Waikato Regional Council Technical Report 2014/55

Rural waste surveys data analysis
Waikato & Bay of Plenty

www.waikatoregion.govt.nz
ISSN 2230-4355 (Print)
ISSN 2230-4363 (Online)

Waikato
REGIONAL COUNCIL
Te Kaunihera ā Rohe o Waikato

Prepared by:
Jeff Matthews, GHD Ltd

For:
Waikato Regional Council
Private Bag 3038
Waikato Mail Centre
HAMILTON 3240

July 2014

Document #: 3114554

Peer reviewed by:
Marianna Tyler Date September 2014

Approved for release by:
Ross Pennington Date September 2014

Disclaimer

This technical report has been prepared for the use of Waikato Regional Council as a reference document and as such does not constitute Council's policy.

Council requests that if excerpts or inferences are drawn from this document for further use by individuals or organisations, due care should be taken to ensure that the appropriate context has been preserved, and is accurately reflected and referenced in any subsequent spoken or written communication.

While Waikato Regional Council has exercised all reasonable skill and care in controlling the contents of this report, Council accepts no liability in contract, tort or otherwise, for any loss, damage, injury or expense (whether direct, indirect or consequential) arising out of the provision of this information or its use by you or any other party.

Rural Waste Surveys Data Analysis
Waikato & Bay of Plenty

Waikato Regional Council

July 2014

Executive summary[1]

Summary statements

- The surveys conducted on 69 rural properties recorded 2564 tonnes of rural wastes. This is an average of 37 tonnes of waste disposed of on each property. Extend this average across all 14,685 farm holdings in both regions and an estimated 544,622 tonnes of rural wastes are disposed of annually.
- Combining the rural waste data from Canterbury with the Waikato and the Bay of Plenty regions', there is a potential 750,000 tonnes of rural wastes being produced and disposed of each year. If the 37 tonne disposal average per property is projected across all the 58,071 rural properties in New Zealand there is over 2.1 million tonnes of rural wastes produced annually.
- 100% of rural properties surveyed in the Waikato and Bay of Plenty regions buried, burned or bulk stored waste on site.
- Fifty percent of the rural properties surveyed had a burn pile or farm dump less than 40 metres from a water course or field drain. This means rural wastes could potentially impact on the streams, rivers, and groundwater.

Purpose of the report

The Waikato and Bay of Plenty Regional Councils undertook this study to determine if rural waste survey findings from Canterbury were representative of other regions in New Zealand. This report builds on the survey work in Canterbury and assesses the volumes and types of rural wastes produced by rural activities in the Waikato and Bay of Plenty regions. Specifically this report contributes towards building a national data set, identifies rural waste streams of concern and highlights the potential environmental risk of rural waste disposal activities. These are described as 3B practices (Burning, Burial and Bulk storage).

Methodology

GHD was commissioned to undertake the study and developed the survey methodology in alignment with those undertaken in Canterbury. This investigated rural waste types, quantities and disposal methods. The study was undertaken in as many districts across both regions, with participation from dairy, drystock, horticulture and arable practices undertaken on landholdings above 5 hectares area. Throughout the survey process GHD ensured anonymity for each of the participants.

[1] This report is subject to, and must be read in conjunction with, the limitations set out in section Scope and limitations and the assumptions and qualifications contained throughout the Report.

Observations

What does the data say?

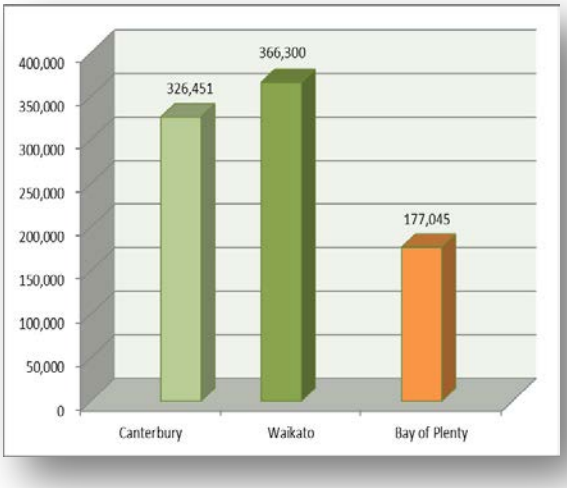


Figure 1 Projected rural waste tonnages (using a 37 tonne average)

The surveys conducted on 69 rural properties recorded 2564 tonnes of rural wastes. This is an average of 37 tonnes of waste disposed of on each property. Extend this average across all 14,685 farm holdings in both regions and an estimated 544,622 tonnes of rural wastes are disposed of annually. Figure 1 projects 326,451 tonnes from Canterbury, 366,800 tonnes from the Waikato, and 177,045 tonnes from the Bay of Plenty Regions per year.

Across the three regions there is a potential 750,000 tonnes of rural wastes being produced and disposed of each year. If the 37 tonne disposal average per property is projected across all the 58,071 rural properties in New Zealand there is an estimated 2,148,627 tonnes of rural wastes produced annually.

The application of an average tonnage per rural property across New Zealand is a simple projection and does not consider the variations in activity (dairy, dry stock, horticulture), property size, and activity intensity. However, the data shows rural wastes represent a national scale issue having been derived in consultation with property owners and industry stakeholders.

What wastes and behaviours stand out and why are they a concern?

Rural wastes include scrap metal, treated timber and fence posts, plastic wraps and ties, animal welfare wastes (syringes and vials), crop netting, glass, batteries, construction and demolition wastes, and domestic refuse. Every site surveyed used at least one form of 3B practices. Information was collected regarding the proximity of 3B sites to environmental receptors. Fifty percent of the rural properties surveyed had a burn pile or farm dump less than 40m from a water course or field drain. This means rural wastes could potentially impact on the streams, rivers, and groundwater in both regions. Rural waste disposal is creating a potential land and water contamination legacy which may impact on human, animal and ecological health for generations to come.

What are the barriers to improving rural waste management?

The findings of the surveys undertaken in the Waikato and Bay of Plenty Regions were similar to those encountered in Canterbury. The barriers to reducing the impacts of rural waste were identified as legacy farmer behaviour, lack of environmental risk awareness, lack of practical waste management options and cost. The surveyed rural property holders were reluctant to pay disposal costs when perceived ‘no cost’ solutions can be created on their properties.

What are the opportunities for improving rural waste management?

78% of respondents felt that they could manage their rural wastes differently. In general farmers were keen for more options and acknowledged that some of the current practices were not ideal. There is an opportunity for better information and access to practical solutions to be developed in collaboration with the rural sector.

Recommendations

The next steps in this rural waste study should address the barriers, risks and opportunities.

In view of this a number of recommendations have been made that include:

- understand the level of risk related to current practices;
- develop collaborative approaches to address issues;
- raise awareness of current disposal and recycling options; and
- raise awareness and create opportunities to share best practice.

Table of contents

Table index

Figure index

Appendices

Appendix A – Waste Data

Appendix B – Photographs

Waikato Regional Council, Bay of Plenty Regional Council and GHD acknowledge and appreciate the valuable contributions from each of the participants in the surveys. Participants were receptive to discussing issues in a transparent and open manner. This level of cooperation has led to a meaningful assessment of rural wastes in the Waikato and Bay of Plenty Regions.

Waikato and Bay of Plenty Regional Councils would also like to acknowledge and thank the District Councils who contributed funding to the project and the valuable input and support from the following organisations:

- **AgRecovery;**
- **Balance Agrinutrients;**
- **Beef and Lamb NZ;**
- **Dairy NZ;**
- **Environment Canterbury Regional Council**
- **Fonterra;**
- **Federated Farmers (Waikato & Bay of Plenty Chapters);**
- **Horticulture NZ;**
- **Open Country Dairy Ltd;**
- **Opotiki District Council;**
- **Otorohanga District Council;**
- **Plasback;**
- **Slatery Contracting;**
- **Tatua Dairy;**
- **Thames Coromandel District Council;**
- **Waikato District Council; and**
- **Zespri.**

These organisations provided support and materials that were instrumental for the successful completion of the survey work.

Scope and limitations

This report has been prepared by GHD for Rural Waste Surveys Data Analysis, Waikato & Bay of Plenty *and may only be used and relied on by Rural Waste* Surveys Data Analysis, Waikato & Bay of Plenty *for the purpose agreed between GHD and the Rural Waste* Surveys Data Analysis, Waikato & Bay of Plenty *as set out in section 1.1 of this report.*

GHD otherwise disclaims responsibility to any person other than Rural Waste Surveys Data Analysis, Waikato & Bay of Plenty *arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.*

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD (described in section 1.4 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

The opinions, conclusions and any recommendations in this report are based on information obtained from site visits. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation, access and the willingness of participants to show areas. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the number and volumes of wastes, the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

GHD has not been involved in the preparation of the Ministry for Environment Waste Minimisation Fund Submission and has had no contribution to, or review of the Ministry for Environment Waste Minimisation Fund Submission other than in the preparation of this Interim Report. GHD shall not be liable to any person for any error in, omission from, or false or misleading statement in, any other part of the Ministry for Environment Waste Minimisation Fund Submission.

1. Introduction

1.1 Purpose of this report

This report presents findings and observations of rural waste surveys that have been undertaken on 69 farms in the Waikato and Bay of Plenty regions.

This report and the survey work that has formed the basis for analysis and discussion were intended to gather data on rural waste management from a cross section of agribusinesses in both regions.

1.2 Background to this report

The Waikato Regional and Bay of Plenty Regional Councils' commissioned GHD to collect waste data from rural activities in their regions. The survey focus was rural wastes produced by different activities, e.g. dairy, livestock and cropping.

A recent study in Canterbury of 53 agribusinesses assessed the volumes and types of rural wastes produced by agricultural activities. The Canterbury report (GHD 2013) highlighted the potential for significant volumes of agricultural wastes being produced annually. This study was undertaken to see if the findings from Canterbury are representative of other regions in New Zealand.

The study included:

- designing and developing a survey programme which aligned with previous surveys;
- reviewing the levels of service provided by district councils and local contractors for waste management across the Waikato and Bay of Plenty Regions;
- performing the surveys; and
- evaluating and reporting on the data gathered.

The goal of the programme was to secure participation of a minimum of 68 rural properties for data collection over three working weeks.

1.2.1 Regional drivers

The Waikato Regional Council and Bay of Plenty Regional Councils' currently work with their respective Territorial Authorities to support and facilitate better waste management and minimisation across their regions. Regional solutions to waste issues are often more practical and cost effective, which places regional councils in a strong position to drive positive change. Undertaking this project provided an opportunity to collaborate with Canterbury Regional Council to broaden this study and add to the cumulative knowledge and data in support of a Waste Minimisation Fund application. The application will seek funding to assess risks posed by rural waste streams; identify opportunities for waste minimisation, recycling and safe disposal options; and designing and implementing programmes aimed at changing behaviour around rural waste management.

Waikato Regional Council

The data from the survey process aligns with one of the key focus areas in the *Waikato Waste and Resource Efficiency Strategy 2012-15* and was identified by council and strategy partners as an important project to ensure the regulatory framework aligns in a way that supports innovation and potential solutions to waste issues, without compromising the integrity of the environment.

Bay of Plenty Regional Council

This programme of surveys supports the objectives of the *Bay of Plenty Waste and Resource Efficiency Strategy.* Several focus areas of the strategy feed into this survey programme, particularly reducing the harmful impacts of waste where on farm waste disposal is identified as a waste stream with a potential to cause environmental contamination and pose a risk to human health. Improved access to information regarding on farm waste disposal, including its prevalence, the types of wastes disposed of, and opportunities for recovery and re-use of some waste streams will assist the regional council and territorial authorities to provide better waste solutions to rural communities.

District Council

Regional councils and district councils from across the two regions have been working together through the combined Waikato & Bay of Plenty Waste Liaison group which has rural wastes as an issue requiring further investigation (see section 3.9.3).

1.2.2 Painting a national picture

Both regional councils are collaborating with Environment Canterbury to develop a national data set (data for 122 farms spread across the three of the biggest agricultural regions in New Zealand).

The development of a national data set will help regional councils, key stakeholders and the Ministry for Environment understand if rural wastes represent an issue that needs to be addressed at a national level or at a more local level. It will also enable key stakeholder to understand what the pressure points are for rural communities in terms of waste minimisation barriers and opportunities. A valid data set will also be the first step in determining the significance of rural wastes in terms of their consequences for environmental harm. The first stepping stone of ‘is there an issue’ to the next step of ‘what is the significance’ will ultimately lead to the final step of ‘what instruments and practices are needed’. In this last step NZ will be able to identify and develop best practice and the appropriate mix of market based initiatives combined with appropriate levels of governance instruments and support.

1.2.3 Previous rural waste surveys

Canterbury survey

GHD was commissioned by Environment Canterbury to carry out an investigation into the types and masses of inorganic wastes produced by rural activities within Canterbury. GHD developed a methodology (that is very similar to the methodology discussed in Section 2) which enabled data to be collected from 53 farms across Canterbury. The data produced some surprising results, specifically in regard to the total mass of wastes from 53 farms which was in excess of 1000 tonnes. The survey process identified plastics, wood, packaging and hazardous wastes as the most predominant waste types produced.

The findings of the Canterbury and Waikato/Bay of Plenty surveys are compared in section 3.11.

Waikato Scoping Study Report

GHD was commissioned by the Waikato Regional Council to study the potential scale of rural wastes in the Waikato in 2013 The Waikato Regional Council scoping study made rural waste projections that used the data from the Canterbury surveys as a basis for projections. An estimation of circa 9900 farms would produce approximately 89,000 tonnes of inorganic waste and 238,000 tonnes of inorganic and organic wastes combined. The scoping study also brought

together internal Waikato Regional Council staff and external stakeholders to discuss key drivers for rural waste minimisation in the region.

Bay of Plenty and Waikato Regions Waste Stocktake[2]

This report identified a number of issues across both Regions including:

- *Many rural properties are not serviced by council collections and private collection services often fill the gap.*
- *Waipa was the only District to offer fortnightly rural kerbside recycling collections.*
- *Many TAs do not provide kerbside refuse and recycling services to all properties in their district due to their rural nature.*
- *Rural TAs have frequently highlighted agricultural waste as an area that needs to be addressed more effectively through Rural Transfer Station service provision.*

The report confirms that the service to rural communities could be improved, and that the councils suspected that rural wastes could be an issue.

1.2.4 National context

The Waikato and Bay of Plenty represent the regions of New Zealand that have the highest and third highest number of farms. Canterbury is the second largest region with 8,823 farms.

There are 9,900 farms in the Waikato and 4,785 Bay of Plenty, which combined represent 25.3% of the total number of farms in New Zealand

Based on NZ Statistics data

[2] Waste Not and Eunomia Consulting, May 2013. Bay of Plenty and Waikato Regions Waste Stocktake, Report for Bay of Plenty and Waikato Regional Councils.

2. Methodology and Survey Design

2.1 Overview of programme

In addition to the field surveys and data gathering GHD undertook consultation to gauge the level of service provided to the rural community by each district council and some waste management contractors. This was tested against the perceived level of service by survey participants.

GHD ensured anonymity to farmers, allowing them to openly discuss their waste management practices, including incentives and barriers to use the disposal options available to them.

2.2 Developing a survey programme

GHD used a similar approach in this survey methodology as that successfully used in Canterbury. The main difference was less reliance on cold calling farms and more reliance on stakeholder support to supply details of farms that may have been willing to participate.

Figure 2 sets out the project goals that helped shaped the programme design. The main emphasis was on developing a survey programme that had a sample set representative of the regional profiles for agricultural activities in the Waikato and Bay of Plenty. The latest NZ statistics office data was used to identify the ratios of farming activities in each region that the survey programme needed to reflect.

	Waikato Region		Bay of Plenty Region	
Total sample size	Determined by the Contractor's proposal dated 19 March 2014, being a goal of 75 farms larger than 5ha (±10% dependent on factors outside the Contractor's control)			
Sample size	To be determined by final funding contributions (indicative 60-70% of total sample size)		To be determined by final funding contributions (indicative 30-40% of total sample size)	
Farm type split	Dairy	~42%	Dairy	~17%
	Dry stock (beef, sheep, deer, piggery and poultry)	~43%	Dry stock (beef, sheep, deer, piggery and poultry)	~33%
	Arable (cropping and arable)	~5%	Arable (cropping and arable)	~4%
	Horticulture	~10%	Horticulture	~46%
	NB: This information is a summary of quotas which were prepared in higher detail for project purposes (e.g. poultry, pigs, horses, kiwifruit, citrus etc). Quotas have been set as per Statistics New Zealand data as at June 2012.			

Figure 2 Project goals

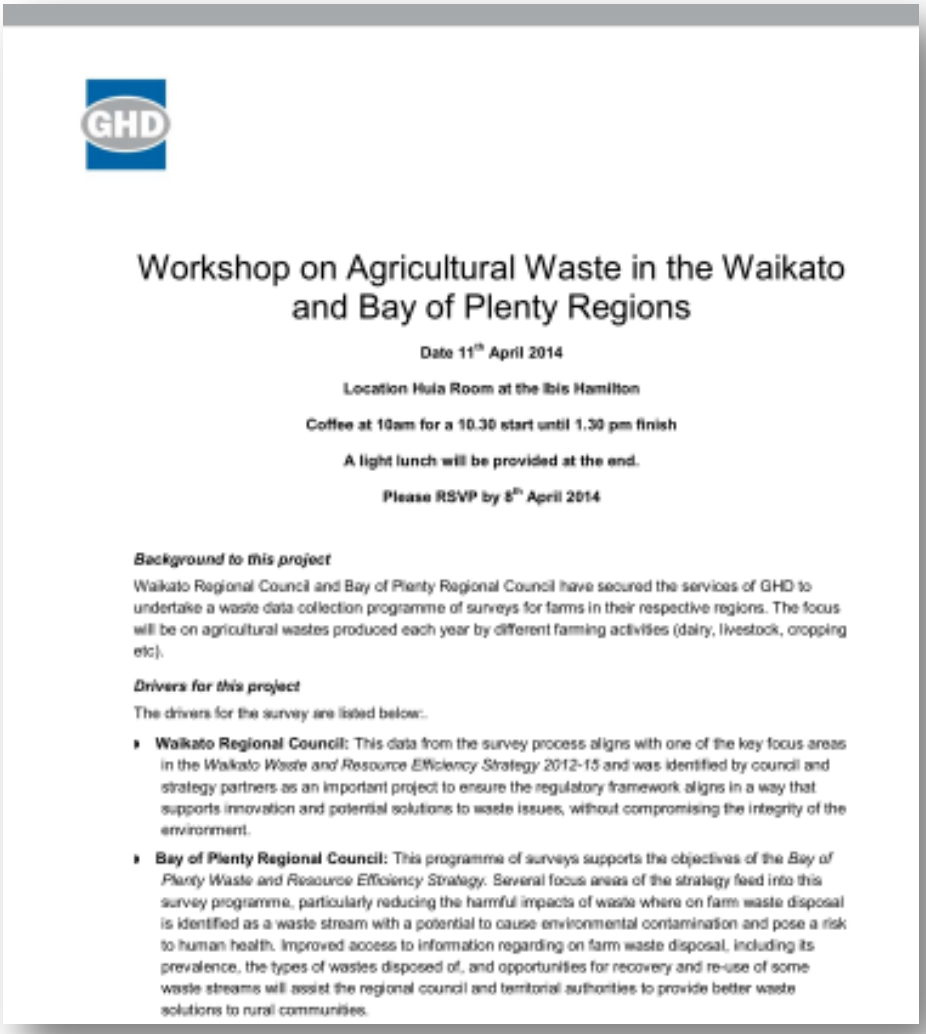
As part of this study, properties less than 5Ha were not included in the surveys as smaller lifestyle blocks are unlikely to have the same waste generation capabilities as more intensive agricultural and horticultural blocks. This decision would seem to be justified based on the data gathered by GHD during the Canterbury surveys (GHD 2013).

Figure 2 shows the breakdown in ratios for activities Dairy, Drystock (livestock), Arable and Horticulture.

2.3 Stakeholder workshop

A workshop held in Hamilton on the 11th April 2014 discussed the aims and the approach of the survey process with invited parties. A briefing note was supplied to each stakeholder group who participated at the initial workshop that could be circulated to farming members. The briefing

note provided details of the project goals, incentives offered, and the contact details for signing up (Figure 3). As part of the survey process GHD maintained a dedicated telephone number and email address (ruralwastesurvey@ghd.com).



Workshop on Agricultural Waste in the Waikato and Bay of Plenty Regions

Date 11th April 2014

Location Huia Room at the Ibis Hamilton

Coffee at 10am for a 10.30 start until 1.30 pm finish

A light lunch will be provided at the end.

Please RSVP by 8th April 2014

Background to this project

Waikato Regional Council and Bay of Plenty Regional Council have secured the services of GHD to undertake a waste data collection programme of surveys for farms in their respective regions. The focus will be on agricultural wastes produced each year by different farming activities (dairy, livestock, cropping etc).

Drivers for this project

The drivers for the survey are listed below:.

- **Waikato Regional Council:** This data from the survey process aligns with one of the key focus areas in the *Waikato Waste and Resource Efficiency Strategy 2012-15* and was identified by council and strategy partners as an important project to ensure the regulatory framework aligns in a way that supports innovation and potential solutions to waste issues, without compromising the integrity of the environment.
- **Bay of Plenty Regional Council:** This programme of surveys supports the objectives of the *Bay of Plenty Waste and Resource Efficiency Strategy*. Several focus areas of the strategy feed into this survey programme, particularly reducing the harmful impacts of waste where on farm waste disposal is identified as a waste stream with a potential to cause environmental contamination and pose a risk to human health. Improved access to information regarding on farm waste disposal, including its prevalence, the types of wastes disposed of, and opportunities for recovery and re-use of some waste streams will assist the regional council and territorial authorities to provide better waste solutions to rural communities.

Figure 3 Briefing Note

The following organisations attended the workshop:

- Fonterra;
- Federated Farmers (Waikato Chapter);
- Ballance Agrinutrients Ltd;
- Beef + Lamb NZ;
- Plasback;
- Dairy NZ representative from AgRecovery board; and
- AgRecovery.

At the workshop it was confirmed to attendees that the following organisations donated support and resources to provide the incentives, as follows:

- AgRecovery – donation of awareness literature and a $500 voucher for a rural supplier to the winner of a participants' draw; and

- Plasback – a large plastic bag valued at $40 for recycling silage wrap.

It was also confirmed that as a token of appreciation both Regional Councils were providing a Beanie hat and pair of winter socks to each potential survey participant.

The workshop discussed the previous survey work undertaken by GHD in Canterbury seeking consensus on the wastes identified and to discuss the total mass of wastes produced. The question was asked of the attendees would it be a similar story across both Waikato and Bay of Plenty Regions. The initial responses were in agreement that a similar story was expected. Having achieved an agreement that there was a potential issue, each organisation was asked for help in securing participants for the surveys, and again a consensus positive response was aired. The help of stakeholder organisations to secure participants was a significant difference in comparison to the methodology used in Canterbury (where cold calling and trawling through phone books was the principal method used). It was hoped that stakeholder participation would result in a larger field survey programme.

2.4 GIS screening targeting and consultation and route optimisation

The first three stages in the programme focussed on constructing the survey programme and developing the tools needed to deliver the survey.

GIS screening enabled the survey team to identify where potential farms and agribusinesses were located (spatial data was obtained from both regional councils, from LINZ, GHD's databases, and the use of postcodes from phone book searches). Contact details for farms were provided by some of the stakeholders.

District councils and local waste management contractors were contacted to discuss the services and opportunities open to the rural community in each district. Additional waste contractors servicing the rural community were identified and contacted for information.

Signing up the participants

The success of the programme hinged on identifying and securing the participation of sufficient representative farmers in both regions. In order to promote what both regional councils were seeking to achieve media statements were released and published on council websites.

Federated Farmers also posted a briefing note in their Friday Flash in the Waikato and Bay of Plenty Regions.

It was felt by both Regional Councils that the surveys should be incentivised, to encourage and reward participation. A set of incentives were provided for participation that included a pair of winter socks and a Beanie hat courtesy of both Councils, and incentives from other stakeholders such as redeemable vouchers and silage wrap bags.

It was hoped that the combination of awareness raising and incentives would generate interest and result in farmers and agribusinesses contacting GHD to sign up for the programme. Between the stakeholder support to help and the awareness raising exercise it was anticipated that a minimum target of 68 farms would be secured.

Route optimisation

Once sites were confirmed, they were plotted using GIS. Optimal routes were chosen to fit with locations and farmers' schedules.

2.5 Data collection and site surveys

For the matter of consistency and repeatability (being able to duplicate a process that generates data) it was deemed important to have a formula for the methodology (Figure 4).

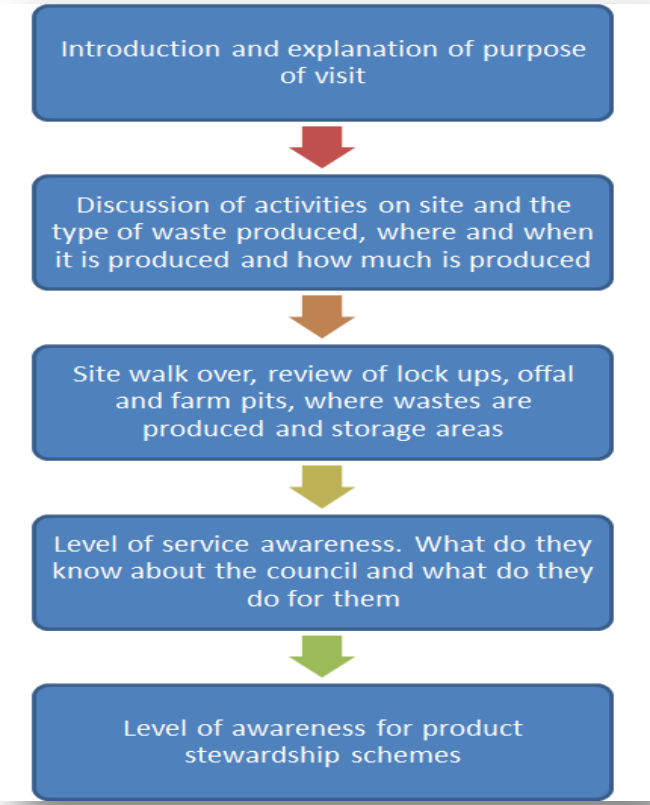


Figure 4 Site survey process

2.5.1 Preparing for the surveys

In preparing for the surveys it was important to help maintain consistency of the questions asked; therefore a survey questionnaire and guidance note for the field survey was prepared. This survey (shown in Figure 5) was developed to provide a detailed picture of the current rural waste issues in each Region. The survey also helped keep the pace for the discussions and helped maintain the focus, which was essential in trying to always stay ahead of targets. Overall the use of the questionnaire allowed for an efficient survey process.

1. Tell us about your business

1.1 For this year please tick the activity/activities that closest describe(s) your operation.

Activity		Activity	
Dairy	☐	Vineyard	☐
Beef cattle (ind. young stock)	☐	Beekeeping	☐
Piggery	☐ ☐	Nursery production	☐
Poultry	☐	Floriculture	☐
Sheep	☐	Arable – maize/wheat/barley/corn	☐
Sheep/beef mix	☐	Kiwifruit	
Deer	☐	Other horticulture – orchards/vegetables Type:_____	☐
Horse breeding	☐	Agri-tourism i.e. farm stays	☐

1.2 Please estimate the size of your farming operation(s) this year per activity.
e.g. 1-50 hectares arable farming, 51-100 hectares dairy farming

☐ 1-50 hectares

_____

☐ 51- 100 hectares

Figure 5 Site Questionnaire

GHD survey team

The survey team comprised of two people on site conducting the field surveys. The field team was supported by office based team who could help answer questions and quickly adapt survey routes in the event of a cancelation (which was a common event). The field team was consistent with 9 of the 10 person-weeks completed by the same two members. The consistency of the

surveying meant that all farmers were asked the same questions in the same way, providing unbiased survey results.

Introductory speech

The same introduction to the survey goals and parameters was given at each site. This began with an explanation of GHD's role as anonymous data gatherers for both Regional Council's, who want to:

a. understand the types and masses of waste that are most prevalent on farms;

b. determine how waste streams are being managed by farmers; and

c. gain an insight into the issues surrounding waste management from the rural perspective.

This was followed with an outline of the geographic scope of the project, details of how many sites and what types of farms were being visited, and to answer questions. The survey format was explained so that the participant felt at ease with the nature of the questions and understood why it was important to collect data for the volumes of all rural waste types produced. During this initial speech each farmer was asked for permission to take photographs, for permission to visit site dumps, burn piles and storage areas and take GPS readings.

General site data

General site data was collected using the site questionnaire, with specific information captured from each property including the:

- location;
- farm activity or activities;
- do they use farm dumps, burn piles or bulk store;
- property size in hectares (all sites to be surveyed were greater than 5Ha);
- number of years the owners have lived on the property; and
- whether they live on the farm premises.

Quantitative waste assessment

Within the questionnaire a list of all non-natural rural waste types was worked through methodically with each participant. This comprised review of available documents, actual weighing, or discussion and estimation. This approach prompted the participants to consider all possible contributions to their rural waste production, and ensured that no waste streams were omitted. At the end of this section, participants were asked if there was anything else they considered to be a waste which had not been covered. Mass and volumetric data was typically measured in kilograms, litres, or the quantity of a certain waste produced per year (e.g. number of feed bags). A set of data conversions were used to make sense of some of the data recorded i.e. a wrap from a silage bale weighs 1KG.

Qualitative waste assessment and the levels of service available

This section of the survey allowed for each participant's perceptions and reflections of their own waste management practices to be captured, as well as the influencing factors around their decision making. A series of closed and open ended questions meant that each participant was able to discuss their behaviours and the perceived waste management services and options open to them. In addition discussions afforded the opportunity to highlight any specific incentives or barriers relevant to each rural waste stream.

Photographic evidence

Due to the guaranteed anonymity, most participants were obliging towards having pictures taken. GHD was able to collect photographic evidence of common practice, best practice and practice examples where there is room for improvement for the management of non-natural rural waste management. However there was some sensitivity towards having photographs of waste dumps, and even though there was a guarantee of anonymity farmers were reluctant to have GPS data recorded for farm dumps.

2.6 Overview of level of service research

GHD undertook a desk study prior to surveys commencing by contacting each of the district councils in both regions to enquire about waste collection and management services on offer to the rural community.

Whilst gauging the service offered by the district councils, the level and types of services offered by waste contractors in the area were also investigated. It should be noted that time and contractual constraints did not allow for exhaustive research, but the research did generate enough useful data to aid the site surveys and provide a useful strategic overview when understanding observed behaviours.

During discussions with the waste contractors it was clear that they have a clear idea of what rural wastes they will and won't accept from the rural community; however on several occasions' members of the rural community had opinions on what was permissible to be put into containers collected by waste contractors (see section 3.9.4 for discussion).

2.7 Post-survey methodology

2.7.1 Data evaluation

A summary table of the data is reproduced in Appendix A. To ensure ongoing anonymity data is not reproduced within this report, nor is it intended for release to the public domain.

2.8 Survey wastes

Table 1 contains the table of core rural wastes that was used in the survey process to establish annual masses, and commonplace disposal method for each rural waste. It should be noted that the surveys did not restrict to just the core set of wastes in Table 1 and wastes were included in the results where encountered.

Table 1 Core rural waste descriptions

Waste type	Sub Group
Plastics	Containers
	Drums
	Silage wrap
	Netting
	Mulch film and crop cover
Hazardous substance containers e.g. agrichemicals, waste oil	Plastic
	Metal
	Lead acid batteries
Packaging	Fertiliser bags
	Seed bags
	Animal feed bags
	Animal health plastic packaging and plastic sheep dip
	Oil containers
	Miscellaneous
Wood	CCA treated timber
	Untreated timber offcuts
	Old fence posts
	Pallets
Scrap metal	Roofing materials
	Used vehicles/ machinery
Chemicals (hazardous & non-hazardous)	Drench/dip
	Agricultural sprays
	Fertiliser
Other	Twine
	Used tyres
	Vehicle batteries
	Building waste
Domestic refuse	Household wastes, Whiteware, TVs, fluoro bulbs etc
Organic Wastes	Animal remains, tree cuttings, and vegetative matter

2.9 Assumptions

The following list of assumptions has influenced the design of surveys and the data collected. Every effort has been made towards the collection and development of a robust data set within the scope of time and resources available to the survey; where assumptions have been made they were either based on precedent or as a judgement call by the survey team.

- A site visit of up to two (2) hours for each farm would yield representative data.
- The accuracy of data presented (documentation, records) was accepted at face value.

- The survey focussed on identifying and recording rural waste data that was representative of one year.
- Where it was not possible to physically or safely weigh the wastes a best estimate was made from direct observation regarding volume or mass.
- Where a range of volumes or counts for rural wastes has been discussed the mid value has been used.
- The data sources consulted to identify farms and businesses (phone books, Yellow and White pages™ etc.) provided a representative population size.
- The participants' farms and premises were representative of practices across both regions, and that the survey programme did not just capture data from farms that were biased towards the better managed end of the spectrum.
- Batteries and tyres have been assessed on a count basis in the field rather than weight. Conversions have been used to change counts to masses.
- All data for each of the respective waste was expressed in Kgs (unless specified). The totals in each table were expressed as tonnes for ease of readability.
- The accuracy of the GPS data could be improved in future exercises, and the accuracy of the GIS shape files could also be improved (GHD used LINZ data sets which are not as accurate).
- The total number of farms in the Waikato and Bay of Plenty Regions is quoted as 14,685 (based on NZ statistics data); however this total does include farms less than 5ha in size whereas the surveys undertaken in bother regions excluded farms of this size. It is important to note that the NZ Statistics data does not identify the smaller farms as lifestyle blocks, so as we are unable to differentiate the total of 14685 has been used. This potentially means there is an overestimation in overall totals when calculating the regional totals. However even if compensation was made to the totals, the message would still be the same – there are significant tonnages of Rural Wastes produced in both Regions.

2.10 Critiquing the survey programme

Before any discussion of the outputs of the programme it is sensible at this juncture to provide context and critique the robustness of the programme. As is often the case in any survey there is the potential for polarisation of opinions and interpretations. In order to provide a sense of understanding of "how level the playing field was" the following represent a self-critique of the process.

2.10.1 Is the geographic spread balanced?

Every effort was made trying to get buy in and secure participation of farms and businesses within the boundaries of each district council across both Regions. However, despite best efforts, it was not possible to secure sites within all the districts across both regions.

2.10.2 Is the size of the sample set adequate?

The collection of data from 69 sites represents a valuable data set, but it is from a potential population size of nearly 14,685 farms and so only represents circa 0.4% of the regions' rural community. In an area where there is very little data the data set collected represents a valuable indicator of practices, behaviours and attitudes within each region.

2.10.3 Did only farms with nothing to hide participate?

There is always a risk that when designing a programme that you will only get participants who have nothing to hide or conversely are keen to demonstrate their credentials. Based on the sample size of 69 and on what was observed by the survey teams it was felt that there was a good cross section of awareness, attitudes, receptivity and observed practices. The survey experience was very similar to the experience within Canterbury.

2.10.4 Was there an even spread across farming types?

The survey programme was weighted by the willingness of dairy farmers to participate. It would have been ideal to have less dairy and more livestock, arable and horticulture. Given the contractual constraints the overall spread was felt to be the best achievable outcome. It should be noted that this does not detract from the significance of the data collected.

2.10.5 Were some important sectors not considered?

Small holdings and lifestyle blocks were omitted from the survey programme as it was felt that they had less potential to produce rural wastes because of the nature of their practices and the intensity of their activities. It should be noted that the overall impact of these small holdings and lifestyle blocks may be significant in aggregation and any outcomes that result from this survey should be sensitive to this.

2.10.6 Were estimations accurate?

A small and experienced auditing team was used to perform the surveys in order to achieve consistent estimation and recording of results. One of the team attended all the sites for consistency while the other two team members split the 15 day programme 7 and 8 days respectively.

During the field surveys the following assumptions were made to help with capturing data:

- 1 litre of oil is equal to 1 kg weight (the actual weight varies depending on the blend and is typically slightly less than a kilo).
- The weight of plastic containers varied depending on the density and age and on the size of the container. An average sample of containers was weighed in the field and an average weight of 1 kg was assigned to a 20 L container. It should be acknowledged that this weight would have undoubtedly included residual liquids. Overall the 1 kg weight was felt to be representative based on a further web based search which specified containers at 850 g[3].
- A steel drum (220 L, 55 Gallon US) weighs 20 kg and the weighed empty plastic equivalent was 10 kg.
- Counts of drums were made and converted based on the above.
- Counts of tyres and batteries were made. One tyre weighs 8 kg.
- The survey collected representative data for one year but it is possible that data for more than one year was captured i.e. tyres.

The following items were also applied to the data:

- Total inorganic waste was calculated excluding battery and tyre counts.
- Total all wastes was calculated excluding battery and tyre counts.

[3] Source http://www.agrochemicalcontainers.co.uk/agrochem-ecostacker-20L-850g.html

2.10.7 Are extrapolations to a regional wide scenario reasonable?

The latest NZ Statistics office figures were used and identified 14685[4] farms across both regions. All farms surveyed used 3B practices (Burning, Burial and Bulk storage), so this behaviour was factored into calculations for the Regional perspective. The average for each waste stream was multiplied by the total number of farms to arrive at a regional total. This is a very simple approach and does not consider any inherent programme design and data collection variability as a result from human judgement, but nonetheless the data still represents a valuable data set in telling the rural waste story across both Regions.

[4] According to NZ statistics office data the total of 14,685 farms in the Waikato and Bay of Plenty Regions does include 2,691 farms that are less than 5 hectares in size. This means that potentially the calculations in this report could consider only 11,994 farms. However it was not clear if the farms less than 5ha were lifestyle blocks or farms. So for the purposes of reporting an unadjusted total of 14,685 has been used.

3. Results

The following sections discuss the data collected from the 69 sites surveyed. Section 3.1 contains information on the distribution and type of sites surveyed. Thereafter in Section 3.4 the farms are considered in total to provide a broad brush perspective. Section 3.6 analyses in more detail rural waste by sector and Section 3.8 provide the results for the qualitative components of the survey.

3.1 Total farms surveyed

A total of 69 farms were surveyed across the two regions, Table 2 sets out the summary details for the farms surveyed (type and location).

Table 2 Survey summary details

Farm Activity	Waikato	Thames - Coromandel	Matamata - Piako	Waipa	Otorohanga	Hamilton City	Western Bay of Plenty	Opotiki	Whakatane	Rotorua
Dairy	13	5	5	9	1		5	4	8	1
Livestock	1									
Livestock & Dairy	2							1	1	
Crops & Livestock			1							
Horticulture & Dairy				1						
Piggery							1			
Poulty	2					1				
Horticulture	3	1					2			
Stud	1									
TOTAL	**22**	**6**	**6**	**10**	**1**	**1**	**8**	**5**	**9**	**1**

3.1.1 The distribution of surveyed sites

In the end the survey teams managed to collect a data set with over a thousand points of data from 69 sites.

Figure 6 and Figure 7 show the percentage distribution of sites visited throughout the district boundaries. The programme was compiled to obtain as even a distribution as possible that reflects the agricultural densities around each region. It was disappointing that farms were not surveyed in the Hauraki, Waitomo, Kawerau, South Waikato, Tauranga City, and Taupo districts; however this does not denigrate from the value of the data collected from rural properties in the other districts.

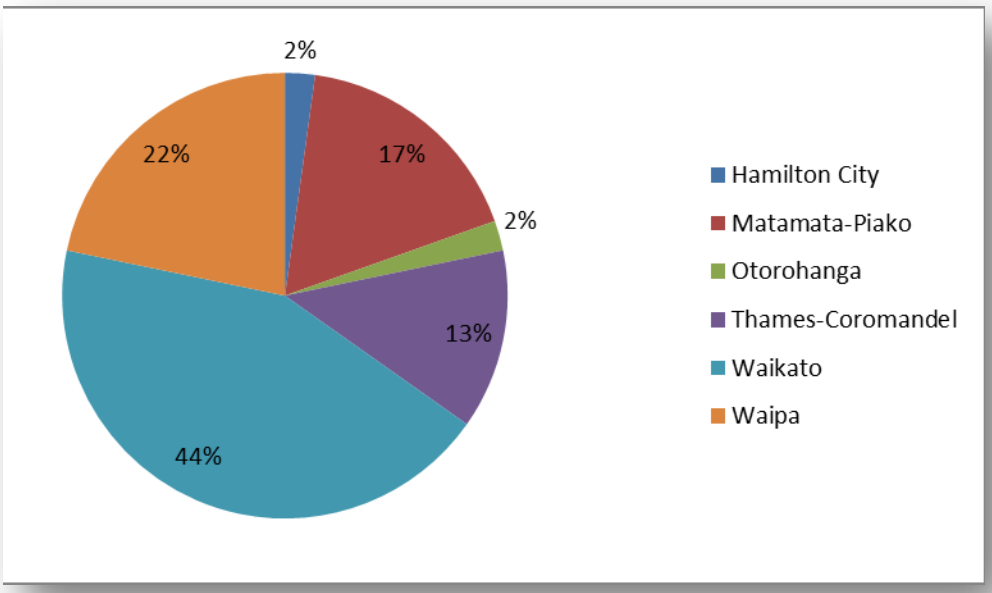


Figure 6 Percentage (%) distribution of sites surveyed by district (Waikato)

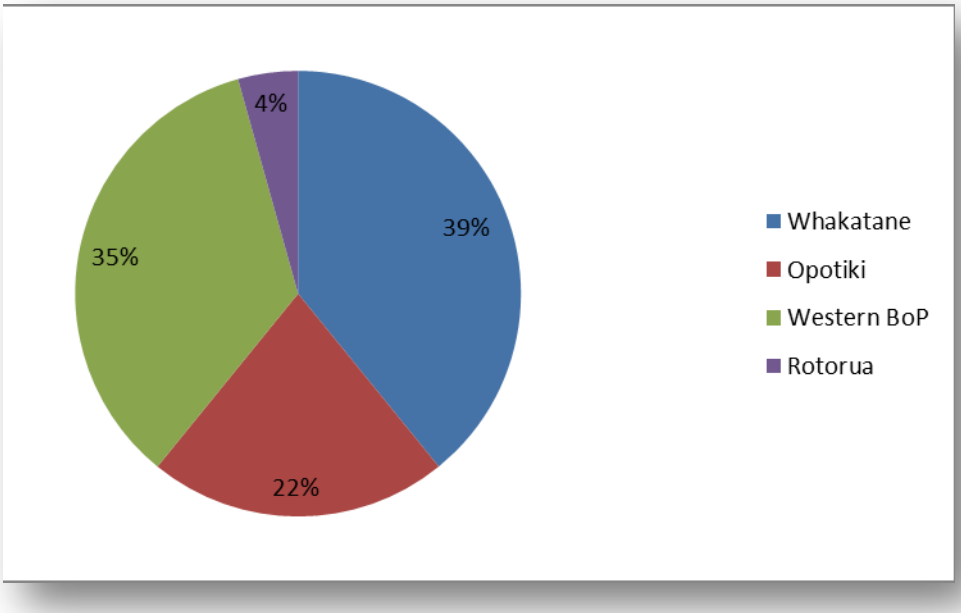


Figure 7 Percentage (%) distribution of sites surveyed by district (Bay of Plenty)

3.2 The types of sites surveyed

It was obvious to the survey team that there was a high level of enterprise displayed by the sites, evident from some farms having more than one activity in place at the time of the visits (and over the course of the year). Table 2 sets out the classifications for each farm, but for the purposes of data assessment the main activity (the first activity listed in each row within Table 2) was used to classify the site and this classification is listed below. Figure 8 and Figure 9 show the percentage distribution of farm types across each activity. The farms and agribusinesses have been loosely categorized as:

- Dairy (and dairy run off grazing farms).
- Livestock (beef, sheep, deer, piggery, and poultry).
- Arable (cropping and arable farming).
- Horticulture.

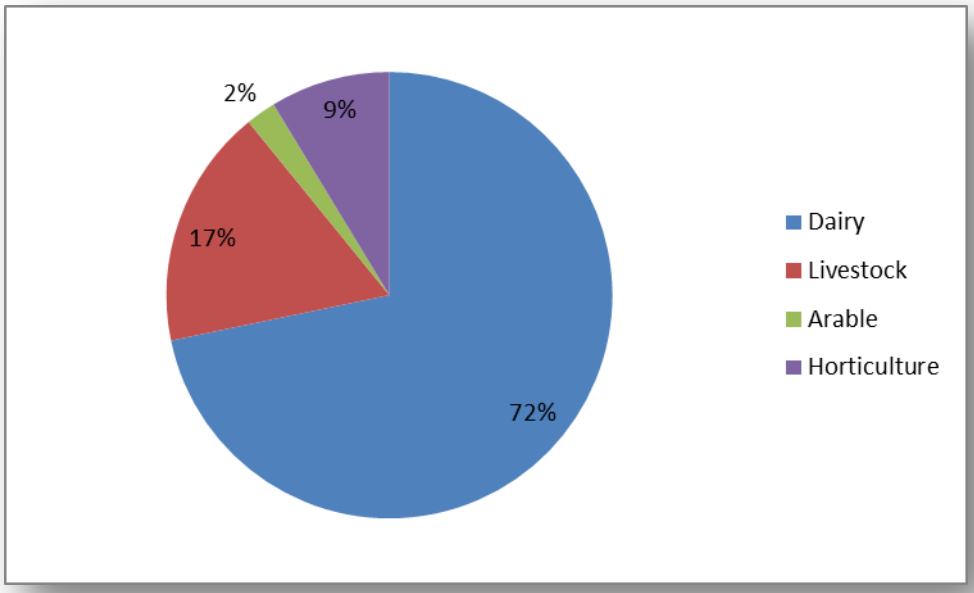


Figure 8 Percentage (%) of sites by practice (Waikato)

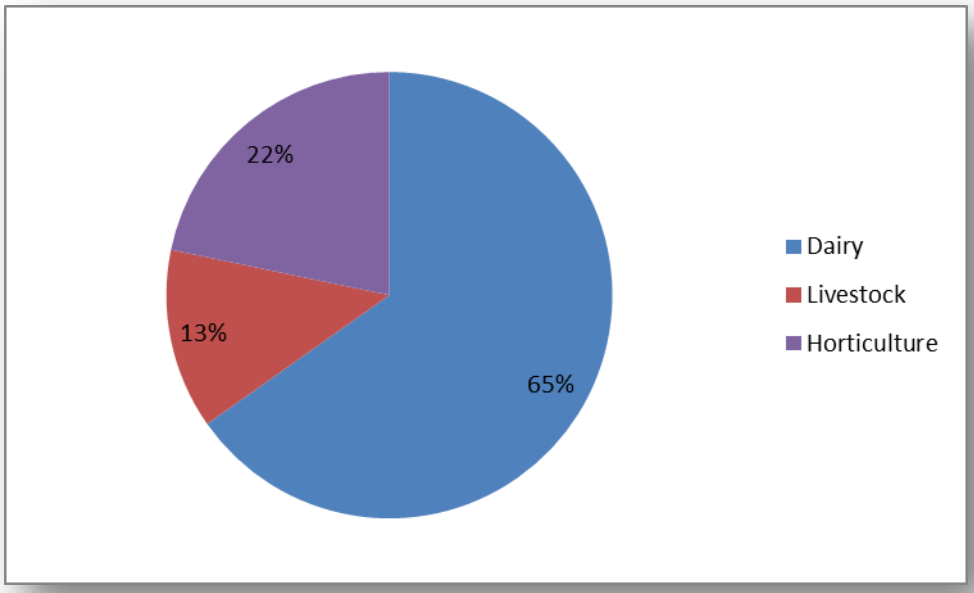


Figure 9 Percentage (%) of sites by practice (Bay of Plenty)

Overall the distribution by activity was felt to be disappointing in some regards (the survey team tried to secure participation from more arable, horticulture and livestock practices but it was not possible). It should be noted that not all of the stakeholder organisations who participated in the workshop provided details, which did hamper progress. It meant that the survey team was forced to rely on cold calling farms to secure participation. This did prove to be a very time

consuming process, but overall a total of 69 represents a significant achievement. The survey programme was predominantly made up of dairy representatives, followed by livestock and horticulture.

3.3 Farm practices observed

3.3.1 Survey findings for 3B practices (Burial in Farm Pits, Burn Piles and Bulk Storage)

All farms surveyed used at least one 3B practice.

3.3.2 Farm dump, burn pile locations and issues

During the surveys the GHD team managed to obtain GPS information for a number of farm dumps and burn piles. These were plotted using GIS to understand the environmental sensitivities that may be impacted on by 3B practices. Figure 10 shows some rural wastes being stockpiled directly adjacent to a watercourse.

Figure 10 Rural wastes adjacent to a watercourse

GIS data showed some farm dumps were within 20m of water courses, which means that they potentially pose a risk to downstream receptors and users. One farmer confirmed that he does not let his stock drink from certain parts of the river bank because he was aware of leachate running into the river from a historic farm dump. Approximately 20% of the farm dumps were adjacent to a water course, 30% were within 10m of a drainage ditch. Some burn piles and farm dumps were situated on higher ground where run off could be an issue and some were known to have been located on overland flow paths. Given the nature of some of the wastes entering burn piles and farm dumps there are potential environmental risks depending on leachability and motility.

A source pathway receptor model is a useful tool that enables in the field observations to identify potential issues. In the case of the farm survey process the sources of pollution are potentially the farm dumps, burn piles and stores, the receptors are the environmental receptors that are close by (rivers, wells, streams) and the pathways are the channels that link the tow (surface drains, overland flow paths).

It is estimated that 50% of the farm dumps/pits observed were close to a river, stream or drain, or were located on an overland flow path. This means that there is the potential for environmental pollutants to reach waterways by leaching through the ground over time or by direct run off and flushing when it rains.

3.3.3 Farm dumps

Farm dumps were observed at the majority of farms visited. The dumps were viewed as a convenient means of disposal. When discussing how they manage farm dumps the farmers typically burned off a lot of the materials to reduce the volume within the dump and to extend the lifespan of the dump. It was clear from discussions that the majority of farmers had been working their farms for a long time, with farms remaining within families for generations. This meant some of the farmers were aware of multiple farm dumps on their properties.

Figure 11 shows that 80% of the sites surveyed had and used a farm dump. Figure 12 and Figure 13 show some variation between the two Regions, with a higher percentage of the Bay of Plenty sites having a farm dump. In reality the sample size does not enable a robust inference to be made in regard to any real difference between the two Regions.

Anecdotal observation of the farm dumps would seem to indicate that the dumps were smaller (5 to 10 m diameter) compared to those seen in Canterbury (20 m diameter). The survey team did not see larger dumps that were seen during the Canterbury survey.

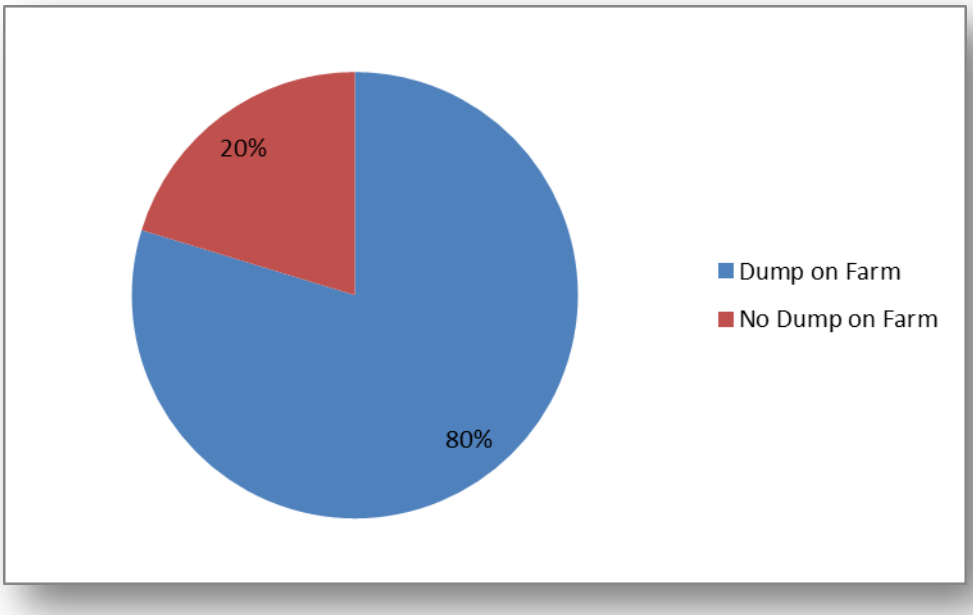


Figure 11 Total percentage with a farm dump

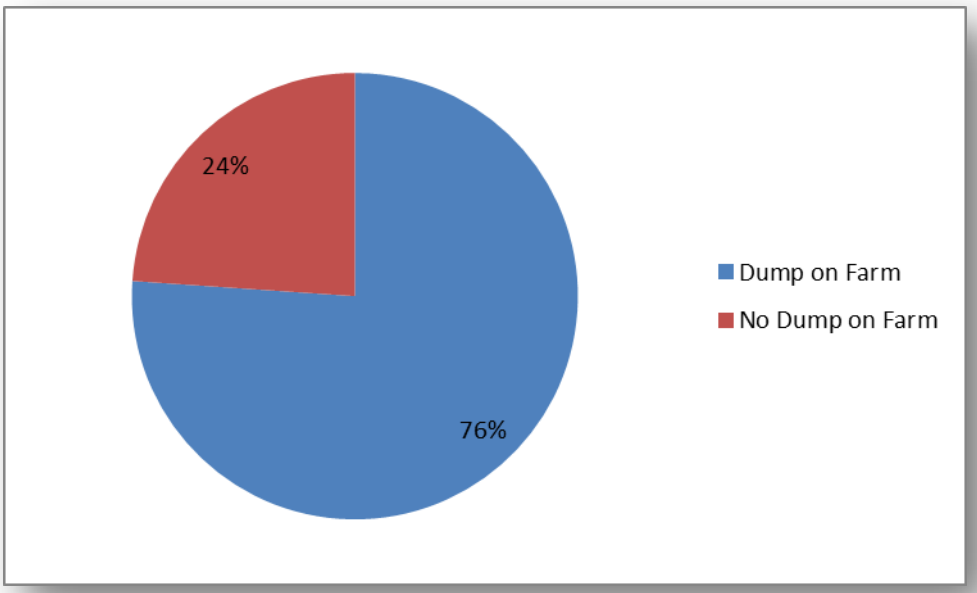


Figure 12 Percentage of Waikato activities with a dump

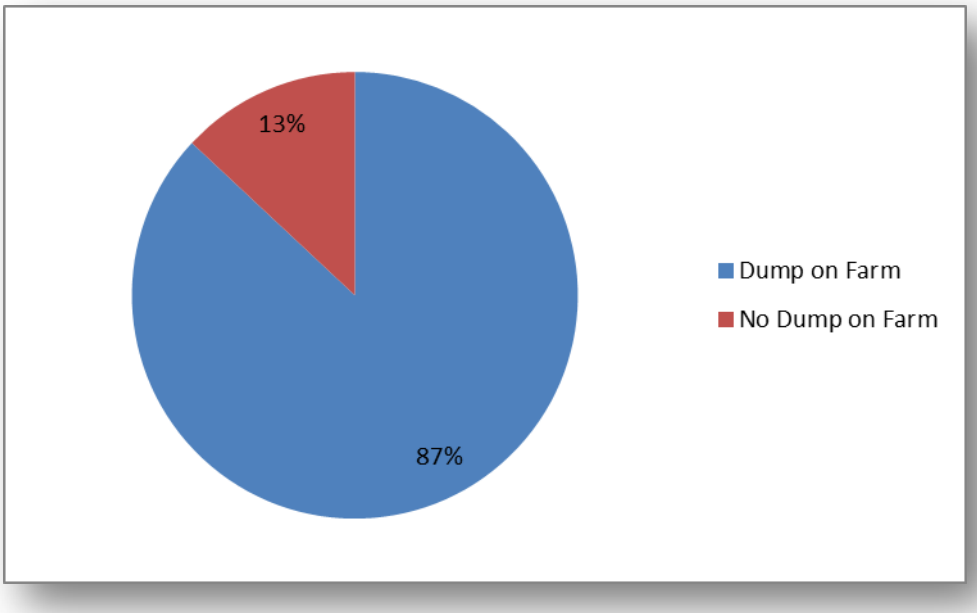


Figure 13 Percentage of Bay of Plenty activities with a dump

Figure 14 Farm dump showing household furniture and wastes

Figure 14 – Figure 16 show typical farm dumps that have a broad mix of wastes including household and furniture. The photographs show how farmers mix in tree trimmings and wood wastes that will help to burn down the contents. The plastic and furniture foam could pose potential air quality exposure issues if they were to be burnt.

Figure 15 Farm dump with wood fence posts, pallets and chemical containers

Figure 16 Farm dump with whiteware and rubber hosing

3.3.4 Open burning

Of the 3B practices the surveys team felt that burning was the most prevalent practice, with virtually every farm having a burn pile, or some form of brazier. Figure 17 shows just how high a percentage of sites burn wastes across both Regions, with 94% of sites surveyed using burning as a waste management option. All farmers that used burning had an annual burn off, but at least 50% had two or more burn piles a year (usually coinciding with a change in farming season).

During discussions it was clear that most farmers use accelerants to start the fire and usually started the burn from cold (all wastes were in place first and none were added once the fire was started).

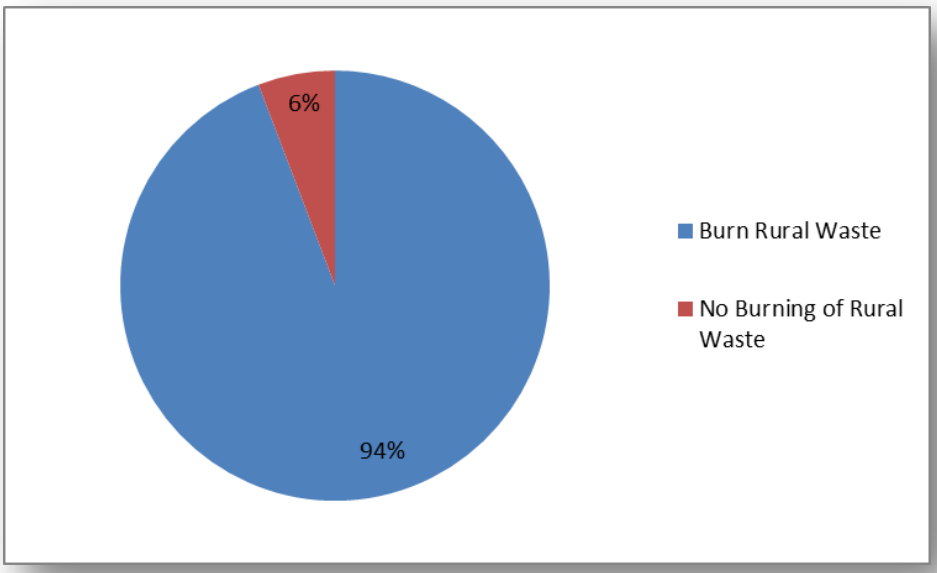


Figure 17 Percentage of sites burning rural wastes

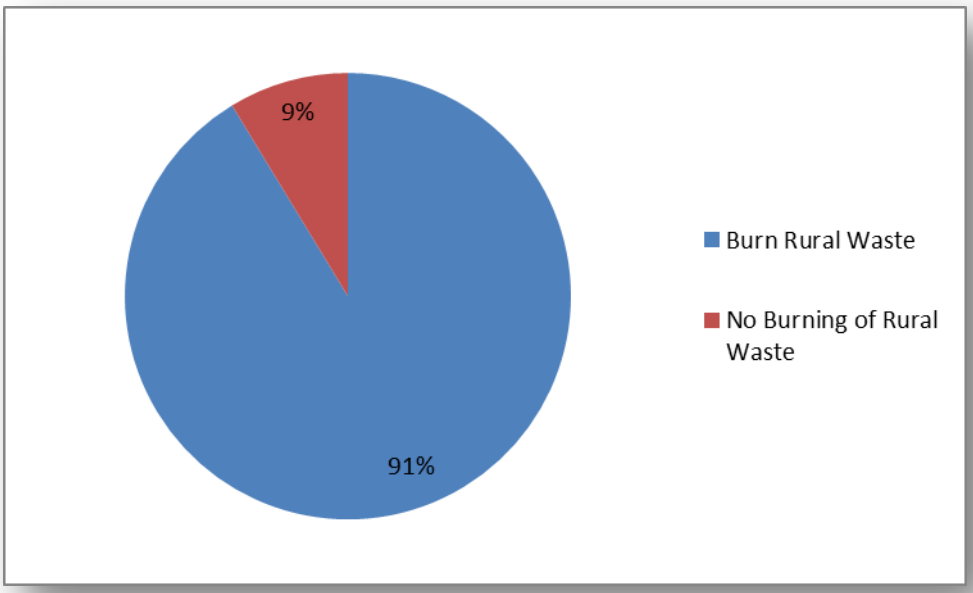


Figure 18 Percentage of Waikato sites burning rural wastes

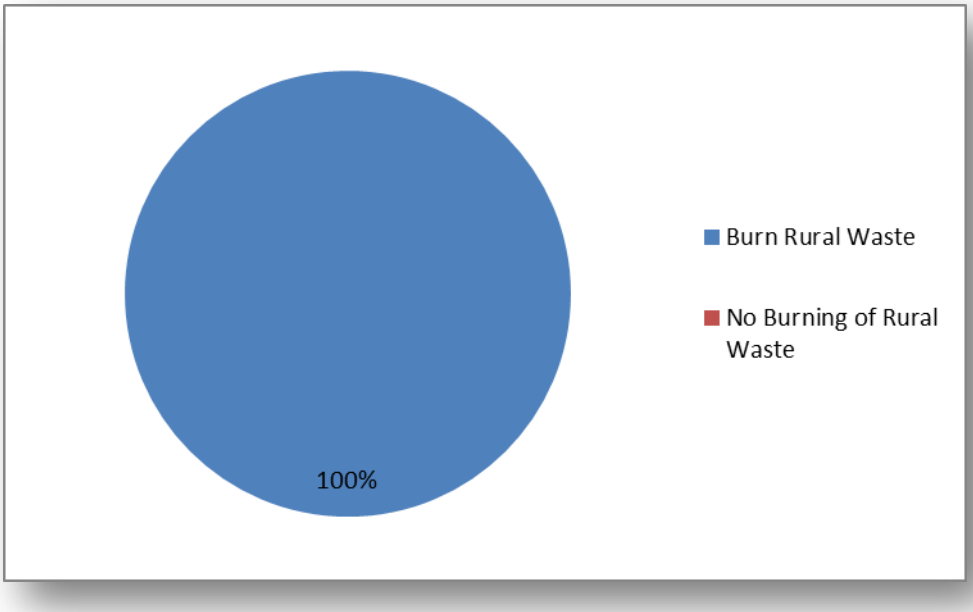


Figure 19 Percentage of Bay of Plenty sites burning rural wastes

Figure 18 and Figure 19 show that burning of waste on farm is the main waste management techniques. Figure 19 shows that all sites surveyed in the Bay of Plenty used open burning as a waste management technique.

Figure 20 Open burning in a O ring

Figure 20 shows an interesting feature of some of the burning practices encountered. Loosely speaking burning practices observed could be categorised as large piles with multiples wastes from around the farm. The other type of burning practice observed was within some form of container or drum, involving smaller scale volumes of wastes but was often specific to a type of waste from a part of the farm. For example a lot of the milking sheds were observed to have a steel drum outside where some of the wastes from the milking shed were burnt.

Figure 21 shows another common burn pile practice whereby silage wrap and bale wrapping are collected into large piles and burnt down.

Figure 21 Silage wrap burn pile

3.3.5 Bulk storage

All of the farms used bulk storage practices. There were some good examples of HAZCHEM storage lockups where chemicals were kept secure, and a lot of bulk stored materials were kept under cover. However there were also a lot of storage areas that were outside and appeared to be random areas where materials had fallen?

Figure 22 Stock pile

Figure 22 shows a typical stock piling practice (estimated 2 to 3 years in place), whereby a farmer is storing materials until such a time that there is sufficient for a pick up. Within the stock pile depicted in Figure 22 the survey team recorded a number of wastes including vehicle batteries, demolition wastes, tyres and fence wire.

3.4 Total farm wastes

3.4.1 Types of rural wastes observed

In total more than 50 types of rural wastes were observed (with 46 being inorganic waste streams). This shows that there is significant variety of materials coming on to a farm or produced on a farm which eventually become waste. The materials ranged from organic wastes, wood chips, and straw progressing to more problematic wastes such as plastics and treated timber.

3.4.2 Total waste from 69 sites

An annual total of 2,199 tonnes of inorganic waste was estimated from the 69 farms. Similarly, a total of 272 tonnes of organic/animal/offal wastes was estimated along with 92 tonnes of domestic waste. This equals 2,564 tonnes of total inorganic, domestic and organic/animal wastes from the surveyed farms.

Table 3 sets out the total tonnages from all the 69 sites surveyed.

Table 3 Total wastes from surveyed sites

Waste stream	Total tonnage
Total Inorganic in tonnes	2,199
Total Organic and animal in tonnes	272
Total Household domestic in tonnes	92
Total all wastes	**2,563**

3.4.1 Total average waste for 69 sites

Table 4 shows that the average farm from the survey produced 37.0 tonnes of all wastes.

Table 4 Total averages for 69 farms

Waste stream	Total tonnage
Total Average Inorganic in tonnes	31.9
Total Average Organic and animal in tonnes	3.9
Total Average Household domestic in tonnes	1.3
Total Average all wastes in tonnes	**37.1**

3.5 Waste totals for each rural activity

The total amount of all the waste for each activity type was calculated and is set out in Figure 23, which shows that each farm type produces a significant volume of waste in total each year. The significance is further emphasised when considering waste generation is a year on year phenomena. It is difficult to compare the sectors, i.e. 1,416 tonnes for dairy versus 1,183 tonnes for horticulture per year as the sample size perhaps does not allow for that level of distinction.

The difference in the sample size (with Dairy sample set nearly 4 times greater than horticulture) is intriguing when you consider that the waste totals are close. It would be worthwhile considering further investigation into horticultural practices, land size and wastes to see if it is a waste intensive activity.

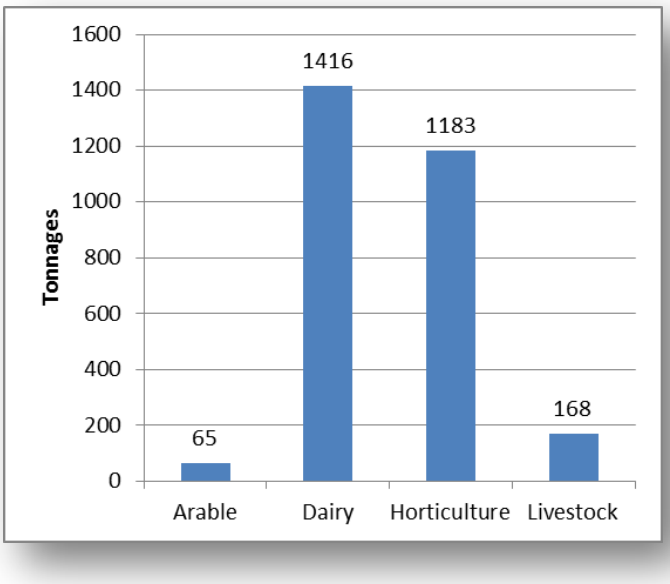


Figure 23 Total wastes from participating farms (by activity)

3.5.1 Total number of inorganic waste types

In total 46 types of inorganic waste types were observed, in addition to the organic/animal remains and domestic wastes. This shows that there is significant variety of materials coming on to a farm or produced on a farm which eventually become inorganic waste.

3.5.2 Total number of inorganic waste types per sector

Figure 24 shows the number of inorganic waste types created by each activity. There is a difference between arable compared to dairy, horticulture and livestock, but this could be due to the small sample size. There is a significant number of waste streams produced for dairy, horticulture and livestock activities.

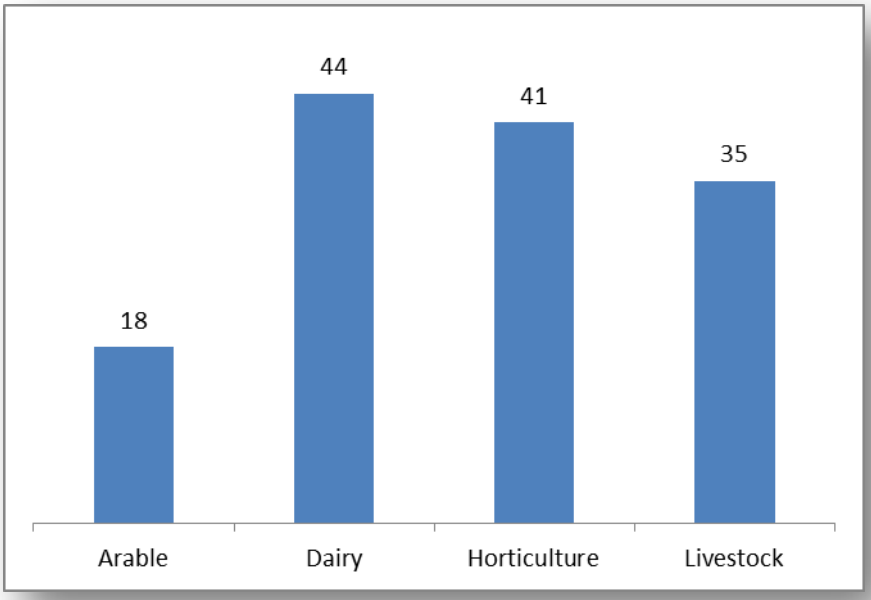


Figure 24 Total types of inorganic waste produced (by activity)

3.6 Rural waste volumes by sector

The following sections discuss in more detail some of the wastes produced and the management practices observed during the surveys. The data for tonnages per farm is contained within Appendix A.

3.6.1 Dairy

The visits to dairy farms were of considerable interest as there were several unique inorganic waste streams for dairy which were mostly associated with milk production (paper filter socks, rubber gloves, mineral bags, magnesium sacks). Some farms have undergone recent dairy conversions and still had some legacy conversion inorganic waste on site.

There was a good distribution in terms of ages of farmers and a mix of New Zealanders and other nationalities. The level of awareness was better with some of the younger farmers, although that did not always correlate with better practices.

Predominant inorganic wastes included plastics in the form of wraps, ties, cartons, container and bags. Large drums and on some occasions industrial bulk containers (1000L) were observed. The larger drums were invariably used for other purposes (typically cut along length as seed containers, used as rubbish bins, or storage bins).

Both dairy and livestock used a large number of animal welfare inoculations and treatments, with sharps and vials comprising particularly hazardous inorganic waste streams.

As with the Canterbury surveys it was noted that farms who were participants in schemes such as “Farmsafe” were organised and well maintained, suggestive of a more proactive approach to waste management. However, this does not necessarily infer reduced amounts of waste being produced or suitable disposal practices.

Some farms also had run offs where paddocks were used to fatten calves and winter stock which added to the volume of rural wastes at certain times of the year. In most cases, waste from the run off would be transported back to the home farm.

Dairy participants – by the numbers

In total the 48 dairy farms visited produced 1,002 tonnes of inorganic waste, 169 tonnes of organic waste and 77 tonnes of domestic waste.

This means the average dairy farm of 203 ha produced 21 tonnes of inorganic waste per year, 3.5 tonnes of organic waste and 1.6 tonnes of domestic waste per year. The figure for domestic waste only considers the main farmers household, which correlates to an average household producing 31 kg per week. Table 18 in Appendix A contains the total and average dairy farm waste data that was observed and recorded during the surveys. The inorganic waste data is expressed as kilograms whereas the total waste data has been expressed as tonnes for ease of readability.

The volume of organic materials includes estimations of calf and slink numbers which are being taken off site (see Section 3.7.10 for a discussion of organic wastes). However a percentage of these animals are entering the farm pits.

3.6.2 Livestock

In total 11 livestock farms were surveyed, that included piggery, poultry, horse stud and beef and lamb rearing. The number of wastes produced is not too dissimilar to Dairy (35 vs 44), but there is a marked difference in the totals. Predominant wastes included plastics, wood wastes, packaging and animal welfare wastes.

Both dairy and livestock types used AgRecovery and Plasback for wraps, some had bought the large containers to house the bags.

Livestock participants – by the numbers

From the 11 livestock farms visited an estimated 98 tonnes of inorganic waste, 30 tonnes of organic waste and 9 tonnes of domestic waste.

This means the average livestock farm was 205 ha, and produced 9 tonnes of inorganic waste per year, 2.7 tonnes of organic materials and 0.8 tonnes of domestic waste per year. Table 19 in Appendix A contains the total and average livestock farm waste data that was observed and recorded during the surveys. The inorganic waste data is expressed as kilograms whereas the total waste data has been expressed as tonnes for ease of readability.

The volume of organic materials includes estimations of calf, bull, slink, chicken and pig numbers which are being taken off site. However a percentage of these animals are entering the farm pits.

3.6.3 Arable

With only one farm surveyed it is difficult to draw any conclusions regarding arable activities across both regions.

Arable participants – by the numbers

In total there was just one arable farm visited. This farm produced 4 tonnes of inorganic waste, 30 tonnes of organic waste (chicken farm run on the side) and 1 tonne of domestic waste.

Table 20 in Appendix A contains the total for the arable farm waste data set documented in the survey. The inorganic waste data is expressed as kilograms whereas the total waste data has been expressed as tonnes for ease of readability.

The volume of organic materials includes estimations of chicken numbers which are being taken off site. However a percentage of these animals are entering the farm pits.

3.6.4 Horticulture

In total 9 farms were visited, the most predominant wastes were plastic associated with the fruit punnets, wood and fence posts, and netting. With only 9 sites visited the survey still observed a significant volume of rural wastes (in excess of 1,000 tonnes), which was quite surprising. It should be noted that one site also had a dairy operation (the wastes from which have been aggregated as part of horticulture).

Horticulture participants – by the numbers

From the 9 horticulture farms visited an estimated 1091 tonnes of inorganic waste, 43 tonnes of organic waste and 6 tonnes of domestic waste.

This means the average horticulture farm was 122 ha, and produced 121 tonnes of inorganic waste per year, 4.8 tonnes of organic materials and 0.7 tonnes of domestic waste per year. Table 21 in Appendix A contains the total and average livestock farm waste data that was observed and recorded during the surveys. The inorganic waste data is expressed as kilograms whereas the total waste data has been expressed as tonnes for ease of readability.

3.7 Totals by waste stream

The following sections discuss the significant rural wastes streams observed during the survey programme.

3.7.1 Plastics

For the purposes of this survey rural waste plastics included:

- Containers;
- Drums;
- Silage wrap;
- Netting; and
- Mulch film & crop cover.

Plastics are a common waste that were mostly burnt or buried on the farms surveyed. Some of the containers were reused on site. Some of the farmers did use AgRecovery and Plasback. The totals across both regions do not consider the collection efficiencies and totals collected from both Regions by the Product Stewardship schemes.

Containers and Drums

From the 69 Farms a total of 7.2 tonnes was observed at the 69 sites. If this is projected across the 14,685 farms (the total number of farms in both Regions) this equates to 1,468.5 tonnes per year across both Regions (Table 5).

Table 5 Containers and Drums

Waste type	Tonnes in total	Average per farm	Total for 14,685 farms x average
Containers	2.2	0.03	440.6
Drums	5.0	0.07	1,027.9
Total	**7.2**	**0.1**	**1,468.5**

Silage Wrap, Netting and Mulch Film & Crop Covers

If this data is extrapolated across both regions there would be approximately 2,416.5 tonnes being burnt or buried per year. If you project this across both regions (as shown in Table 6) then it is estimated that 5,874 tonnes of wraps, films and covers would potentially be disposed on to land or burnt across both Regions. Figure 25 and Figure 26 illustrate silage wrap stored in Plasback bags waiting for collection and crop netting.

Table 6 Wraps, Covers and Films

Waste type	Tonnes in total	Average per farm	Total for 14,685 farms x average
Silage wrap tonnes	11.4	0.2	2,937.0
Baleage wrap tonnes	9.1	0.1	1,468.5
Mulch Film and Crop Covers	5.8	0.1	1,468.5
Total	**26.3**	**0.4**	**5,874.0**

Figure 25 Silage Wrap ready for Plasback Collection

Figure 26 Crop Netting

3.7.2 Tyres and Rubber

Tyres were not weighed during the survey process, instead a count of waste tyres that stayed on the farm per year was recorded, and in addition an estimate for the stockpiling of tyres at each farm was also recorded.

[5]Since 1975 the weight of a tyre of average size has reduced from 11.6 kg to 8 kg due to technological advances in manufacture and materials. Tyres contain a number of materials including:

- Rubber (natural and synthetic rubber) 41%;
- Fillers (carbon black, silica, carbon, chalk) 30%;
- Reinforcing materials (steel, polyester, rayon, nylon) 15;%
- Plasticizers (oils and resins) 6%;
- Chemicals for vulcanisation (sulphur, zinc oxide, various other chemicals) 6%; and
- Anti-ageing agents and other chemicals 2%.

Based on the assumption of 8 Kg per tyre it is estimated that 574.6 tonnes of tyres will be stockpiled annually on farms across both Regions (Table 7). In addition to the year on year tyres that are added to a farm, the survey estimated that an average farm has 630 tyres stockpiled, if this is scaled up across both regions then there is an estimated 75,085 tonnes of tyres across both regions (Table 7, Figure 27). This figure does seem very high and would need further investigation. But it was clear to the survey team that farmers were receiving from outside parties the tyres for their silage stacks.

[5] Source https://www.conti-online.com/generator/www/au/en/continental/tyres/general/downloads/download/reifengrundlagen_en.pdf

Table 7 Tyres and rubber

Waste type	Total	Average per farm	Total for 14,685 farms x average
Tyres per year – count of tyres	334	5	71,084
Tyres per year in tonnes	2.7	0.04	574.6
Stockpiled tyres – count of tyres	44100	639	9,385,630
Stockpiled tyres in tonnes	352.8	5.1	75,085
Rubber in tonnes	2.2	0.03	468
Wash down hose* in tonnes	0.2	0.003	42.6
Drag hose* in tonnes	0.06	0.0009	12.8
Tubing * in tonnes	14.0	0.2	2,979.6
Total (tonnes)	**371.96**	**5.39**	**79,162.6**
Total (count)	**44,434**	**644**	**9,456,714**
*these materials have been assumed to be rubber in nature			

Figure 27 Tyre wall on a farm

3.7.3 Metal

The survey of the 69 farms estimated 333.7 tonnes of scrap metal on site. This results in an average of 4.8 tonnes of scrap accumulating per year on one farm.

Metal wastes invariably were regarded as having a scrap value, with farmers stockpiling and looking to sell when the value of scrap was higher. This meant some farmers had stock piles of metal on site (Figure 28) for more than a year due to a combination of ensuring sufficient volume to be of value to a merchant and the scrap price. Based on a scrap value of $120 per tonne for ferrous (car body) metals the farms had $44,044 worth of metal stockpiled. This value is conservative as there were more valuable ferrous metal grades on the farms that can command in excess of $200 per tonne (based on June 2014 prices).

Figure 28 Metal wastes

If the data from the 69 farms is project across both regions then it is estimated that 71,000 tonnes of scrap could be found in on the Regions farms. This waste stream perhaps represents a more measurable waste stream that may have data available from other sources (scrap merchants and metal associations); it is recommended that the numbers in Table 8 be tested against other data sources and or consultation. To provide further financial context the 71,075.04 tonnes of metal on the farms in the Waikato and Bay of Plenty Regions has a potential conservative value of $8,529,048. It is felt that the majority of this metal will find its way to a scrap merchant.

Table 8 Metals wastes

Waste type	Tonnes in total	Average per farm	Total for 14,685 farms x average
Roofing materials	290.1	4.2	61,677
Used vehicles. machinery	40.6	0.6	8,811
Other metals (fence wire, misc.)	3.0	0.04	587.4
Total	**333.7**	**4,84**	**71,075.4**

3.7.4 Animal welfare wastes

The surveys identified 3.1 tonnes of animal welfare wastes distributed among the farms (Figure 29). It should be noted that horticulture and arable practices will not produce these types of wastes, but for the purposes of calculations contained within Table 9 it has been assumed that all of the farms in both Regions have the potential to produce these wastes.

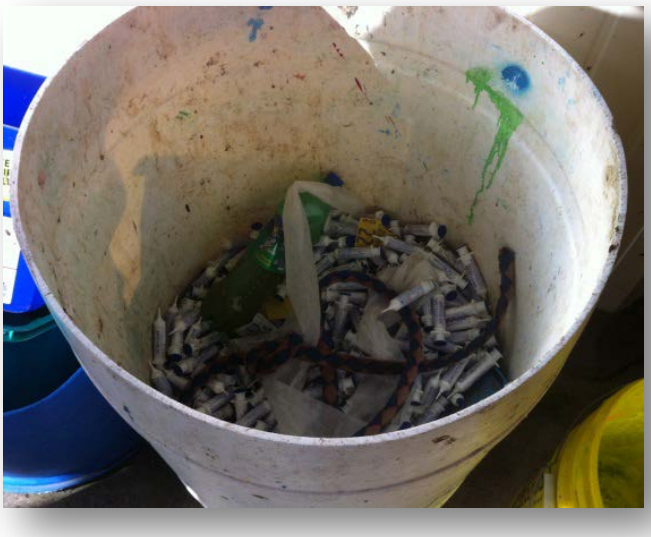


Figure 29 Animal welfare wastes

Table 9 Animal Welfare Wastes

Waste type	Tonnes in total	Average per farm	Total for 14,685 farms x average
Animal health plastic packaging and plastic sheep dip packaging	3.1	0.04	587.4
Total	**3.1**	**0.04**	**587.4**

Based on the average of 0.04 tonnes per farm per year it is projected that 587.4 tonnes of animal welfare wastes would be produced annually each year across both Regions. This is one of the wastes of concern as discussions with some of the farmers indicated that some of these wastes were being disposed of as household domestic wastes and were being picked up by contractors (unbeknownst to the contractors). The other routes for disposal were via 3B practices on site.

3.7.5 Agrichemicals

The surveys estimated over 4,600 L of agrichemicals or converting this to a mass 4.6 tonnes (Table 10). It was assumed that this was concentrate and not in the dilute form. At this stage it would be prudent to say that the bulk of this liquid will be used and will not end up as a waste. However this data is useful to know because it provides insight into how much of these hazardous materials are stored across the Regions (1,828 tonnes), and it is reasonable to assume 1% of this liquid would end up as a residue or a waste, which translates to approximately 182.8 tonnes (Table 10, Figure 30).

Table 10 Agrichemicals

Waste type	Tonnes in total	Average per farm in tonnes	Total for 14,685 farms x average
Drench, and Dip	0.6	0.01	146.9
Agricultural Sprays	4.0	0.06	881.1
Total (have assumed 1 L = 1KG)	**4.6**	**0.07**	**1,028**

Figure 30 Last season's agrichemicals

3.7.6 Packaging

For the purposes of the survey, packaging comprised:

- Fertiliser bags;
- Seed bags;
- Animal Feed bags;
- Animal health plastic packaging and plastic sheep dip;
- Oil containers; and
- Miscellaneous (materials such as packing chips, and other types of bags i.e. mineral bags)

The survey of 69 farms observed an estimated total of 25.6 tonnes of packaging, with the average farm producing 0.364 tonnes per year (Table 11). If the average per farm is multiplied by the total number of farms in each region then a projected 5,286.7 tonnes of packing is anticipated to end up on farm dumps and burn piles each year across both regions (Table 11).

Table 11 Packaging

Waste type	Tonnes in total	Average per farm in tonnes	Total for 14,685 farms x average
Fertiliser bags	3.0	0.04	587.4
Seed bags	0.7	0.01	146.9
Animal Feed bags	8.2	0.12	1,762.2
Animal health plastic packaging and plastic sheep dip	3.1	0.04	587.4
Oil containers	2.9	0.04	587.4
Miscellaneous	4.7	0.07	1028.0
Fertiliser bags	3.0	0.04	587.4
Total	**25.6**	**0.364**	**5,286.7**

3.7.7 Twine and Ties

The survey team recorded an estimated 5.8 tonnes of this rural waste, which given its lightweight nature represents a significant volume of twine. Invariably this waste is either stockpiled or burnt. The higher grade twines have some reuse value on the farm as they are regarded as a useful material for fastening and fixing. Projecting the average weight from the survey per farm produces an estimation of 1,468.5 tonnes of twine and ties entering burn piles and farm dumps each year (Table 12, Figure 31).

Table 12 Twine and ties

Waste type	Tonnes in total	Average per farm in tonnes	Total for 14,685 farms x average
Twine and Ties	5.8	0.1	1468.5
Total	**5.8**	**0.1**	**1468.5**

Figure 31 Ties and string wastes

3.7.8 Construction and demolition wastes

The survey identified 33.2 tonnes of demolition wastes (metal roofing wastes from demolition activities have been captured as part of the metal waste stream) (Table 13, Figure 32). If the average from the 69 wastes is applied to the 14,685 farms in the Waikato and Bay of Plenty Regions then 7,342.5 tonnes of building wastes are estimated (Table 13).

Table 13 Building wastes

Waste type	Tonnes in total	Average per farm in tonnes	Total for 14,685 farms x average
Building waste	33.2	0.5	7,342.5
Total	**33.2**	**0.5**	**7,342.5**

Building wastes tended to be concrete and brick, but it was noted that some asbestos looking material was seen (but not tested). It is likely that given the age of some of the farm buildings that asbestos wastes are being produced and potentially buried.

Figure 32 Demolition wastes

3.7.9 Wood wastes

Wood wastes were identified by the survey process as significant wastes because of the volumes observed. During the survey the team estimated a total of 832.8 tonnes of wood wastes, with the average farm in the survey producing 12.05 tonnes (Table 14).

The most common form of disposal is burning either as a domestic fuel (some farmers noted some of the off cuts were used for fire wood purposes), or on burn piles on site. Some farmers were capable of chipping some of the wood wastes to create animal bedding, it was not clear if CCA treated timber was part of the chipping outputs. If this average is projected across both regions then 176,504.3 tonnes of wood wastes are possible (Table 14). The waste wood of concern is the treated timber component where 2,937 tonnes is projected to be burnt each year across both regions (Table 14).

Table 14 Wood wastes

Waste type	Tonnes in total	Average per farm in tonnes	Total for 14,685 farms x average
CCA treated timber	15.3	0.2	2,937
Untreated timber offcuts	779.4	11.3	165,490.5
Old fence posts	34.4	0.5	7342.5
Pallets	3.7	0.05	734.3
Total	**832.8**	**12.05**	**176,504.3**

Figure 33 shows a typical stockpile of wood, some will be earmarked for reuse as it is still usable planking; however some will be burnt (some of the younger farmers liked a tidy farm and would regularly burn off their wastes to maintain a tidy appearance – this meant wood was used to help get the fires going).

Figure 33 Wood waste stockpile

3.7.10 Organic wastes

Organic wastes represent another significant waste stream from rural activities. On the 69 farms 1,147 tonnes of organic wastes were observed (Table 15). At this point it is important to qualify that the wood chip and straw bedding was mostly ploughed back into the earth as a nutrient enrichment media, and some was used to aid composting and breakdown of dead animals (which again was ploughed back into the property). The animal remains do not include slinky and bobby calf counts. The average farm within the survey produced 16.6 tonnes (for all 69 farms; however if figures are adjusted to remove the horticulture and arable practices then the average is 20.1 tonnes from Dairy and Livestock farming) (Table 15). Typically animal remains were being sent to processing where possible to extract value, but if the cause of death or time of death meant it was not possible to send a carcass off for pick up then the remains were put into a farm dump (Figure 34).

Table 15 Organic wastes

Waste type	Tonnes in total	Average per farm in tonnes	Total for 14,685 farms x average
Animal Organic Waste	271.7	3.9	57,271.5
Straw (bedding)	5.0	0.1	1,468.5

Waste type	Tonnes in total	Average per farm in tonnes	Total for 14,685 farms x average
Wood chip (bedding)	870.5	12.6	185,031.0
Total	**1,147.2**	**16.6**	**243,771.0**

Figure 34 Poultry remains

3.7.11 Domestic

The survey team estimated a total 92.3 tonnes of domestic waste produced annually by rural households (Table 16). It should be noted that larger properties often had a main house and houses for tenants or farm hands. Seasonal employment can create pulses in domestic waste as more workers are on the farm for the season. Some farmers were disposing of wastes to farm pits and some were using waste collection contractors. If projections are made across both Regions then 19,090.5 tonnes of domestic waste is either going to farm dump or to contractors (Table 16).

Table 16 Domestic refuse

Waste type	Tonnes in total	Average per farm in tonnes	Total for 14,685 farms x average
Domestic refuse	92.3	1.3	19,090.5
Total	**92.3**	**1.3**	**19,090.5**

Discussions with farmers led the survey team to a conclusion that more than domestic wastes were being disposed of in the bins, with some farmers confirming that they were disposing of animal welfare wastes, domestic batteries, aerosols, paints and the “odd container now and then”. This does represent a behaviour that is a concern, from a H&S perspective and the manual handling of rubbish sacks, and also a concern that wastes that may be hazardous by nature are entering general waste streams. In discussions with waste contractors they were consistently adamant that certain wastes were not accepted and were not being received (animal welfare wastes as an example). However site based discussions would indicate that some wastes were being accepted without knowing contents.

3.8 Responses to qualitative questions

The survey posed questions to each of the participants that were intended to shed light on behaviours, awareness and attitudes. The following sections document the survey question as a section heading and the subsequent responses to the questions.

3.8.1 Size of farms surveyed.

Figure 35 shows that the survey was successful in targeting a good range of rural property sizes – it should be noted that no rural properties smaller than 5Ha were surveyed. It was felt that the small rural properties represented either lifestyle blocks where previous survey experience had shown that these were not significant produces of rural wastes on an individual basis as they are not intensive practices. It was also felt that smaller farms were perhaps not significant enough in scale to produce significant volumes or rural wastes.

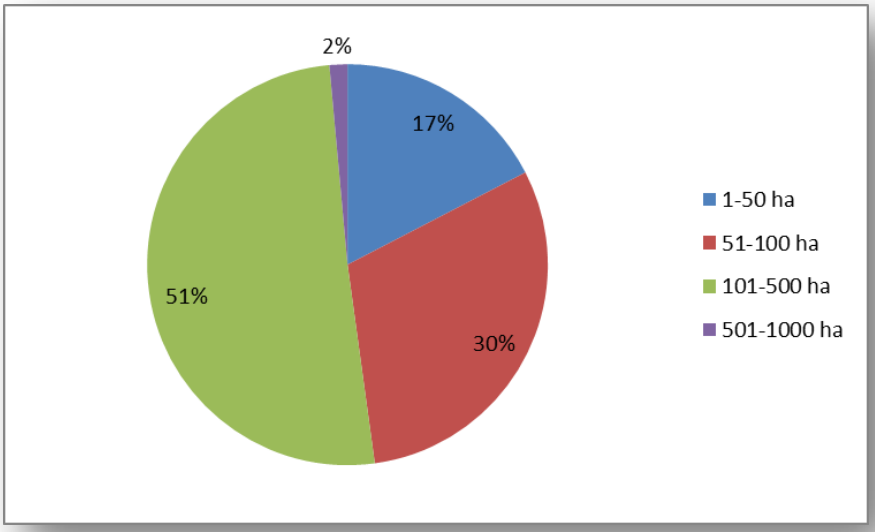


Figure 35 Survey farm size distributions

3.8.2 How many years have you been operating?

The survey produced an interesting result with long standing farmers operating on their farms for an average of almost 33 years in the Bay of Plenty compared to the farmers in the Waikato who had been operating for 29 years (as shown in Figure 36). Both regions had averages close to the 30 years on farm. Many farmers expressed that their farms had been in their families for generations. Potentially it could mean that farms and learnt experience are handed down from father to son. If each new generation of farmers is exposed to new practices and governed by new legislation and has more waste management options, could 3B practices be reduced to those acceptable?

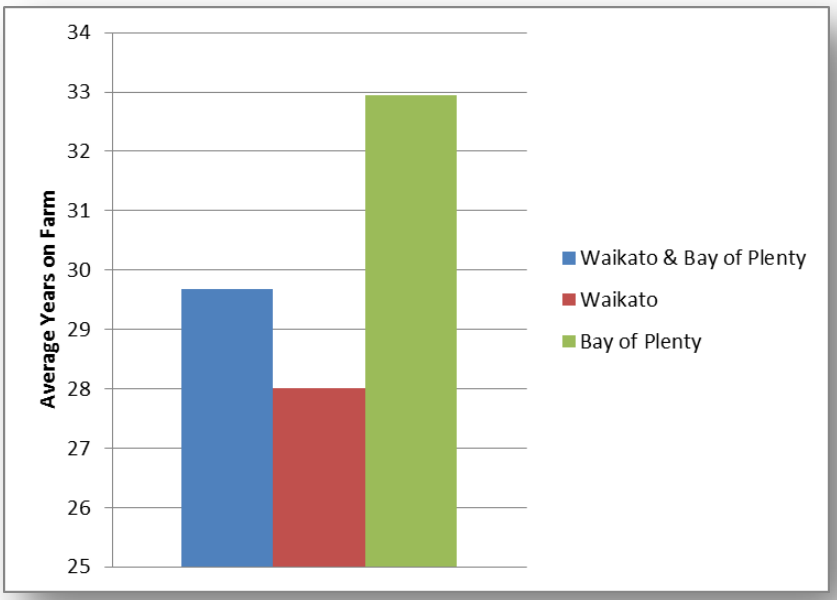


Figure 36 Operating on the farm

3.8.3 I feel that I manage my wastes well.

Looking at Figure 37, Figure 38, and Figure 39 it can be seen that a significant percentage of farmers feel that they are managing their rural wastes well.

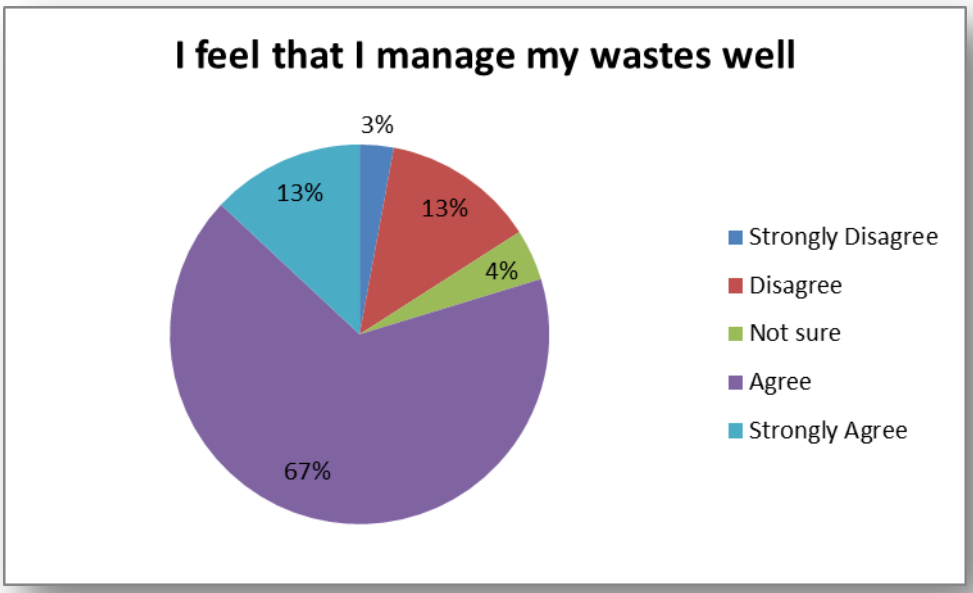


Figure 37 All 69 Farmers opinions – managing wastes

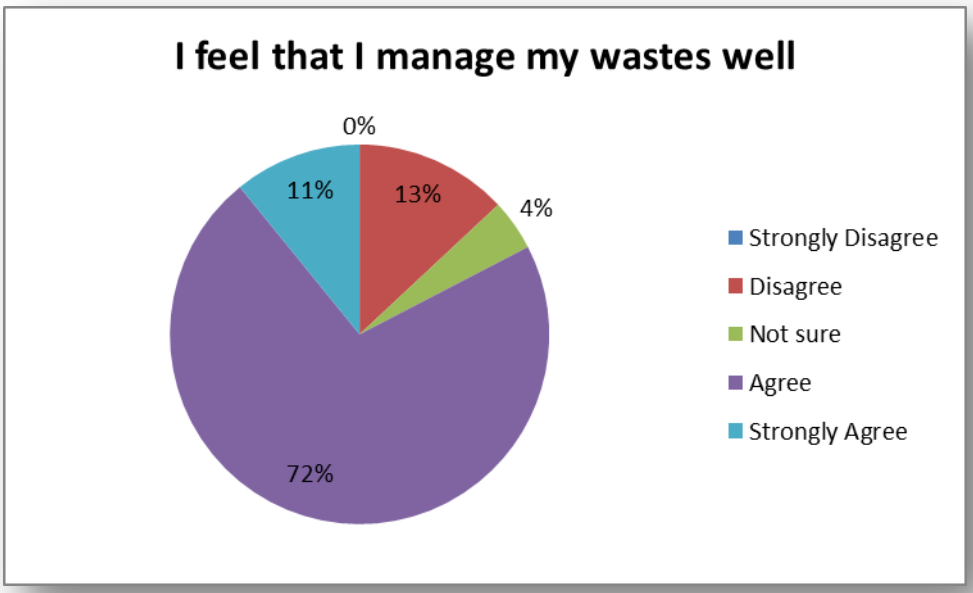


Figure 38 Waikato farmers opinions – managing wastes

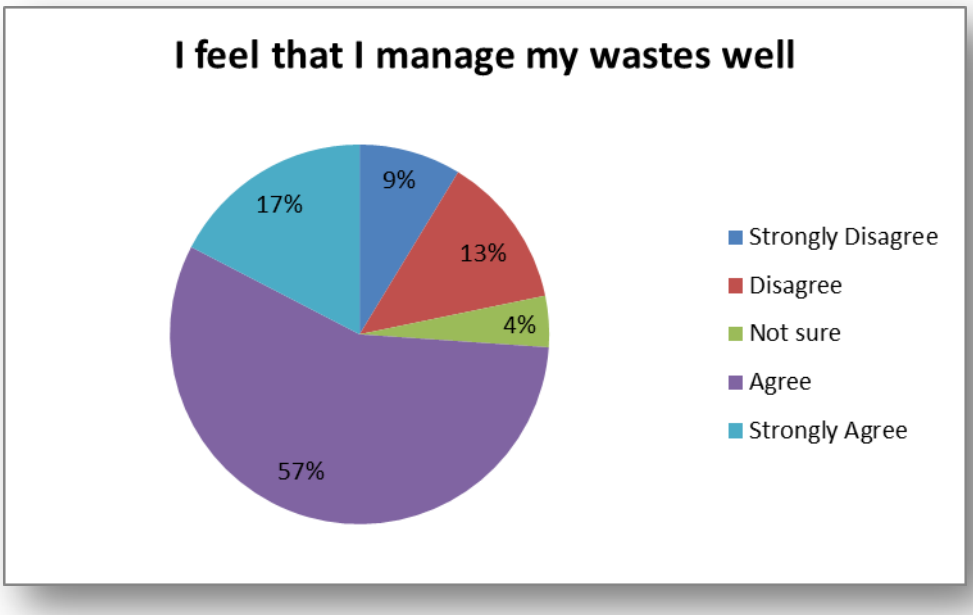


Figure 39 Bay of Plenty farmers opinions – managing wastes

This belief that farmers manage their activities well is consistent with the experience from surveys in Canterbury. When asked the question the survey team felt that each farmer was sincere in their response.

3.8.4 I think that the disposal of rural wastes represents an issue for the Region.

The survey revealed that 89% of farmers (as shown in Figure 40) felt that rural wastes were an issue for their respective Region.

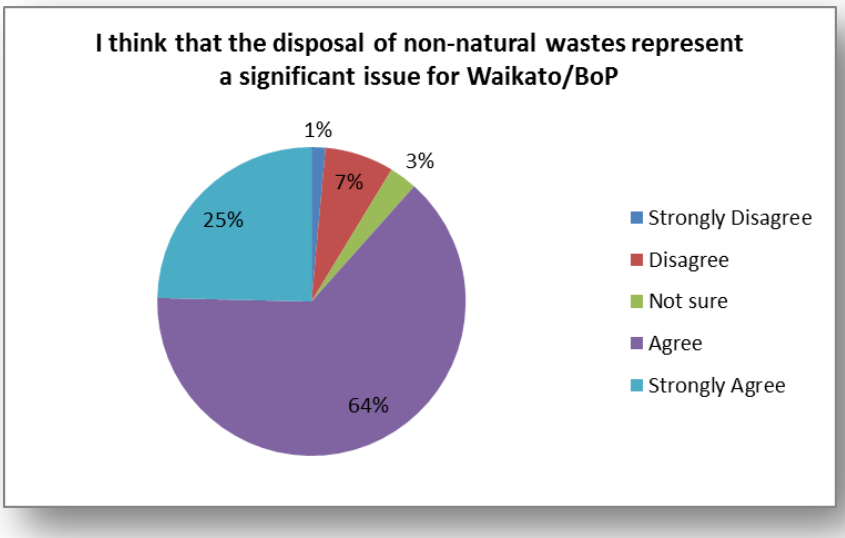


Figure 40 Is rural waste an issue?

This does represent an interesting dilemma because as the producers of rural wastes farmers are saying there is an issue, but conversely farmers (on the whole) felt they managed their rural wastes well. Perhaps the response to Section 3.8.5 below identifies the opportunities for improvement.

3.8.5 Do you think you could manage your wastes differently?

The response by farmers was very similar in both regions with no significant difference between the responses. Figure 41 shows that 78% of respondents felt that they could manage their rural wastes differently.

In responding to this question the survey team felt that farmers were recognising that they were trying to manage their rural wastes in the best way given the set of circumstances they found themselves whilst acknowledging there was room for improvement. In general farmers were keen for more options and acknowledged that some of the current practices were not ideal.

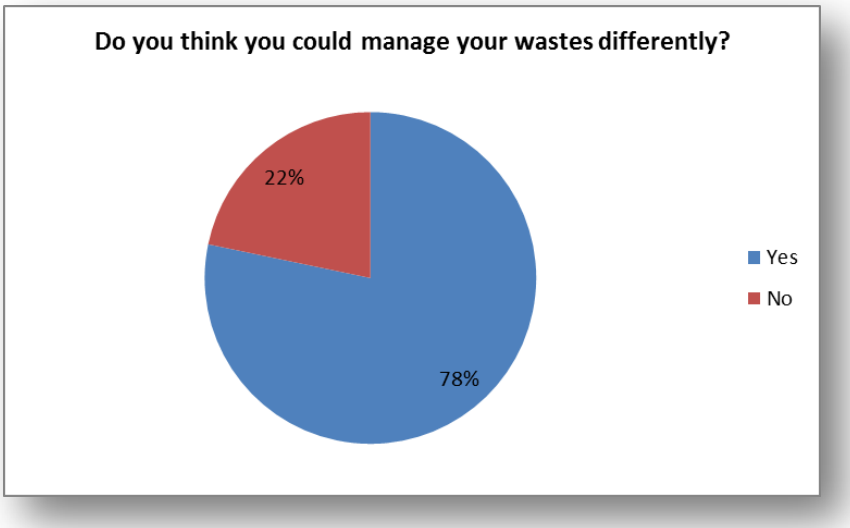


Figure 41 Is there room to improve?

3.8.6 I feel that rural waste collection in my area is adequate.

Figure 42 shows that 62% of respondents felt that waste services were not adequate (69% for Bay of Plenty and 58% for Waikato). This is consistent with farmers view, discussed above, that there could be more options.

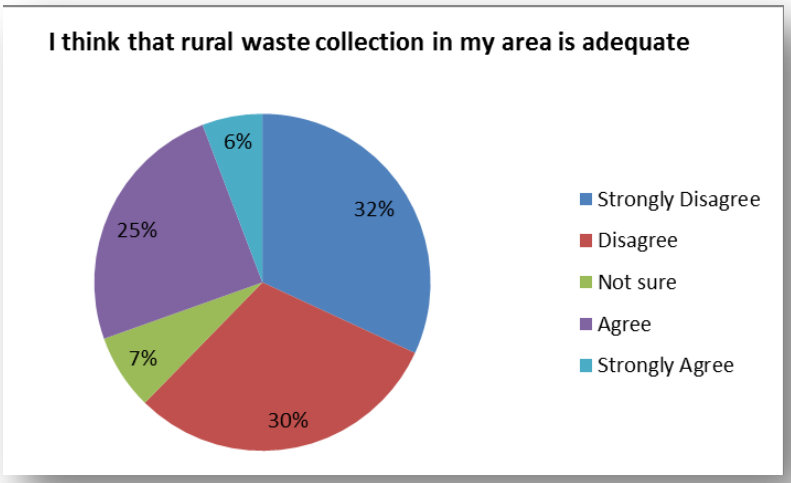


Figure 42 Are waste collection services adequate?

3.8.7 My council provides me with information about waste management options available to me in my district.

Some of the farmers felt in the dark as to their options, and for that matter what was required from them by Regional and District Rules and Plans. Within the respondents 58% (an average across both regions and shown in Figure 43) felt that their respective Councils could provide them with more information. For the Waikato 54% felt this way and 65% felt this way in the Bay of Plenty. There is perhaps a sufficient enough cause for both Councils to consider raising awareness regarding waste options and contractors?

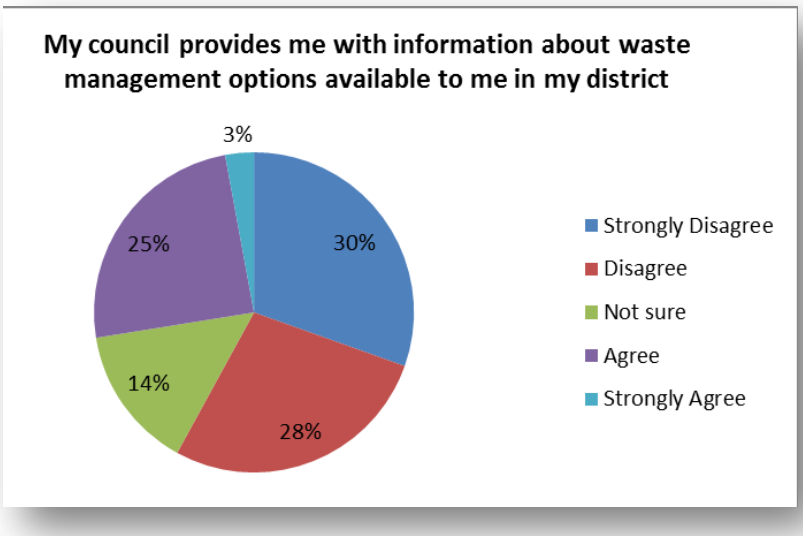


Figure 43 Do you have enough information?

3.8.8 Do you use Plasback or AgRecovery to collect some of your wastes?

The survey showed that 44% of respondents were making use of the schemes services (Figure 44). But the message is that there is room for improvement in terms of support, advocacy and awareness raising (especially regarding the benefits), from the schemes and from the Councils in the Regions (who are committed to supporting Product Stewardship).

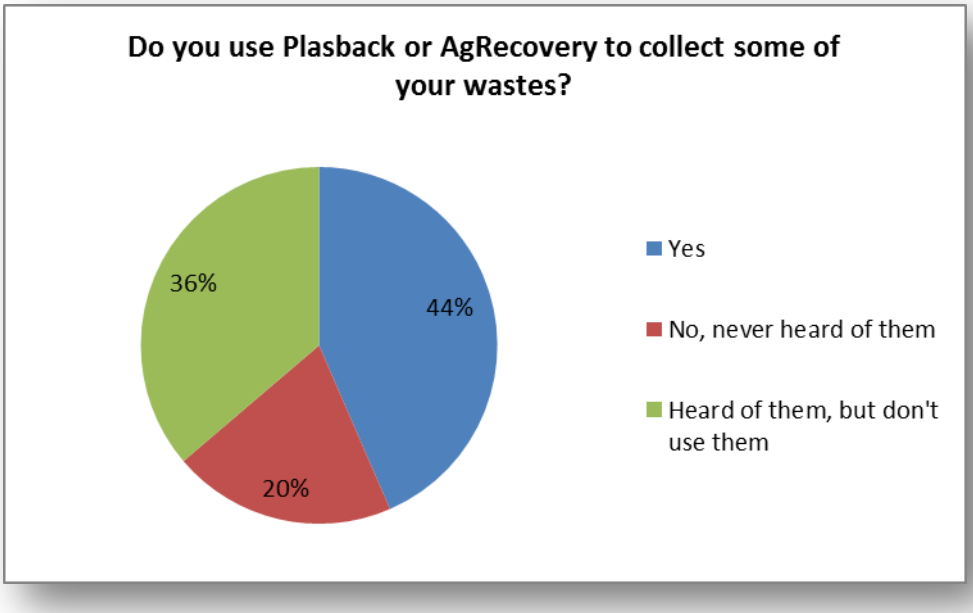


Figure 44 Are you familiar with the Product Stewardship Schemes in your area?

3.9 Level of Service Assessment

3.9.1 District Councils

There are 16 territorial authorities in the Waikato and Bay of Plenty Regions. Although waste collection services are offered by almost all of the council (Table 17), many rural properties are not serviced by council collections and are dependent on private collections where available. This is primarily due to the reduced efficiency and increased cost associated with providing these services to low density rural communities. Table 17 below summarizes the services available by each council.

Table 17 Summary of Council Operated Waste Management Services.

TA	Kerbside Refuse	Kerbside Recycling	Greenwaste	Inorganic	Drop Off Facility (Non RTS)	RTS	Landfill
Waikato Region							
Hamilton CC	Weekly	Weekly				1	
Hauraki DC	Weekly	Weekly		Annual (Franklin area)		2	
Matamata-	Weekly	Weekly				3	

TA	Kerbside Refuse	Kerbside Recycling	Greenwaste	Inorganic	Drop Off Facility (Non RTS)	RTS	Landfill
Piako DC							
Otorohanga DC	Weekly	Weekly and public spaces			1	2	
South Waikato DC	Weekly	Fortnightly	Putaruru only		3	1	1
Taupo DC	Weekly	Weekly and public spaces				6	1
Thames Coromandel DC	Weekly	Weekly			3	7	
Waikato DC	Weekly	Weekly	Raglan only	Annual		3	
Waipa DC		Weekly urban, fortnightly rural					
Waitomo DC	Weekly	Weekly			1	5	1
Bay of Plenty Region							
Kawerau DC	Weekly	Weekly	Fortnightly			1	
Opotiki DC	Weekly	Weekly (urban)				3	
Rotorua DC	Weekly				1	4	1
Tauranga CC	Weekly					2	
Western BoP DC					4		
Whakatane DC	Weekly	Weekly	Fortnightly			4	

3.9.2 Bylaws

Only two of the 16 TAs have no waste bylaw at the time of writing this report. The majority of existing bylaws are based on standard provisions. However, the purposes of all these bylaws relate to the effective and efficient promotion and management of general waste within their regions and lack clear provision for rural waste streams.

3.9.3 Rural waste specific

The emphasis for waste management is concentrated around the urban community with few services being targeted at the rural audience. The non-collection Waste minimization support services targeted at the rural audience includes:

- AgRecovery Programme – agrichemical container collection;
- Plasback Programme – Silage wrap collection;
- (Waikato only) Dunstan Nutrition Ltd – packaging reduction project (support WMF application); and
- (BoP only) Zespri General waste minimisation and management advice and research into alternative technologies.

Irrespective of the services available the following councils identified rural waste as an area of concern:

- Otorohanga DC;
- Tauranga CC;
- Western BoP DC;
- South Waikato DC;
- Whakatane DC;
- Matamata-Piako DC;
- Hauraki DC; and
- Thames-Coromandel DC.

Rural TAs have highlighted rural waste as an area that needs attention in their Waste Minimisation Management Plans. This is demonstrated by Otorohanga, Western BoP and Tauranga Council which have all included actions in their WMMPs that are specific to the farming communities.

Difficulties the Districts face – Otorohanga District Council

Using Otorohanga as a case example there are currently no rural waste collection and no plans for a rural waste collection service at this stage (June 2014). At present Otorohunga Council is conducting a survey and researching data to find out the dollar cost per property to provide a Rural Waste collection service. The potential additional costs to provide Rural Waste collection of recyclates is estimated at $120/year increase in rates.

There are 4 rural recycling centres (volunteer staffed) and 2 “urban” recycling centres (full time staffed). A waste contractor collects the recyclates from the once a fortnight. Contamination of the recyclates is a major issue (with people using the centre as a dump). “Urban” recycling centres take a wider range of waste including tyres and green-waste. Another option is to buy “yellow rubbish bags” ($2.50, heavy duty bag 50Kg), which are free to drop off in town centre.

Therein lies the quandary for District Councils, with the potential costs for Rural Waste services combined with the logistical and operational management issues means Councils will need to clearly understand risks, costs and benefits before decisions are made that have implications for rate payers.

3.9.4 Contractors

Several of the farms surveyed used the Council operated domestic waste collection service for the disposal of certain wastes generated by their farming operation. The items disposed of in

this manner were generally small items that had been deemed by the farmer as not suitable for other disposal methods such as burning or burying. The primary motivations for the adoption of this practice were convenience and cost efficiency. However, it is noted that this practice was only available to those with access to council collections and on properties where the practice would be commensurate to the scale and nature of the farming practice.

Independent of the use of the Council collection services, approximately 55% of farmers used privately operated collection services. It was noted that greater uptake of private collection services was observed in the Bay of Plenty Region as compared with the Waikato Region. This trend is likely a function of a number of factors including greater provision of services, greater awareness of services and better awareness of 'best practice'.

The privately run collections in the Waikato Region were dominated by large operators and include the Red Bin service managed by Envirowaste and Transpacific Industries. However, the Bay of Plenty Region had a number of small operators which included but were not limited to:

- Kleana Bins Ltd;
- J.J. Richards & Sons Ltd;
- Blue Rock Bin Hire; and
- Handee Can Services Whakatane.

The services offered by these operators were predominantly 120L to 240L small drums and wheelie bins with some operators also offering various skip sizes. These services were largely provided on a pay per use basis however some farms indicated that rental fees also applied in some circumstances. The collection operators provide information on what materials are acceptable for disposal through these services. The information provided indicated that general waste was acceptable but hazardous substances such as chemicals and oil were not. Some operators also offered services for hardfill and green waste. However this information was generally ambiguous for a farming context and may lead to misuse of the service. For example, many farmers and operators themselves were unsure whether animal health plastics were appropriate for disposal in this manner. This observation is reflected by the impression given from the farms surveyed suggesting that these services could benefit from greater adaption to farming needs where possible. Examples of these adaptation suggestions included information specific to farm waste streams, reliability of service, and centralized collection for areas not viable for property specific collection.

3.10 Challenges encountered

During the surveys the team did note some areas of concern or push back from the farmers:

- Some farmers were reluctant to allow photographs.
- Some did not want the survey team to visit farm dumps and take GPS readings.
- There were 14 cancellations that the survey team could not follow up with.
- Some were reluctant to provide information regarding organic wastes.

3.11 Comparing the Regions

To date GHD has conducted rural waste surveys in the three most significant agricultural regions of New Zealand, namely the Waikato, Canterbury and Bay of Plenty Regions.

3.11.1 Canterbury vs Waikato & Bay of Plenty

In Canterbury surveys recorded a total of 490.4 tonnes of inorganic waste and 741.9 tonnes of organic wastes and 25.8 tonnes of domestic waste from 53 farms. This means the average farm

is producing nearly 10 tonnes of inorganic waste annually. In total 1258.1 tonnes of inorganic and organic wastes was estimated, with an average farm producing 23.7 tonnes.

In the Waikato and Bay of Plenty the total mass of rural wastes estimated from 69 farms was 2564 tonnes of inorganic and organic wastes. There was 2199 tonnes of inorganic, 272 tonnes of organic and 92 tonnes of domestic. The average farm produced 37 tonnes of rural waste annually, with an annual inorganic average content of 32 tonnes. 100% of all farms used 3B (so no calculation adjustments were needed).

Very similar survey programmes were used using similar tools. The types of wastes observed were very similar with the dominant types wastes being plastics, wood wastes, packaging and hazardous waste. The survey process in the Waikato and Bay of Plenty identified a larger mass of waste. But if 16 more farms were to be added to the Canterbury numbers using the average figure of 23.7 per farm then the total would be 1637.3. This results in a 926.7 tonne difference between the two totals (2564 - 1637.3). Is this a significant difference? Probably not as the data collection process is not exact with measurement being based on best judgement by the survey team.

Figure 45 shows that the Waikato Region is potentially the largest producer of rural wastes compared to Canterbury and Bay of Plenty. This is to be expected as there are more farms in the Waikato. The data for Canterbury has two potential annual tonnage based on the Canterbury survey average of 23.7 tonnes per farm per year (blue bar in Figure 45) and the average of 37 tonnes (light green bar in Figure 45) which has been calculated as part of the Waikato and Bay of Plenty surveys.

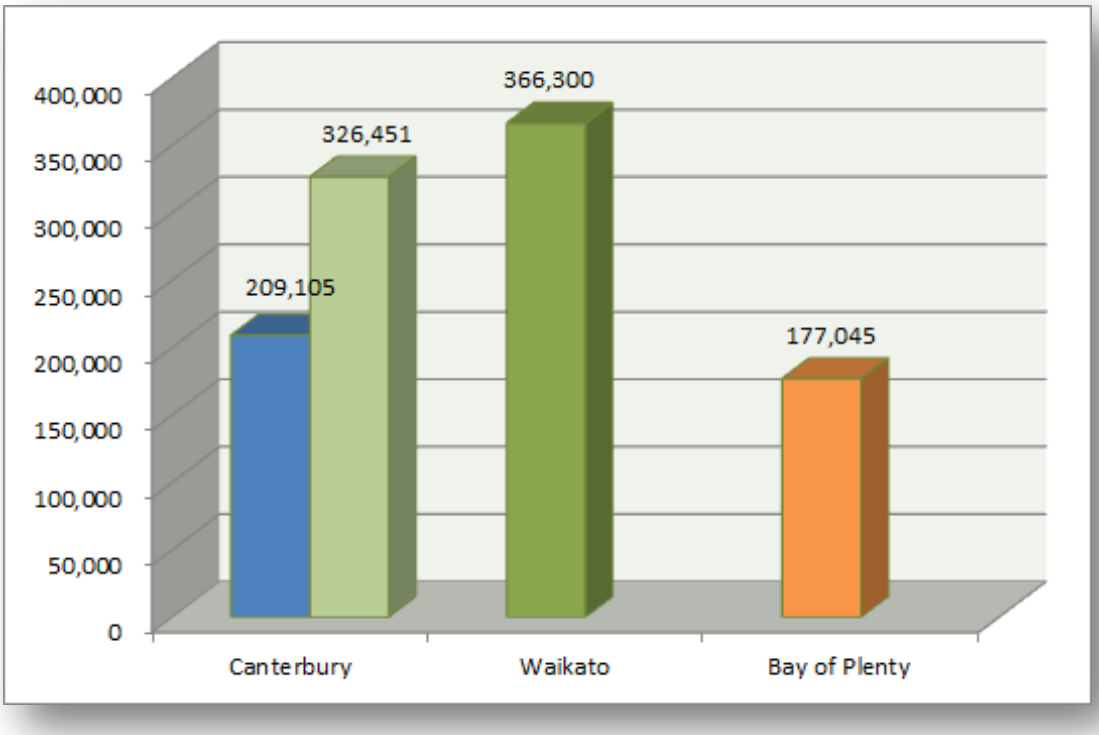


Figure 45 Comparing the Regions (annual tonnages)

Further examination of the stocking density per farm, and production yields is recommended to see if there is a correlation to the size and agricultural intensity versus rural waste tonnages produced per year.

4. Discussion and Conclusions

4.1 Discussion of findings

4.1.1 Significance of waste tonnages for the region

The potential for 69 farms producing 2564 tonnes of rural waste annually is significant, especially when scaled up to reflect the regional numbers for farms. Based on the derived assumption that the average farm produces 37 tonnes of rural waste per year this means **543,345** tonnes of waste will be produced on the farms in the Waikato and Bay of Plenty Regions. The significance of this regional total needs to be considered against the finding that 100% of the farms surveyed were burning, burying or bulk storing these wastes.

4.1.2 National significance

GHD has managed to develop three data sets representing the three most important agricultural regions in New Zealand. If you consider Canterbury has 8823 farms (source NZ statistics) with an average farm producing 23.7 tonnes of waste annually (GHD 2013), this means a total of **209,105.1** tonnes of rural wastes is estimated for the Region. If this is combined with the Waikato and Bay of Plenty Region estimates then **753,723.1** tonnes of waste are produced.

The survey process has started the development of a national data set that could enable projections to be made across New Zealand. The next steps should focus on what elements of the rural waste streams (and makeup of the 753723.1 totals) should be focussed on first to understand the significance and potential impacts and thereafter developing best practice?

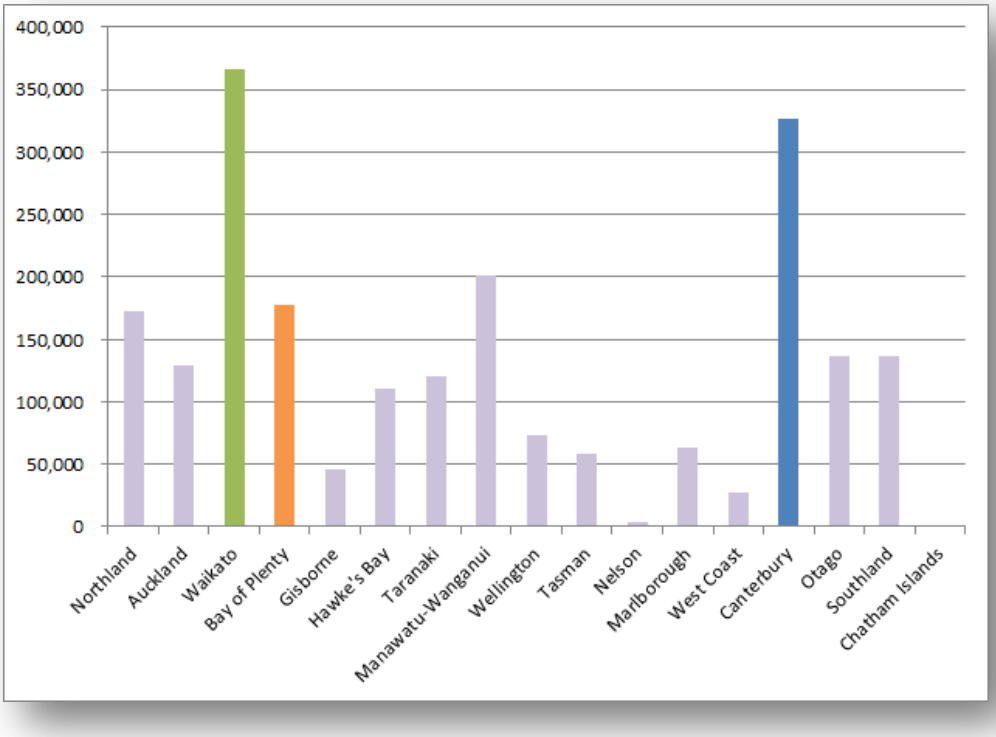


Figure 46 National rural waste projections

Figure 46 sets out the projections of Rural Waste production per year in each of the Regions around New Zealand (using the 37 tonne per year average discussed in Section 3.4.1). The

total volume across all the regions is **2,148,627** tonnes of rural waste per year primarily being disposed of by 3B practices.

4.1.3 Barriers to improving practices and behaviours

The findings of the Waikato and Bay of Plenty Regions were similar to those encountered in Canterbury, with the suggested main barriers being:

- legacy farmer behaviour,
- a lack of awareness and
- a lack of tangible waste management options.

Cost is also an important barrier with farmers reluctant to pay additional and or significant disposal costs when perceived no cost solutions (3B practices) can be used on their properties. Any measures, either market based or regulatory instruments will need to be cognisant of barriers and the potential effort required to circumvent them. Perhaps the first step towards achieving this goal is to:

1. further investigate the risks posed by rural wastes;
2. optioneering for market and regulatory mechanisms for improvement;
3. identify the means of behaviour changes/development of best practice, and as a final point to consider; and
4. roll out a national implementation programme based on findings of 1,2, and 3.

The following recommendations provide some detail regarding initiatives that could be included within the above 4 step process.

4.2 Recommendations to consider

The following recommendations have been made in priority order for both Regional Councils to consider:

4.2.1 Developing a prioritisation hierarchy

As part of any strategy to develop options, a prioritisation hierarchy of the rural waste streams should be undertaken to help focus efforts and resources. It is recommended that a rural waste hierarchy be developed to help raise awareness, inform decision making and policy development and help identify where market options may or may not be needed.

As part of this prioritisation exercise the following criteria are suggested as a starting point (further work is recommended in this area to produce a robust of evaluation criteria):

- Likely volumes;
- Locations;
- Time of year;
- Environmental persistence;
- Risks and Hazardous;
- Available end markets;
- Costs;
- Complexity to reprocess;
- Number of waste management contractors; and

- Likelihood of collaboration/partners.

Having the ability to focus and prioritise on rural waste streams will facilitate effective regulation and the development of market based solutions.

4.2.2 Rationalising the data

There are several prudent steps to be taken to rationalise the data from the Canterbury, Waikato and Bay of Plenty farm surveys (and the Regional and National data projections). It is advisable to discuss the data findings and projections with stakeholders to determine if the data is robust.

It would be prudent to build a mass balance model for rural wastes by examining available data, for example is it possible to rationalise the volume of silage wrap sold each season against the volumes collected by Plasback and the data projections from the surveys to see if the totals agree. The principle of understanding the inputs into rural activities being balanced against the projected rural wastes makes sense to help inform decision making, policy making and service development.

If possible examination of the linkages of rural practices to rural waste production should also be examined, i.e. stocking density per farm, and production yields versus rural waste tonnages produced per year. This potentially will enable the development of robust forecasting models for rural waste tonnages.

4.2.3 Understanding the risks

The findings from Section 3.3.2 tell us that up to 50% of farm 3B disposal points are potentially close to environmental receptors such as streams and rivers. From evaluation of source pathway receptor linkages (discussed in section 3.3.2) it was felt that there is a risk that pollutants from the 3B disposal points could enter the waterways over time. Further investigation is recommended into understanding the environmental risks posed by 3B practices. The 50% estimate from the Waikato and Bay of Plenty surveys may not be reflective of National behaviours and further investigation is recommended. The farm dumps and burn piles are typically located well away from properties to avoid the nuisance issues from farm dumps etc (odour, flies and pests). The underlying message is that farm 3B disposal points are located away from the productive areas of farms and mostly created near property or paddock boundaries. This means that they can abut against waterways as the waterways are often natural property or paddock boundaries. It would be prudent for both Regional Councils to review permitted activity status based on the potential for farm dumps and burn piles to potentially cause environmental issues.

4.2.4 Identifying and developing best practice

It was clear to the survey team that there was variable understanding on what is best practice. What best practice for each rural waste stream should entail is an area that both Councils and Stakeholders should engage in. The Waikato Regional Council has several Farm Menu's that provide guidance for onsite management (nutrients, drainage etc) but currently there is no such equivalent for rural wastes. It is suggested that the Menu format would be ideal to present sound practice for rural wastes. Development of any document should be done in conjunction with, or ideally led by stakeholder organisations.

4.2.5 Telling the waste story

Having more appreciation for how wastes are managed and the potential effects from them was an issue in Canterbury and was an issue in the Waikato and Bay of Plenty that could potential influence behaviours. Where there was a clear understanding of the end fate for the wastes (i.e.

wastes were clearly understood to be entering domestic recycling routes) then better practices were employed. In view of this the Regional Councils should consult with District Councils and relevant stakeholders with the intention of developing a succinct briefing note on options for wastes, which includes disposal locations, contractors, costs, and source of additional help. A compendium of waste resources specifically geared towards supporting the rural sector would help; this could build upon online applications and data bases.

4.2.6 Creating a stakeholder forum

GHD was successful in managing to secure buy in from several prominent stakeholder organisations. It is recommended that a stakeholder forum be created that could act as a sounding board for ideas and provide thought leadership. It is important that any measures to address rural waste issues are done in a collaborative manner. The Regional Councils have a role to play in running and convening the forum, or participating and contributing to alternative forums. For example if an organisation such as Wasteminz were seeking to assemble a forum then the Regional Councils could support this.

4.2.7 Supporting product stewardship

After reviewing the findings of Section 3.8.8 it is clear that help and support for Product Stewardship is needed. The Regional Councils and the District Councils should consult with Product Stewardship organisations to discuss how support can best be provided.

It is important to acknowledge that the Ministry for Environment is consulting on the potential for the creation of mandatory product stewardship schemes covering some of the rural waste streams (agrichemicals). The findings from the consultation process should be examined by the Waikato and Bay of Plenty Regional Councils for discussion with stakeholders in the Regions to understand moving forward how best to support Product Stewardship.

4.2.8 Leveraging off of existing management plans

Part of the tool box of approaches should consider voluntary standards for farm management. There was an impression that tidier farms were members of a farming organisation that had performance expectations. There are a number of management plan templates and guidance starting to emerge. It is recommended that a brief consultation exercise take place whereby key stakeholders are consulted to learn about the tools and templates that they currently have and are planning. An example of how rural wastes could be integrated into farm plans is with Horticulture NZ who have a Good Agricultural Practice scheme but currently waste management is not included in this scheme criterion.

Appendices

Appendix A – Waste Data

Table 18 Dairy sector waste data

Inorganic waste (in Kg unless otherwise stated)	Dairy total	Dairy average
Containers	808	17
Drums	3,605	75
Silage wrap	9,111	190
Netting	7,065	147
Mulch film & crop cover	4,225	88
Plastic	380	8
Metal	4,357	91
Lead acid batteries	98	2
Fertiliser bags	2,551	53
Seed bags	635	13
Animal Feed bags	7,445	155
Animal health plastic packaging and plastic sheep dip	2,684	56
Oil containers	2,392	50
Miscellaneous	3,827	80
CCA treated timber	10,311	215
Untreated timber offcuts	509,210	10,609
Old fence posts	26,992	562
Pallets	2,510	52
Roofing materials	288,573	6,012
Used vehicles and machinery	31,434	655
Drench dip	545	11
Agricultural sprays	2,946	61
Fertiliser bags	22,120	461
Twine	3,262	68
Building waste	26,820	559
Filter socks	1,575	33
Tubing	0	0
Aerosol cans	129	3
Warratahs	12	0
Rubber	1,555	32
Waste oil	966	20
Waste oil filters	14	0
2.4D chemical	1,000	21
Glass containers	69	1
Other metal	1,665	35
Newspaper	312	7
Bicycles	0	0
Shrink wrap	228	5
Silicon	92	2
Wash down hose	112	2
Drag hose	13	0
Alcathene	20	0

Inorganic waste (in Kg unless otherwise stated)	Dairy total	Dairy average
Cardboard	155	3
Wood chip	15,000	313
PVC	0	0
Straw	5,000	104
Tyres (number per year, stockpiled in brackets)	174 (23,800)	4 (496)
Tyres (Kg per year)	1,392	32
Vehicle batteries (number per year)	18	0
Vehicle batteries (Kg per year)	450	9
Total Inorganic in tonnes	1004	21
Organic waste in tonnes	169	3.5
Household domestic in tonnes	77	1.6
Total all wastes in tonnes	1250	26

Table 19 Livestock sector waste data

Inorganic waste (in Kg unless otherwise stated)	Livestock total	Livestock average
Containers	215	20
Drums	710	65
Silage wrap	1,868	170
Netting	1,418	129
Mulch film & crop cover	791	72
Plastic	52.4	5
Metal	1,085	99
Lead acid batteries	28.5	3
Fertiliser bags	344	31
Seed bags	42.6	4
Animal Feed bags	620	56
Animal health plastic packaging and plastic sheep dip	249.9	23
Oil containers	423	38
Miscellaneous	631	57
CCA treated timber	3,280	298
Untreated timber offcuts	35,050	3,186
Old fence posts	3,840	349
Pallets	734	67
Roofing materials	595	54
Used vehicles and machinery	2,150	195
Drench dip	37.5	3
Agricultural sprays	357	32
Fertiliser bags	834	76
Twine	1,217	111
Building waste	4,800	436
Filter socks	186	17
Tubing	0	0
Aerosol cans	12	1
Warratahs	0	0
Rubber	296.5	27
Waste oil	15	1
Waste oil filters	0	0
2.4D chemical	0	0
Glass containers	0	0
Other metal	620	56
Newspaper	168	15
Bicycles	0	0
Shrink wrap	25	2
Silicon	0	0
Wash down hose	25	2
Drag hose	0	0
Alcathene	0	0
Cardboard	110	10
Wood chip	35,000	3,182

Inorganic waste (in Kg unless otherwise stated)	Livestock total	Livestock average
PVC	0	0
Straw	0	0
Tyres (number per year, stockpiled in brackets)	63 (1,750)	6 (159)
Tyres (Kg per year)	504	46
Vehicle batteries (number per year)	11	1
Vehicle batteries (Kg per year)	275	25
Total Inorganic in tonnes	99	9
Organic waste in tonnes	30	2.7
Household domestic in tonnes	9	0.8
Total all wastes in tonnes	138	13

Table 20 Arable sector waste data

Inorganic waste (in Kg unless otherwise stated)	Arable total	Arable average
Containers	12	12
Drums	0	0
Silage wrap	6	6
Netting	6	6
Mulch film & crop cover	0	0
Plastic	0	0
Metal	0	0
Lead acid batteries	1	1
Fertiliser bags	8	8
Seed bags	3.5	3.5
Animal Feed bags	0	0
Animal health plastic packaging and plastic sheep dip	0	0
Oil containers	0	0
Miscellaneous	0	0
CCA treated timber	15	15
Untreated timber offcuts	3,000	3,000
Old fence posts	10	10
Pallets	0	0
Roofing materials	500	500
Used vehicles and machinery	180	180
Drench dip	0	0
Agricultural sprays	60	60
Fertiliser bags	5	5
Twine	1	1
Building waste	3	3
Filter socks	0	0
Tubing	0	0
Aerosol cans	0	0
Warratahs	0	0
Rubber	0	0
Waste oil	0	0
Waste oil filters	0	0
2.4D chemical	0	0
Glass containers	0	0
Other metal	250	250
Newspaper	50	50
Bicycles	25	25
Shrink wrap	0	0
Silicon	0	0
Wash down hose	0	0
Drag hose	0	0
Alcathene	0	0
Cardboard	0	0
Wood chip	0	0

Inorganic waste (in Kg unless otherwise stated)	Arable total	Arable average
PVC	0	0
Straw	0	0
Tyres (number per year, stockpiled in brackets)	2	2
Tyres (Kg per year)	16	16
Vehicle batteries (number per year)	0	0
Vehicle batteries (Kg per year)	0	0
Total Inorganic in tonnes	4	4
Organic waste in tonnes	30	30
Household domestic in tonnes	1	1
Total all wastes in tonnes	35	35

Table 21 Horticulture sector waste data

Inorganic waste (in Kg unless otherwise stated)	Horticulture total	Horticulture average
Containers	1,181	131
Drums	720	80
Silage wrap	430	48
Netting	630	70
Mulch film & crop cover	740	82
Plastic	58.5	7
Metal	290	32
Lead acid batteries	12.5	1
Fertiliser bags	116	13
Seed bags	12.8	1
Animal Feed bags	146.2	16
Animal health plastic packaging and plastic sheep dip	163.6	18
Oil containers	60	7
Miscellaneous	218	24
CCA treated timber	1,692	188
Untreated timber offcuts	232,110	25,790
Old fence posts	3,532	392
Pallets	422	47
Roofing materials	420	47
Used vehicles and machinery	6,850	761
Drench dip	37.5	4
Agricultural sprays	671	75
Fertiliser bags	157.2	17
Twine	1,281.5	142
Building waste	1,570	174
Filter socks	40	4
Tubing	14,000	1,556
Aerosol cans	175	19
Warratahs	0	0
Rubber	378.3	42
Waste oil	125	14
Waste oil filters	14	2
2.4D chemical	0	0
Glass containers	306	34
Other metal	500	56
Newspaper	520	58
Bicycles	0	0
Shrink wrap	100	11
Silicon	0	0
Wash down hose	53	6
Drag hose	50	6
Alcathene	57	6
Cardboard	804	89
Wood chip	820,500	91,167

Inorganic waste (in Kg unless otherwise stated)	Horticulture total	Horticulture average
PVC	5	1
Straw	0	0
Tyres (number per year, stockpiled in brackets)	49 (8,850)	5 (983)
Tyres (Kg per year)	392	44
Vehicle batteries (number per year)	3	0
Vehicle batteries (Kg per year)	75	8
Total Inorganic in tonnes	1,092	121
Organic waste in tonnes	43	4.8
Household domestic in tonnes	6	0.7
Total all wastes in tonnes	1,141	127

Appendix B – Photographs

Typical Bulk storage practices

Figure 47 Hazardous substance shed with various chemicals stored without appropriate compartments

Figure 48 Bulk storage behind a building – this was a common practice with materials often stored for years

Figure 49 Storage shed with assorted farm machinery, equipment and farm waste

Figure 50 Storage shed with multiple open feed bags and plastic containers

Figure 51 Demolition waste stored away from operational areas

Figure 52 Storage shed with containers, vehicle and various pieces of farm equipment

Figure 53 Tidy bulk storage of farm supplies

Figure 54 Storage of empty barrels prior to reuse on site

Figure 55 Locked hazardous substance shed with clear signage. Tidy storage of spent plastic containers prior to pickup

Figure 56 Confined storage of petrol and diesel tanks

Figure 57 Storage of used pallets prior to pickup and used plastic containers. Full bags stored for farm use

Figure 58 Storage of feed bags

Bulk storage was commonly away from paddocks and was typically close to or within farm buildings. On a number of occasions large stockpiles of wastes and materials were located behind buildings so that they were out of sight – creating the impression of a tidy farm.

Typical Burial storage practices

Figure 59 Dairy farm pit with various waste types. Pit located near to a waterway

Figure 60 Shallower scrape awaiting burn down and eventual cover over

Figure 61 Demolition and mixed wastes about to be taken to farm dump and burnt

Figure 62 Farm dump that has recently been burnt

Figure 63 Mixed wastes in a farm dump

Figure 64 Deeper excavation on this farm dump means it can receive significant volumes of rural wastes

Typical burial practices ranged from wastes being deposited in shallow surface scrapes to burial in more substantial excavations. It was common place that the contents were set on fire to reduce volumes. This practice extended the lifespan of the farm dump because of the reduction in volume of waste.

Typical Burning practices

Figure 65 Frequently used burn site location

Figure 66 Partially burnt silage wrap

Figure 67 Rural waste remains after burning

Figure 68 Rural waste remains after burning

Figure 69 Rural waste awaiting burning

Figure 70 Rural waste remains after burning in a concrete O-ring

Burning of wastes within a farm dump was a very common practice.

Figure 71 Silage wrap awaiting pick up

Figure 72 Container wastes stored prior to pick up

Figure 73 Silage wrap awaiting pick up

Figure 74 Silage wrap awaiting pick up

Figure 75 Waste bags within an old 1000L container cage

Figure 76 Silage wrap awaiting pick up

Figure 77 Silage wrap awaiting pick up

Figure 78 contractor waste wheelie bins

Figure 79 Waste bags full of pine cones

Figure 80 Silage wrap awaiting pick up

GHD

Level 3, 27 Napier Street
Freemans Bay
T: 64 9 370 8000 F: 64 9 370 8001 E: aklmail@ghd.co.nz

G:\51\32432\Reporting\Working draft\2014 - 07 - 18 July Rural Waste Report Final.docx

Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
1.0	Jeff Matthews					18th July 2014

www.ghd.com