish – residents perceived that there would be smell and odour issues during the summer and if the bin was not collected more frequently. Some residents suggested a summer trial to asses the issue.

Most residents managed their waste responsibly and only around six residents reported smell and maggots in the white bin. Officers visited these residents and offered advise on how to deal with the problem.

A large number of residents compost at Greenwell Point and deal with their more difficult waste items such as seafood in the following ways:

1) throw the remains or leftovers back into the river as burley.
2) freeze and then place in the bin on the morning of collection
3) Dispose of in the street litter bin.
4) Compost or pet food

Residents also recognised the need for a green waste collection alternative but were reluctant to accept a third bin alternative if the trial system provided a better more environmentally responsible option.

Residents were concerned that people who composted or had vegetable gardens and very little organic waste would not need a large bin and suggested smaller bins with variable charges. Similar to the three bins sizes we now have in the current system.

Issues with the orange (recycling and general waste) bin:

Residents had few concerns about the orange bin. The major concern was about the collection frequency - responses related to a weekly service versus fortnightly service and the smaller bin size options for residents who did not generate sufficient volumes of waste to fill a 240 litre bin.

Are you finding the kitchen tidy bins and the biodegradable bags easy to use?

□ Easy to use.	(124)	44%
□Going well	(53)	19%
□ Doesn't fit in my kitchen.	(13)	
□ It is a little smelly but OK.	(32)	11%
□ Too smelly	(12)	
□Attracts insects.	(24)	
□ Not large enough for my needs	(21)	
□ Too hard	(1)	
□Not interested.	(3)	

Residents found the system - easy to understand and implement, going well - 74%

Issues with the kitchen tidy and bags:

The kitchen tidy bin and bags system was well received and was very popular with residents. Feedback two months after the trial confirms some residents are still using the kitchen tidy and bags.

Residents concerns were :

- Bio bags needed to be bigger
- Biobags needed to have tie handles so the bags could be tied at the top before being removed from the tidy.
- A surprising number of residents informed staff that they used to bags for pet litter, and pet manure.
- In some cases residents requested bigger tidy's for larger families and to save having to empty the tidy as often.
- Residents also reported that they used the bio bags as freezer bags for the more difficult material like meat and seafood.
- Residents used an average of 5 kitchen tidy bags per week
- Some residents used the bags for nappies(feedback from nappy trial and drop ins)

Do you have any concerns about the use or collection of the White Bin?

□ Collect it weekly	(116)	55%
□ Maggots	(39)	19%
□ Smell	(54)	26%

Residents had significant concerns about smell and the frequency of the collection of the white organics bin – 81%

TWO BIN TRIAL SYSTEM VERSUS CURRENT TWO BIN KERBSIDE COLLECTION SYSTEM

A overwhelming number of residents, conclude from the qualitative feedback, favoured the trial system over the current two bin system:

85% of comments were in favour of the trial system,
10% in favour of the current two bin system and
5% found little difference in the two systems.

BEHAVIOURAL AWARENESS

Residents were committed to doing the right thing
Residents were engaged and encouraged to provide feedback throughout the trial.
Council staff had high visibility during the trial

Residents commented on how they –

- looked at packaging and were more aware of what they were buying.
- recycle more items
- joined the council compost program
- noticed a significant reduction in waste going into the orange bin
- considered the environment more
- were concerned about reducing waste to landfill

4.0 Collection and Delivery

It was decided, after much deliberation, that the residents of Greenwell Point should store their current red and yellow bins on their property for the duration of the trial and that Council would provide them with two new 240 litre wheelie bins with differing colour lids. The lids of the trial bins were chosen as Orange and White to distinguish them from the current bins. During the time of the 14 week trial only the Orange and White Lid wheelie bins were serviced.

Bin deliveries to each house commenced one week prior to the commencement of the trial, together with relevant trial information, including when and how to start using the new bins and what to do with their current bins. This information was mailed to non permanent residents.

The first collection for the trial, was Monday the 23rd March, 2009, and the plan was to have all the new bins delivered by Wednesday 18th March after the red and yellow bins were serviced on Monday 16th March. This would give the residents nearly a full week to use the new bins before servicing on the 23rd March.

Between Thursday 12th and Sunday 15th March the kitchen caddy, corn starch bags and the collection calendar were hand delivered to each residence. This was designed as an opportunity to inform residents of the impending start of the trial, when and how the bin change over would occur, and to answer any questions the residents may have. Non-permanent residences were visited on Saturday and Sunday creating the best opportunity to meet them.

The Orange Lid Dry Recycling Residual bin was collected weekly and the White Lid Organics bin was collected fortnightly.

For the purposes of the trial, the township of Greenwell was geographically divided into two areas, those north of Greenwell Point road and those south of Greenwell Point road. This was done for the following reasons:-

- To divide the collection areas to look at compaction and quality of the delivered material and
- To carry out a comparative trial of two styles of bins for the collection of the organic waste

There was a delay in the delivery of the new bins and some residents didn't receive their bins until the afternoon of Thursday 19th. This resulted in the presentation of both the Orange and Red Lid bin on the first servicing day Monday 23rd March.
It is recommended that if this system were to be rolled out 'City Wide' that the new bins arrive in the week before the changeover to the new service begins, to overcome any disadvantage to residents in the timing of delivery.

The residents on the north side of Greenwell Point Road were delivered a 240litre aerated organics wheelie bin. (pictured left) The residents on the south side were delivered a standard 240litre organics wheelie bin.
The trial compared the two styles of bins to see whether the aerated bin had a positive effect of reducing (liberating) moisture, thereby weight in the bin, and to reduce smells because of the combination of food, nappies and green waste.
The aerated bin is fitted with a grate in the bottom above the wheel axel, and ventilation holes top and bottom shown in light green on the adjacent bin.
The grate is pivoted just above the bottom front ventilation hole. This assists in emptying the material in the bin which usually tends to be soggy, condense, bind together and stick to the bottom of the bin.
So the different bin performance could be compared, the organics bins from the north side and south side were collected separately and delivered to the compost site.

Results – The weight of the truck and the number of bin lifts for the north and south side were recorded to determine a weight per bin. It was assumed that there would be little or no variation in the composition of the organics between the north and south side. Visually, the material appeared to be dryer from the north side aerated bins compared to the Southside. Despite this appearance, there was no significant difference in weight per bin. It was difficult to assess any difference in odour between the two bins.

However, the collection truck drivers reported that the material from the north side aerated bin were easier to empty. This could be significant for ongoing wear and tear on the truck lifting arm and the life cycle of the 240litre bin and repair frequency. The normal (necessary) mode of operation for the drivers to empty the bins is to strike the bin multiple times against the side of the hopper to dislodge the material. This causes stress on the lifting arm and high impact on the bins.

Auditing of the Kerbside Bins.

An auditor recording the information.

Prior to the collection of the bins every Monday, an audit team inspected the bins and recorded the following information and observations:
The percentage volume of the bin; any obvious contamination and any non presented bins.
For the Orange lid bin, percentage volumes for recycling, bagged waste and loose dry waste were recorded.
For the white bin the materials that were present, i.e. garden waste, bio bags, nappies, kitty litter and their volumes were recorded.
An example sheet is contained in the Appendix

Through the collection of this data we could observe

- the degree of understanding of using the system by the householder and
- the level of active participation.
- the increasing level of acceptance
- behaviour change
- resident awareness of Council services for waste streams not suitable for kerbside collection

It also allowed the Consultant to follow up directly with some residents who had a simple misunderstanding about the use of each bin and guided the education team in tailoring follow up information.
It provided information on those non particpants; those who were using the bins like the red and yellow lid bins; and those who were generating organics or recycling beyond the capacity of the 240l wheelie bin. This confirmed whether the collection of Orange Lid bin weekly and the White Lid bin fortnightly was an appropriate timeframe

4.1 Challenges with the Fortnightly Collection of the White Lid Bin
From a statistical point of view, with an average volume of 32% per week, the choice to collect the white bin fortnightly was confirmed through the data collected as part of the weekly audits. This however, did not account for the individual habits of residents, their individual waste needs and the make up of their households e.g. no of people, age etc.
It was anticipated that there would be resistance to this system from some residents and there existed the need to respond to these residents directly in a timely manner.

- For houses that placed green waste and food waste including meat into their white lid bin there was no problem with a fortnightly collection.
- No problems were caused for households that placed biobags filled with vegetable scraps in the white bin.
- Problems did occur when just biobags with food waste including meat were placed in the bin in the first week. By the second week it caused a strong smell, attracted flies and in some cases maggots appeared.
- The combination of only food waste and nappies in the bin caused difficulties with smell.

Below is a case study.
A resident emailed Council complaining about the smell in her bin. The consultant visited her within 24 hours of the call to investigate. The bin had been serviced 3 days prior to the visit and the resident had rinsed the bin out with disinfectant. There appeared to be no significant smell or odour when the consultant arrived. The resident had observed a liquid in the bottom of the bin and smelt a strong odour emanating from the bin which was attracting flies. She was only placing biobags with food waste, soiled paper and the occasional nappy in the bin. The resident was happy to do something different and agreed to try placing layers in the bin with paper and cardboard between the layers of biobags.

It was discovered that the fortnightly collection of the white lid bin had caused some residents to change a good habit. Prior to the trial, residents would keep their leftover meat and seafood in the fridge and freezer until bin night thereby eliminated the chance of smells and flies in the bin. With the fortnightly collection, they no longer had space in the fridge or freezer to store the extra weeks material. Therefore, they were putting it into the bin in the first week causing smells and flies in the bin in the second week.

In the Groundswell Project locations they had not experienced this, but due to the coastal moisture it became a problem.

Newspaper placed in the bottom of the bin to soak up any liquid

Then the biobags were placed as the 2nd layer.

Cardboard and paper were placed as the third layer.

Picture 1

Picture 2

Picture 3

Picture 4

The resident emailed the consultant a week later a great disappointment strongly criticising the trial.
On the return visit the consultant observed the following.
There was a strong offensive odour.
There were maggots in the bin.
Picture 1 shows the brown discolouration in the offending biobag.
Picture 2 shows maggots coming out of the bag.
Picture 3 shows the decomposition of the material in the biobag.
Picture 4 shows the bacon that has caused the problem.

4.2 Biodegradable Nappy Trial

Due to the inclusion of nappies in the Organics Bin, a trial of bio-degradable nappies was undertaken. From the kerbside bin audits, notes were made to observe houses where nappies were being used. After the first two weeks of the trial a list was compiled of all those properties with nappies and the consultant and Council's Waste Educators visited these houses with a view to signing up the residents to be part of the nappy trial.
Of the eighteen residents approached, only one decided not to participate. Other houses visited that were ineligible to participate, were those where the nappies belonged to visitors or to holiday houses with non permanent residents.

Residents were supplied with nappies for the remainder of the trial and provided with larger biodegradable bags which could be used in the house before placing them in the white lid bin for disposal. Two styles of Nappies were offered to the residents. One was a direct replacement for a disposable nappy with 80% bio-degradable contents, whilst the second, was a 2 part system with an outer reusable pilcher pants into which a 100% compostable pad was placed.

It would have been preferred to use a 100% biodegradable disposable nappy, however, at the time of the trial, none could be sourced. It is now possible to purchase these from an Australian manufacturer. They are working with Councils who provide residents with an organics collection.
Of the 12 participants, 3 chose to use the reusable pilcher/pad system. They did also combine this with the disposable nappies which they used when they were away from home. One resident also chose to use their current nappy for overnight use. On average each household used 42 nappies per week, therefore 84 per fortnightly in the white lid bin collection. This gives a total of 1008 nappies per fortnight collected.

The residents reported they were happy with both systems and the quality was equal to what they were currently using. The greatest challenge for the system occurred where residents only placed nappies and bio-bags with food waste including meat in the white lid bin. These residents experienced strong smells emanating from the bin and attraction of flies. Attempts to address this with layering with newspaper and using a spray masking agent were not 100% successful. (Results from composting the nappies appear in the Compost Section of this Report.)

During the time of the trial there were no Australian producers of a 100% bio-degradable disposable nappy. However, since July 09, a Tasmanian based company is now retailing a locally produced 100% bio-degradable disposable nappy and is proactive in working with Councils on promoting their use. Householders using the nappies are acknowledged by a sticker on their Organics collection bin and other incentives. (Please refer to www.eenee.com.au)

4.3 The Effect of Truck Compaction on MRF Material (Orange lid bin)

After the first two collection weeks of the trial, it became obvious that the quality of the material arriving at the MRF was heavily influenced by the weight and volume in the back of the collection truck and the type of compaction device that was used by individual trucks. It became necessary to investigate the effect of this compaction and to determine the most appropriate style of compaction device and the optimum weight in the trucks according to compactor body size (kg/m3) to achieve the best result for the MRF processing.

Investigation was carried out to source information on previous studies. Work done by A Prince Consulting on the style of Recycling Trucks and their compaction effects on the quality on recycling was used as baseline data.

Two styles of compaction device were used during the Greenwell Point trial,

- the paddle type (McDonald Johnston) and
- the pendulum type (Superior Pak).

The size of the compactor bodies varied from 22 – 25 cubic metres (m3). At the commencement of the trial the Orange Lid bin was collected in one load whilst the White Lid Bin was collected in two loads, those north of Greenwell Point Rd and those south of Greenwell Point Rd. As previously stated this was done to conduct the trial on the two styles of White Lid Bins. We were initially limited by this collection regime and associated truck allocation from the collection company. Therefore, the opportunity existed to compare truck compaction mechanism with the initial collection regime and a later a specific load/weight/compaction trial was conducted to determine an optimum kg/m3 for the preferred compaction device.

The different challenges that this system offers lies in the fact that residents were directed to bag some types of residual waste and place them in the orange lid bin with loose recycling. Results from the weekly kerbside audits showed that most residents were faithfully following this procedure and were achieving good and clean separation in their bins. The maintaining of the physical integrity of these bags during transportation to the MRF is a key component of the system. This means that the composition of the bin is fundamentally different from a "normal" recycling bin and the effects of compaction are also slightly different. Secondly, it was important to test the capacity of the system to deal with those recalcitrant! residents who would normally use any bin as a garbage bin.

This picture shows the effect of excessive compaction with the worst case resulting in a 1^{m2} compressed core from the front to the back of the truck. Glass is crushed, bags burst open, plastic bottles & aluminium cans are squashed and clean loose recycling binds together with paper and plastics. This increases the difficulty of separating the individual products and their recovery along the MRF sort line. The crushed glass bottles/ jars shred bags by the motion of the material in the back of the truck as it transported to the MRF. Bags containing food waste could be squeezed out over other material. This adds to the contamination and smell of the paper. The MRF operator commented that the speed and ease of processing the load was direct related to the degree of compaction.

In contrast, the result achieved when the load is at the optimum 200kg/m3 using a Pendulum Style compaction device. (Shown above) Bags are still intact, glass bottles loose and whole. Although there is a little compaction, bags don't burst, paper quality is as per normal recycling loads and materials are easily separated and recovered through the MRF process. There may even be a benefit from the padding provided by the bags in reducing overall glass breakage in the back of the truck. The compaction trial was carried out over 5 weeks and looked at compaction rates of 140kg/m3 to 240kg/m3. The same Superior Pak, Pendulum Style collection truck was used during the trial.

What implications does this have for a city wide collection?
Are there other options with current truck designs?
Is there the possibility of redesigning the trucks for better dispersion of material in the truck bodies?

The trial collection truck body capacity of 25m3 at 200kg/m3, will deliver a 5000kg payload for the orange lid bin material. On average for the trial, these bins weighed 11.5kg and about 25% of bins were not presented. This gives an effective weigh of 9.2kg. Below is a table summarising number of households that could be serviced per truck with columns showing the results if increases in body capacity and kg/m3 could be achieved.

Table 4.3 Truck Capacity and Compaction

Truck capacity	Payload at 200kg/m3	No. Households serviced (9.2kg / bin, 25% non present)		
		200kg /m3	210kg /m3	220kg /m3
25m3	5000kg	543 houses	570 houses	598 houses
29m3	5800kg	630 houses	662 houses	693 houses
31m3	6200kg	674 houses	707 houses	741 houses

It is hard to clearly say that an increase in truck capacity will directly correspond to an increase in the volume of quality recycling we are looking for. Larger truck bodies aren't necessarily much longer but look to utilise height and width. This means that material will be compacted against the rear of the body to push it higher into the load. This will result in greater volume in the back of the truck but the quality could be compromised.

As part of looking at possible solutions the Consultant contacted Superior Pak to discuss these issues. Two courses of action stemmed from discussions with the R&D Manager

- Investigate the practicality of using a single pass split body collection truck
- Redesign of the face of the pendulum compactor mechanism

4.4 Use of a single pass split body truck.

Superior Pak manufactures a pendulum style split body truck. It is split horizontally. Its purpose it to collect both recycling and garbage in the same truck as it travels down the street. Garbage is loaded into the bottom of the truck with recycling loaded into the top. The truck is fitted with a single pendulum mechanism. Its forward stroke down clears the hopper and compacts the garbage in the bottom split section and the return upward stroke clears the hopper and compacts recycling in the top split section of the truck.

Council is considering this is as an option as the whole truck, top and bottom, is utilised without having to push material up higher into the back of the truck. The Consultant visited Camden Council to inspect these trucks as they unloaded at the waste facility. The opportunity was taken to talk with the truck driver concerning the operation of the split truck in comparison to a normal truck.

The main comment from the driver concerned the clearing of the hopper for the recycling section of the truck. A flap on top of the hopper changes position to allow material to either be directed into the bottom or top of the truck body. Whilst the available space in the hopper for the garbage is sufficient, at times space for recycling material is found to be insufficient and takes a few passes with the pendulum to clear the hopper.

Please Note - If this truck was to be used, the surface area of the face of the pendulum that compacts the bottom of the truck, would need to be increased to a suitable size for recycling. Currently it is of a reduced size to achieve greater compaction for garbage.

4.5 Redesign of the Compactor Mechanism

Superior Pak suggested a trial of a modification to the face of the pendulum compactor mechanism. The face was to be fitted with a three face pushing attachment. The idea is to disperse the material more evenly in the back of the truck overcoming or reducing the compressed core that was observed during the Greenwell Point trial.

Superior Pak manufactured and supplied the modification as pictured above. Using the shape of the attachment, it is hoped that more material would be pushed to the sides of the truck. The Collection provider agreed to fit this to one of their trucks for evaluation. The Consultant carried a comparison trial using recycling that was delivered to the MRF. The modified truck was compared to an unmodified truck of the same cubic capacity as well as a paddle type and a pendulum garbage truck. Currently, we are awaiting results of the side by side tests.

5.0 Materials Recovery Facility Processing

This was another key area of the trial. Material from the Orange Lid bin was collected weekly and delivered to Shoalhaven Recycling MRF in Bomaderry. We would like to acknowledge the cooperation, collaboration and flexibility of the MRF Manager and staff.
There were many unknowns and some degree of reservation before the trial began such as;

- Was it possible to separate two waste streams from the one bin?
- Was it possible to successfully separate out the dry residual waste and bagged waste from the loose recycling?
- Would the quality of the recycling suffer?
- How would the possible increased presence of food waste affect staff conditions.
- Does the system have the capacity to cope with non participants contamination of the load?
- How different is the material compared to the Christmas Holiday Period?

Initially material was collected in one load from Greenwell Point. Within the first couple of weeks of the trial it became evident that the quality of the recycling recovered at the Materials Recovery Facility (MRF), was largely depended on,

- the weight collected by the truck in one load,
- the number of the bins loaded into the truck
- the size of the truck body in m3,
- the compaction rate and style of the compaction mechanism used by the truck.

This is reviewed in the collection and delivery section of the report.

Prior to arrival at the MRF, the truck's weight was measured at a public weighbridge. The material from Greenwell Point was unloaded in a specially constructed bay and processed separately to gain accurate weights of the recycling recovered and the residual that was sent to landfill.

The MRF staff would finish processing their general load to clear the MRF process line of any material that wasn't from Greenwell Point, clear all their sorting station collection bins and place new ones in location to capture only the material from Greenwell Point. After this was completed, processing of the Greenwell Point material began. After processing was complete, the sorting station collection bins were removed and the weights of individual materials were recorded. When the residual bin was taken to the landfill, the weight was recorded, and the composition was visually inspected before being buried.

A weekly meeting was held between Council's Waste Manager, the Consultant and Shoalhaven Recycling. As this meeting Shoalhaven Recycling presented a spreadsheet of the week's results for discussion to further improve the sorting and delivery process and give feedback on their impressions of the trial. This proved to be a valuable component for assessing the viability of the orange lid dry recycling residual waste bin. (Results for the 14 weeks are contained in the Appendix)

Fortnightly, audits were carried out at the MRF on the contents of bags from the orange lid bin. Randomly bags were selected from the unloaded material before it was processed through the MRF. More than 50 bags and there contents were recorded. Large individual items were also removed, weighed and recorded.
This helped to build a picture of:-

- what was contained in the bags
- how the residents were disposing of a variety of wastes,
- Was the system compromising the recovery of recycling?
- Was there potential for the recovery of additional material?
- to evaluate the effectiveness of the education messages and
- to gauge the resident's understanding of how to use the system.

During the course of the trial the open/tied and % damage categories were added. These gave clarity to damage caused during transportation

Auditing bags from the orange lid bin at MRF

Weight grams	2400	1100	300
open/tied	O	T	T
% damage	0	0	0
Bag No	**Bag 22**	**Bag 23**	**Bag 24**
soil food pack	40		40
plastic pack	25	30	10
mixed recycling	20	10	10
paper	15		
food		10	10
misc			
medical/sanitary		10	
Cigarette buts		10	10
nappies			
green			20
textiles		30	
e-waste			
Total	100	100	100

A Sample of MRF Bag Audit Sheet

Larger items like bike parts, pots and pans, were recovered for scrap metal.

The addition of food did cause a low level of contamination.

Green waste in the orange bin was a low 0.1% of the load

This shows bag damage caused by compaction and broken glass.

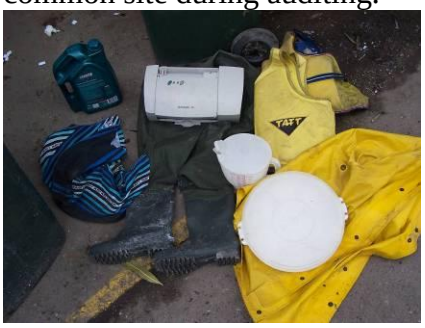
Textiles and clothes contributed a significant 4.9% of the load.

An example of courtesy shown to the MRF staff.

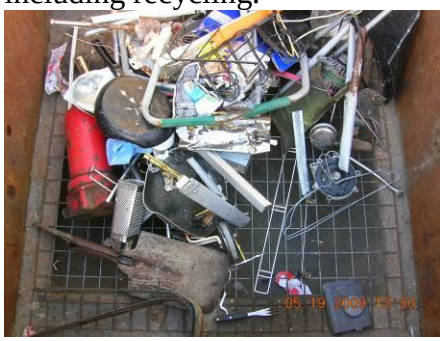
A bag of bags. This was a common site during auditing.

A bag containing mixed waste, including recycling.

Larger items removed before processing through MRF



Waste was found that was consistent with a fishing village



Scrap metal recovered through the MRF process.

Materials separated from the 1st station of the MRF process

The table below shows the total result achieved for the 3 month trial. More than 75% of the material from the Orange Lid Bin was recovered with less than 25 % residual to landfill. A more extensive audit was carried out at the MRF on the residual to landfill on 18th May. The results are also shown in this table.

A total of 322 kg of material was audited randomly selected from the different stations around the MRF. The first station is where bagged and oversize materials are removed. This was where the greatest material was sourced. Bags that feel light or obviously contain recycling are not removed and continue through the MRF process to be sorted. A bag splitter rips bags as they enter the trommel allowing the contents to roll loose.

Table 5.0 Material Weights and Audit Results From the MRF

Average Trial MRF Result Recovery and residual to Landfill from Orange Lid Bin		**Comprehensive Audit Results on Residual to Landfill Conducted at the MFR, 18th May 09**			
Material Type	Weight tonnes	**Material Type**	Weight kg	% of residual	% of load
Paper and cardboard	28.414t	soil food pack	41.0 kg	12.7 %	3.2 %
Glass recovered	7.329t	plastic pack	62.6 kg	19.4 %	4.9 %
Glass Fines	19.359t	mixed recycling	28.0 kg	8.7 %	2.2 %
Cans steel	2.6687t	paper	27.0 kg	8.4 %	2.1 %
Cans Aluminium	0.876t	food	43.0 kg	13.3 %	3.3 %
Plastic mixed	4.038t	medical/sanitary	2.3 kg	0.7 %	0.2 %
Bulky plastic products	0.976t	cigarette buts	1.4 kg	0.4 %	0.1 %
Residual to landfill	21.007t	green waste	1.5 kg	0.5 %	0.1 %
TOTAL PROCESSED	**85.834t**	nappies	7.9 kg	2.4 %	0.6 %
	24.46%	textiles	63.0 kg	19.5 %	4.9 %

Residual Percentage	**75.54%**	e-waste	13.3 kg	4.1 %	1.0 %
Percentage Recovery		misc	10.6 kg	3.3 %	0.8 %
		scrap metal	21.0 kg	6.5 %	1.6 %
		Total	**322.6 kg**	**100 %**	**25%**
RESIDUAL BREAKDOWN					
Plastic bags with contents and non-recyclable plastic	16.557 0.136	scrap metal = baking trays, frying pans, washing machine panels, trolley			
Ceramic and pyrex	0.265				
Timber	0.899				
Rags	0.025	misc = broom head, gyprock, front door mat, bicycle Helmet, timber, boogie board			
Polystyrene	0.182				
Hazardous Waste (car battery, gas bottle, ink cartridges, flares)	1.777	e-waste= DVD player, kettle, keyboard, batteries			
Other (cigarette butts, food scraps, sloppy paper/ plastic/ glass fines in a mush)	0.922				
Metal Ferrous (old BBQ plate, toys, kitchen pots)	0.103				
Metal Non-ferrous (aluminium, bike parts, toys etc)	0.141				
E-Waste (keyboards, tvs, dvds)	**21.007t**				
TOTAL					

5.1 Separation of Plastic Bags and the Effect of Additional Food Waste on Staff and Product Quality

During the course of the trial two methods were used to remove the bagged waste from the loose recycling.

- The first was to use the current MRF system and put more emphasis on the separation at the first station
- The second was to conduct a pre-sort of the delivery floor before processing the load.

The MRF operator decided to continue to use the current system and the first station. With the other system on the delivery floor a reduction in recycling was noticed. For a City wide system, it is suggested that an extra section of conveyor be established as a pre-sort to separate the bags and a second stream of processing be established to recover materials from the bags.

Although the recovery rate for material at the MRF was 75%, the presence of 3.3 % food and 3.2% soiled food packaging did increase the smell at the MRF. This was greatly influenced by the weight of the load and the associated compaction rate, i.e. bags would split, or be cut by broken glass under heavy compaction rates when the weight of the material in the 25m3 truck was above 5000kg. This compaction also had an effect on the quality of the material as food escaped from the bags and mixed with the loose recycling and because of the pressure materials were squashed together and difficult to separate through the MRF process. In assessing this effect, measurements were made of the sludge that was left at the end of the processing line.

The paper output was checked for quality to assess the degree of contamination by food & plastic as well as cross contamination from recyclables caused by excessive compaction squashing materials together.

This photo is indicative of the residual to landfill from the MRF processing of the orange lid bin material. As can be seen plastic bags make up the majority of material.

Food waste of course should have been placed in the white lid bin. One way that this could be further reduced is to collect the white bin weekly. What this trial has shown is that this system has the capacity to cope with the varying level of participation and understanding of permanent residents, part-time residents and tourists. With simple modifications to the current MRF process, the potential exists for greater capture and recycling of this material.

In the design of the pre-sort separation of the bagged waste from the orange lid bin material, consideration should be given to odour control and safe material handling practises for the staff. These bags could contain sanitary products as well as food soiled materials.

With this 2 bin system, because the whole waste stream is captured, there is an opportunity to crossover materials from the MRF and the Composting Site. An example of this are the paper fines that currently are captured at the MRF but can't be recycled. This material however would be perfect for composting.

A load of paper that may be soiled at the MRF could be re-directed to the Compost Site as newspaper and soiled paper are commonly found as part of the material to be composted. Conversely, the composting site is receiving bags of material that contain both recycling and textiles that could be re-directed to the MRF.

6.0 Organics Processing Area Composting Process

Under the direction of the Waste Services Manager, the Environmental Consultant was engaged to receive and process material from the White Lid Organics Recycling Bin using two different composting processes.
These are a

- Forced Aeration Composting System and
- EM Inoculated Composting System similar to the DECC Groundswell Project.

Both of these systems were chosen because of their simple technology, low embodied energy processes and the ability to cope with an uncertain and varying feedstock. That is, they can overcome the lack of the accepted carbon to nitrogen ratio contained in the material arriving from the residents. It should be highlighted that no additional feedstock was added, only what was received through the white lid organics bins was composted.

The material was collected fortnightly from the residents. The collected material was used to prepare 7 compost piles over the 14 week trial. It was decided that to construct four EM Inoculated compost piles and three Forced Aeration compost piles.


Composting bay with all weather service roads

The Composting Facility is located on an existing site at the West Nowra Landfill. It is a clay capped area of old landfill.
Prior to the trial composting beginning, earthworks were completed to establish an all weather access road for the collection trucks to empty their loads and service roads for the consultant.
Further to this, composting bays bounded by clay bunding were constructed to enclose and manage leachate and separate the compost from any storm water (rain water).

Week of Trial	Date of Collection	Method of Composting	Initial Turning Cycle	Variation in Turning Cycle
Week 2	30th March, 09	EM Inoculated	6 week	
Week 4	13th April, 09	Forced Aeration	6 week	4 week
Week 6	27th April, 09	EM Inoculated	6 week	4 week
Week 8	11th May, 09	Forced Aeration	6 week	4 week
Week 10	25th May, 09	EM Inoculated	4 week	4 week
Week 12	8th June, 09	Forced Aeration	4 week	2 week
Week 14	22nd June, 09	EM Inoculated	4 week	4 week

There were questions before the trial began such as

- What will the quality of the material be like that is received for composting?
- Will contamination be able to easily be separated?
- Will the system be able to cope with a large holiday and non permanent population?
- How will the composting process deal with the presence of meat, seafood, nappies, dog manure and kitty litter?

- What proportion of green waste, food waste, nappies, soiled paper, dog manure etc be contained in the material?
- How will the environmental requirements of the site management be met?
- With this combination of materials what are the implications for staff health and safety?

Pictured is a typical load of material collected from the white lid organics bin from the residents of Greenwell Point.
Within the load it is easy to see litter contamination. During the course of the trial contamination varied from 9 – 12% or conversely we were able to recover and compost 88 – 91%, which is an excellent result. There is also an opportunity to further recover the mixed recycling and textiles.

Some of the reasons for this material being in the incorrect bin could be attributed to:-

- Correct material but contained in a plastic bag or plastic packaging
- Simple misunderstanding of the system by residents (not quite sure which bin to put the waste in)
- Non permanent residents and transient visitors having limited understanding and experience of the system
- Some residents were filling their orange lid bin weekly so their additional "overflow" material went into the organics bin,
- Some residents were using the trial bins as they would the red and yellow lid bins. As the orange bin had the normal recycling in it, any general garbage or mixed waste was place in the white bin.

Despite the presence of this contamination, it was **easily to identify** and **easy to separate** out during the litter picking conducted by the compost team. This phase was identified as a necessary step of the composting process prior to the trial beginning.

Most of the material was contained in plastic bags which were still in tact upon arriving at the compost facility. It was observed that during the truck journey through the movement of material in the back of the truck, many of these bags made their way to the front and sides of the load. This gave the appearance when the truck unloaded of a greater amount of contamination that was real, and did assist in its separation.

As with the orange lid bin, it become necessary to observe the compaction rates effect on maintaining the contamination in tact, especially garbage bags of mixed waste, and loose recycling primarily glass bottles and jars.

As with the Orange lid bin material, the Superior Pak Pendulum Compacting System gave the best result but was limited to a maximum of 8 tonnes in a 25m3 Truck body. This is below the weight that could be achieved in garbage truck and more than the weight for a co-mingled recycling truck. **This could be increased once the levels of contamination are reduced through effective education programs.**

After the material was received, the litter picking and composting process began. Material was spread out over a runway in front of and inside the bunded area where the compost pile was to be made. Bins were set out along the length of the run way for ease of collecting the litter picked contamination. Bins were also placed around the unloaded material from the truck to directly remove contamination from this pile. Later, this was refined with the litter pickers carrying 20litre buckets to place the litter directly into.
This gives two distinct areas for capturing the contamination and helped to be more efficient working around the movement of the loader. The contamination was divided into three categories, mixed bagged, loose recycling, clothes and textiles.

Organics bin load on arrival with nearby litter bins

Material laid out along a run way for litter picking

Watering the spread out material to achieve even moisture

HDPE pipes for the Forced Aeration Compost System

Mixed VRM inoculant being applied from a backpack sprayer

Loader pushing up material after litter picking and watering

Compost area covered with polytarps to keep area dry from the rain.

VRM inoculated compost piles were covered with poly tarps. Tyres were used to hold down tarps.

6.1 What's in the bags?

It was common to receive plastic bags with green waste, dog manure and kitty litter.

This bags shows food waste with soiled paper towel and paper bags

A good attempt from a resident but not quite correct, with food waste still in their packets in a biobag. This improved during the trial with contaminated biobags 1.22%.

Bags of left over bread were common. Many of these were split open and emptied at the time of litter picking. Others were left to compost in the bag.

Although bags were removed during the litter picking phase of the compost making process, if the bags obviously contained food or green waste they were split open and the contents emptied into the compost. This was also true for meat, seafood dog manure and kitty litter. Some bags were left intact to see if the compost process affected the materials inside. These were observed at the 4 and 8 week turning phases of the compost process. It was shown that the meat, seafood, vegetables and bread were baked and had started to break down.
Later in the composting process, a rotary tiller was used to breakdown, blend and mix the material. This caused remaining bags to split open allowing the composted material to come loose and the bags were lifted to the top of the pile by the action of the tiller.

6.2 Auditing the White Lid Organics Bin

	Total (kg)	% of total
loose food	5.11	1.23
loose clean paper	2.4	0.58
soiled paper	1.93	0.46
food in biobags	109.53	26.35
garden refuse	240.0	57.73
nappies	11.68	2.81
biobags with contamination	5.09	1.22
dog manure, kitty litter, pet bedding	16.48	3.96
Mixed recycling	0.02	0.00
bagged waste	21.7	5.22
loose rubbish	0.88	0.21
Loose plastics	0.81	0.19
medical/sanitary	0.03	0.01
Cigarette butts	0.08	0.02
	415.74kg	100%

An audit was conducted on 25 white lid bins on the 8th June, 09. The addresses were randomly generated from the list of 720 services. A second list was generated to cover those houses that didn't present their bins for servicing on that day.
The material from these bins was collected prior to the collection truck servicing the area. The audit team emptied the bins into the back of a truck where preliminary sorting was completed.
Green waste, biobags, nappies, bags of general waste and loose items were arranged in the back of the truck. Once the 25 white lid bins were emptied, the truck was taken to the West Nowra Landfill where the auditing was completed.
The audit showed that it was possible to recover 94% of the material with 6% residual.

Although the average for the recovery of organics for the trial was 88% not 94% as in this audit, the audit results are representative of the characteristics of the trial. Some interesting facts to come out of the audit are

- green waste comprises 58% of the total material with food in biobags contributing a further 26%and loose food 1.23%. This constitutes for 85% of the load with a ratio of green waste to food of 66 %green to 33% food.
- The biobags with contamination only accounted for 1.22%, a lower figure than expected. It was observed by the audit team that the contamination in the biobags did reduce over the course of the trial, especially after the mid trial public meeting and education brochure.
- Most of the contamination was from bagged waste which comprised only 5% of the load. Of this, 50% was either food or green waste which potentially could be recovered.

This picture shows materials collected from the white lid organic bin audit assembled in the back of the truck. The material was divided into green waste, biobags, clean paper, nappy bags, plastic bags, loose food, garbage and recycling.

6.3 EM Inoculated Compost

This is a relatively new process and it is still under investigation. Initially the consultant followed the work done by the Groundswell and City to Soil projects. We would like to acknowledge the generous support given to the Shoalhaven Project by Simone Dilkara and Gerry Gillespie from Groundswell.
As previous explained EM stands for effective micro-organisms. The product was sourced through VRM (Vital Resource Management) who specialise in inoculants and microbial formulations used as Composting aids. These formulations typically contain a diverse range of microbial elements including yeasts, fungi, phototrophic bacteria, and lactobacillus.

It is claimed that the use of these inoculants promote stability in the composting process with the maintenance of temperature and microbial diversity throughout the processing term with better retention of nutrients and higher yield in the end product.

VRM EM contains both aerobic and anaerobic micro-organisms, however the formulation is designed to produce the compost primarily through a **fermentative anaerobic process**. Both the VRM *Starter Culture* and VRM *Microbial Seeding Agent* were used during the process. These are specifically designed for the varied feedstock of mixed food and garden waste that was collected in the white lid organics bin. Specific microbes are included that actively breakdown fats, meats and other difficult products that might challenge a conventional aerobic composting process.
The Starter culture is designed for rapid development of fermentative and rhyzobial activity and is used to quick start compost processes and digestion of sludge and difficult organic material.
The Microbial Seeding Agent also contains lactic acid bacteria, yeasts and photosynthetic bacteria which help to digest organic material. It also contains yeasts and special micro-organisms for the decomposition of oils and cellulose which suited the breakdown of the larger green waste that was placed in the white lid bin.
Collectively these composting solutions provide a range of significant advantages.

- Firstly, the requirement to turn piles is reduced as the microbial population does not require ventilation.
- Secondly, carbon retention is considerably higher than in regular composting.
- Thirdly, odour is greatly reduced and in most instances eliminated all together.
- Fourthly, the thermal and moisture efficiency of the piles, reducing both water requirements and runoff. This reduces leachate production.

These attributes are very attractive in the development of appropriate low technological composting solutions for the future which may be ideal for Regional Council areas. The conservation of water and reduction in turning provide significant savings in time and resources. Odour and the generation of methane are significant environmental factors for consideration for any composting facility.

The inoculant was supplied as a concentrate in a 25 litre container. It was mixed 1litre in 10 litres of water and applied with a back pack sprayer at a rate of 1 litre per cubic metre.

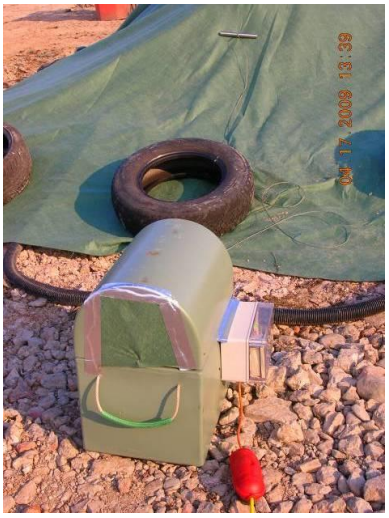
Temperature Results

	EM 1 Core Temps	Week Turned	EM 2 Core Temps	Week Turned	EM 3 Core Temps	Week Turned	EM 4 Core Temps	Week Turned
Week 1	62 ° C		63 ° C		69 ° C		73 ° C	
Week 2	62 ° C		63 ° C		72 ° C		72 ° C	
Week 3	60 ° C		66 ° C		71 ° C		69 ° C	
Week 4	59 ° C		66 ° C		68 ° C	turned	69 ° C	turned
Week 5	56 ° C		68 ° C		68 ° C		67 ° C	

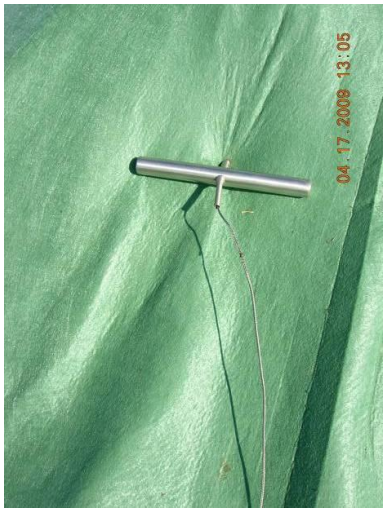
Week 6	50 ° C	turned	61 ° C	turned	74 ° C		66 ° C	
Week 7	57 ° C		64 ° C		72 ° C		63 ° C	
Week 8	57 ° C		58 ° C		69 ° C		57 ° C	turned
Week 9	51 ° C		61 ° C		64 ° C	turned	57 ° C	
Week 10	53 ° C		55 ° C		59 ° C		57 ° C	
Week 11	47 ° C		52 ° C		61 ° C		55 ° C	
Week 12	43 ° C	turned	55 ° C	turned	48 ° C	turned	52 ° C	turned

6.4 Forced Aeration

During the trial, variations were made to the Aerated process in response to the composting results. Initially, 2 x HDPE 110mm pipes were laid equally distant in the base of the compost. These pipes had 3 holes drilled at 500mm centres along its length. After the pile was constructed a compost probe was inserted and connected to a thermostatic switch which controlled a fan to blow air through the HDPE pipes. The thermostat was set to turn on at 65˚C and off at 55˚C. It was noted in the first couple of weeks composting of the first Aerated Pile that the fan was continually on and this was contributing the sides of the compost pile drying out. Water was added to the pile and one side was covered with a poly tarp underneath the compostex cover. It was found that the poly tarp helped retain the moisture.



Forced Aeration Fan Control Unit, with 750 W fan and thermostat controlled switch



1200mm Compost temperature probe insert through Compostex Cover

Temp Data Loggers taped to conduit. This was inserted into the compost piles to log temperature through the pile.

At the first 6 week turn the pipes were placed down the centre of the compost pile at the base. The composted material needed to be well watered to return the appropriate level of moisture for satisfactory composting. Further to this a poly tarp was placed on one side of the compost pile to test moisture loss.

By the time the third aerated pile was to be constructed, the system had to modified to

- Replace the HDPE drilled to a slotted 100mm pipe,
- The turning frequency changed to 4 weekly from 6 weekly,
- The use of only one aeration pipe to be placed centrally at the base of the pile and
- Covered with a poly tarp with air holes cut into the top instead of the Compostex cover.

Forced Aeration Temperature and Watering

In the first phase of composting the heap would exceed 65°C and the fans would operate fairly constantly over a 2 week period. After this period the fan would cycle on/off regularly. When the compost pile was first constructed about 1000litres of water was used. In the first aerated pile, due to the location of the aeration pipes drying out the heap, a further 600litres of water was added to return the heap to the necessary moisture level. In the subsequent aerated pile around 100litres was added during the turning process.

The final modifications suggested by the consultant are

- Use a timed on /off cycle whilst the fan is on to further reduce moisture dispersion and sweating under the poly tarp. It was suggested a 15 minutes on phase followed by 15 minutes off.
- For longevity, return to using the HDPE pipes but with slots cut in them rather than using the slotted agricultural pipe which tended to be crushed during turning of the compost piles.
- Consider a 4 week phase initial composting phase, followed by 2 weeks1st turn phase and finish with a 2nd turn 2 week maturation phase. The pile would then be uncovered for drying before screening.
- Use a stronger and heavier tarp with vent holes sewn in the material.
- Investigate the rate of air flow to the size of the compost heap. (The 750W fans used for the trial were considered to deliver air in excess of the requirements necessary for the 8 metre long compost piles.)

1st Step 2x HDPE air pipes

2nd Step HDPE pipes in core

3rd Step Slotted pipe in core

Temperature results, Watering, changes in turning cycle.

	Air 1 Core Temps	Week Turned	Air 2 Core Temps	Week Turned	Air 3 Core Temps	Week Turned
Week 1	70 ° C		63 ° C		68 ° C	
Week 2	70 ° C		68 ° C		64 ° C	
Week 3	68 ° C		65 ° C	turned	60 ° C	
Week 4	66 ° C		65 ° C		58 ° C	turned
Week 5	65 ° C		56 ° C		70 ° C	
Week 6	64 ° C	turned	59 ° C		64 ° C	
Week 7	56 ° C		56 ° C	turned	58 ° C	turned
Week 8	58 ° C		55 ° C		57 ° C	
Week 9	53 ° C		51 ° C		56 ° C	
Week 10	51 ° C		49 ° C	turned	44 ° C	
Week 11	46 ° C		45 ° C		37 ° C	
Week 12	52 ° C	turned	45 ° C		45 ° C	turned

6.5 Biobag Digestion, Degradable Bags, Food in Plastic Bags and Dog Manure

- Pictured below is a **biobag** made from corn starch after 3 weeks in a compost pile. As can be seen it has nearly decomposed. At the 4 week turn of the compost pile, there was very little evidence of any biobags. Those that did remain had been situated on the outside of the pile and therefore not exposed to core temperatures and microbe numbers.
- A number of bags labeled **"100% degradable"** were placed into the compost to test their rate of decomposition. These performed poorly and many were still intact at the end of twelve weeks of composting and 3 turns in the pile. These are not recommended for use in any compost system.
- **Food waste** left in its packaging was observed throughout the composting process. Depending on the material three results were observed.

1. Food was baked by the temperature in the pile and turned to sludge.
2. Food was baked and changed state into a stable solid material.
3. Nothing happened to the material.

- **Dog manure** was placed in both biobags and plastic bags by the residents. The biobags were left intact but the plastic bags needed to be split and emptied. Those that were missed were revealed during the 4 & 8 week turning of the compost. The manure inside had either turned to sludge or dried out.
- **Composting Nappies** - As part of the trial, 12 residents were supplied with biodegradable nappies. (Please refer to the Delivery and Collection Section of this report for more information.) This began between the third and fourth collection of the white lid organics bin. For the first two compost piles, the majority of nappies were removed as contamination as part of the first litter pick prior to making the compost. A handful of nappies were left in to observe their breakdown during the composting process. From the 4th compost pile all nappies were deliberately left in to observe the effect of the composting process on their contents. This included both the trial nappies and others that were collected in the white lid bin. Some nappies were subsequently removed during the 2nd and third turns of the compost, where it was clear they were non-biodegradable.
  Nappies had differing degrees of breakdown.

1 The biodegradable nappies located in the core of the compost broke down well including the corn starch bags they were placed in.
2 Nappies that were contained in plastic bags despite being biodegradable didn't decompose.
3 Nappies which weren't biodegradable remained in tact and dried out through the final phases of the process and were recovered during screening.



Biobag and contents after 3 weeks

Bread composted in its packet

Decomposing Nappy. Only the plastic outer cover will remain.

6.6 Screening and Sampling

The first screening occurred on 15th August 2009. Four piles were screened, EM1, EM2, Air 1, Air 2. The screen used was 25mm

Fines are being collected in the truck whilst the oversize heap is to the right. The over size was later screened to remove contamination

Picture 1

Picture 2

Picture 1 shows a close up of the oversize pile after screening the compost. **Pictures 2, 3, 4 & 5** show the materials that were separated from the oversize pile.
Picture 2 shows the fine material that was screened from the oversize pile. This could be put back into the composting process.
Picture 3 shows contamination from the site. On closer inspection you can see the clay and crushed rock that was picked up by the loader.
Picture 4 shows the litter that was collected. This consisted primarily of plastic, some nappies, some pieces of glass and a few AA batteries. This residual was weighed and sent to landfill.
Picture 5 shows the large sticks that were recovered from the oversize pile. These were recycled through the Green Waste Recycling Area at the end of the process.

Contamination from the Site and Site Conditions (refer to Picture 3)
During the process of turning the compost piles, both clay and rocks were introduced into the compost from the clay capping, the clay bunding and the service roads that were made from crushed concrete,

brick and tile. These materials influenced the quality of the test result. This was minimised in later piles by changing the bunding around the piles and the natural firming of the base that took place as the loader moved back and forth over the surface.
It was also discovered that EM 2 and Air 2 were located in low points in the site where rainwater pooled causing saturation of the compost material and clay at the bottom. This also could have influenced the quality of the test results these compost piles.

Picture 3

Picture 4

Picture 5

Preparing Lab Samples & Test Results
Compost piles EM1, EM2, Air1 & Air2 were screened on 15th August , 2009. Lab samples for these compost piles were prepared on 17th August and arrived at the lab on the 18th. The sampling process was observed by staff from the DECC Wollongong office.

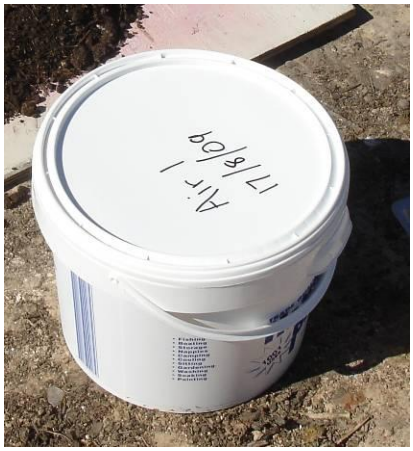
The results for the first 4 samples (EM1, EM2, Air1, Air2) achieved an 'A'Grade Classification for the AS4454. The micro testing according to the biosolids guidelines indicated a slightly elevated level of ecoli. Further testing and investigation for these piles is currently being undertaken. It would appear that the site contamination and site conditions have influenced the results.

The later compost piles (EM3, EM4, Air3) are showing minimal site contamination and the friable quality of the maturated compost is self evident. These later piles are proceeding through their final maturation phase and will shortly be tested to AS4454 & for levels of ecoli, faecal coliforms and salmanella. These results should be available late October, 09. It is anticipated that the results from these piles will differ from the first 4.

1. Samples were removed from throughout the pile.

2. These were placed on a board and mixed thoroughly.

3. The material was sieved with a 16mm screen.



4. Screened material was placed in a labeled bucket and sent off to the lab for testing.

6.7 Moisture and Air Monitoring

Post hole digger used to take the core samples. Pictured right-a close up of 450mm sample.

The core samples laid out for testing

To investigate the differences in the 2 compost processes, core samples were taken from EM4 and Air 3 to compare to moisture and air composition. Samples were taken using a post hole digger at a depth of 150mm, 300, 450 & 600mm. These were laid out and moisture level compared using the squeeze test.

Prior to taking the core samples, oxygen and temperature readings were recorded. Although the oxygen meter indicated a similar level of oxygen for both piles, the level of moisture was vastly different. Water could be freely squeezed from the EM 4 pile where none could be extracted from Air 3 despite being moist. The way moisture and air are consumed and used in these two systems is different and warrants more scientific investigation.

6.8 Design of Composting Facility

In consideration of how to reduce the impact of collection time and truck movements with a weekly collection of the Organics Bin, it proposed to establish decentralised Composting Facilities to better service the LGA.

These would be located at West Nowra Landfill, Huskisson Waste Depot and a site in the Ulladulla area. It is anticipated that with the introduction of an Organics Waste Collection Service an increase in the kerbside collected waste would occur. It is estimated that an annual average weight of 19,000 tonnes would be collected with possible seasonal variations to a maximum of 21,000 tonnes down to 17,500 tonnes.

The technology employed at the West Nowra Compost Facility compared with the Huskisson & Ulladulla facilities may vary do to the volumes each site processes. Below is a table indicating the possible volumes for each facility and a possible layout for West Nowra.

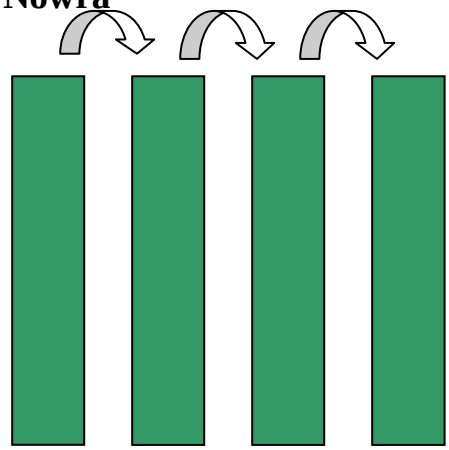
Volumes Anticipated at each Composting Site.

19,000 tonnes p.a.	West Nowra Landfill	Huskisson Waste Depot	Ulladulla Compost Site
% of Organics Stream	50%	20%	30%
Tonnes per annum	9360 tonnes	3900 tonnes	5720 tonnes
Tonnes per week	180 tonnes	75 tonnes	110 tonnes

Suggested Layout for West Nowra

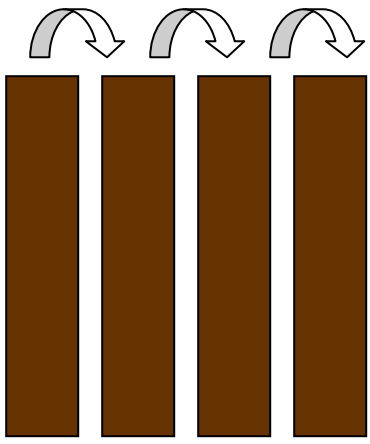
Undercover Receival and Processing Area
Concrete Floor
Front End Loader
Inclined Conveyor
Elevated Platform for Pickers
Over belt Magnet
Trommel
Mist Sprayers for EM
Transfer Bins and Truck

- 4 week compost turning cycle
- 12 week process including screening

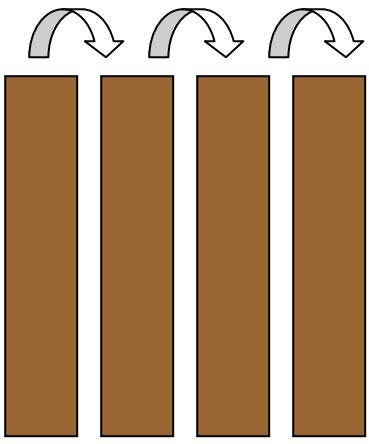


Zone 1, Wk1 Compost Windrows

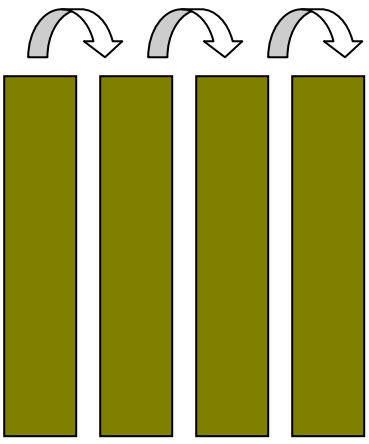
1st Turn 2nd Turn 3rd Turn



Zone 4, Wk 4 Compost Windrows

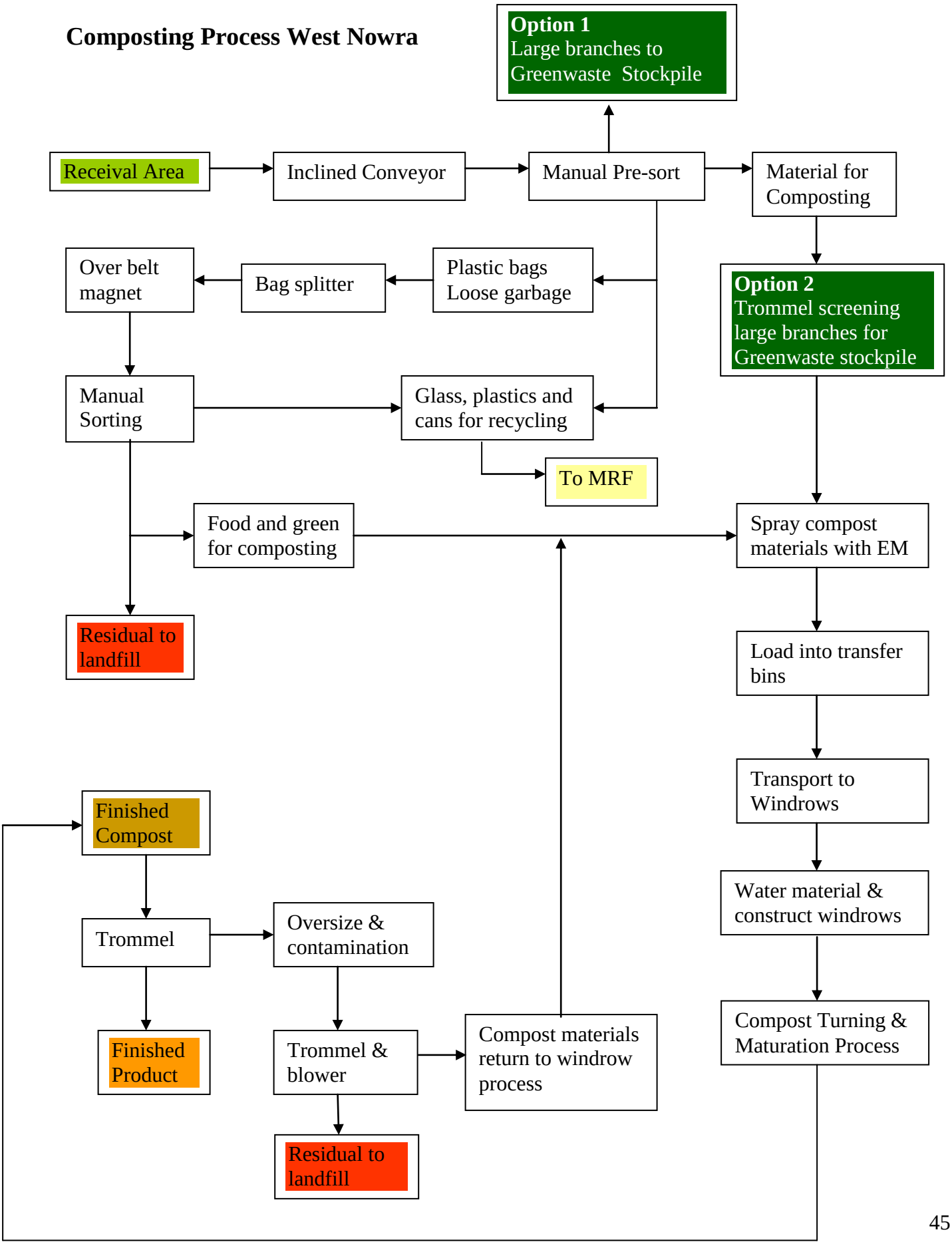


Zone 3, Wk3 Compost Windrows



Zone 2, Wk 2 Compost Windrows

Composting Process West Nowra



Manual Sorting

Resource Use Guide & Waste Hierarchy