Litter Costs to the NSW Economy – a preliminary report

NSW Environment Protection Authority

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Executive Summary

Introduction

MRA Consulting Group (MRA) was engaged by the NSW Environment Protection Authority (EPA) to quantify the cost of litter management to the NSW economy. The results of this preliminary report will be incorporated into the Cost Benefit Analysis (CBA) that will inform the design and implementation of a Container Deposit Scheme (CDS) in NSW. The study also serves to provide useful information for litter reduction and management programs. The study was divided into the following two components:

1. A literature review of national and international studies that seek to quantify the cost and impact of litter; and
2. A preliminary study of the current costs of litter management in NSW.

Litter studies

A literature review was first conducted. Although there are limited studies for Australia, examples from America and Europe provide a range of methodologies for review and comparison. All relevant studies concur that it is difficult to accurately quantify the direct cost of managing litter. Direct litter costs are commonly aggregated with other costs (for example street sweeping and illegal dumping), and are borne by many different organisations.

In addition to the direct costs borne by authorities and communities, there are indirect costs associated with litter, including reduction in real estate values, negative impacts on tourism and road traffic accidents (e.g. punctured tyres from broken glass bottles).

Table 1 provides a summary of all relevant national and international studies that have endeavoured to quantify the direct and indirect costs of litter.

Table 1 Summary of past litter cost studies

Study	Data year	Author	Location	Key findings	Reference
Victorian Local Government Annual Survey	2010-2011FY data	Sustainability Victoria	Victoria, Australia	Annual cost of litter and street sweeping to local governments and expenses related to maintenance of litter bins, traps and litter clean up	(Sustainability Victoria, 2013)
Victoria Litter Report	2005, 2007, 2009, 2010, 2011	Sustainability Victoria	Victoria, Australia	Beverage composition of litter has increased	(Sustainability Victoria 2012)
Cost of littering in the UK	Unclear	Keep Britain Tidy and Eunomia	UK	Cost of litter management including direct and indirect litter costs	(Keep Britan Tidy , 2013) (Keep Britain Tidy , 2012)
Exploring the Indirect Costs of Litter in England	2013	Eunomia	England	Indirect litter costs, which includes both internal and external costs	(Eunomia , 2014)
Exploring the Indirect Costs of Litter in Scotland	2013	Eunomia	Scotland	Indirect litter costs, which includes both internalised and external costs	(Eunomia, 2014)
Estimating Beverage Container Litter Quantities and Clean-up Costs in Michigan	2015 (meta analysis)	Container Recycling Institute (CRI)	Michigan, USA	Litter clean-up cost savings due to CDS	(CRI, 2015)
Cost of litter study in Switzerland	2011	Federal Office for the Environment	Switzerland	Total cost for cleaning litter and distribution of costs by litter composition	(Federal Office for the Environment , 2011)
2009 National Visible Litter Survey and Litter cost study	2008	Keep America Beautiful	USA	Annual direct and indirect litter clean-up costs	(MidAtlantic Solid Waste Consultants, 2010)

Methodology

MRA drafted a tailored survey for each stakeholder group in consultation with NSW EPA. Survey Monkey® was used to prepare and distribute the surveys to stakeholders.

Figure 1 provides a generic summary of the methodology employed to obtain data from stakeholders. However, as each stakeholder was unique, a more nuanced approach was employed when assisting stakeholders to complete the survey.

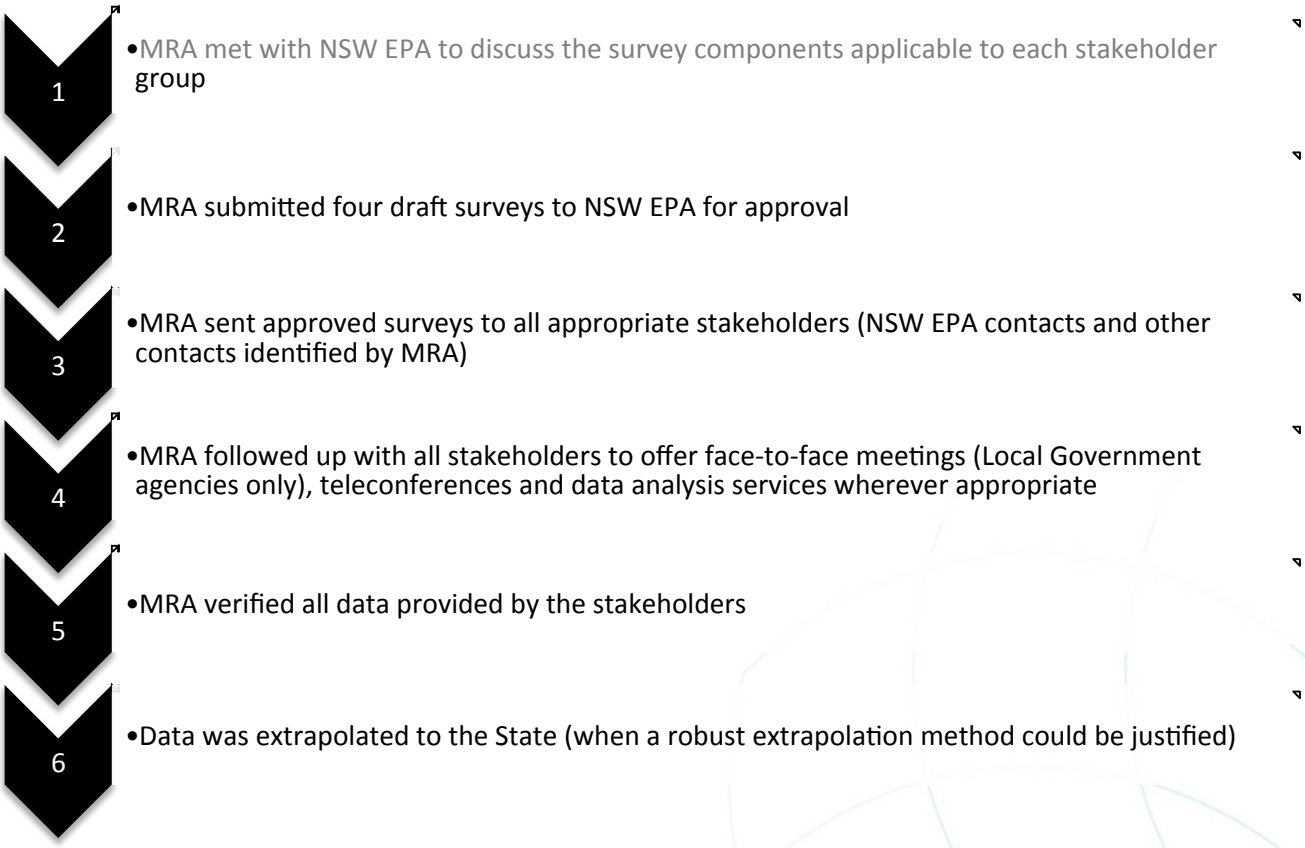
Each stakeholder was requested to provide the 2014/2015 costs associated with the following:

- Education (labour and materials);
- Infrastructure and equipment (e.g. bins, signs, gloves, PPE etc.);
- Movement and haulage equipment (e.g. street sweepers, trucks etc.)
- Clean-up labour (both paid labour and volunteer time); and
- Disposal/recovery.

The surveys also allowed for qualitative comments and considerations to be included as appropriate. The surveys are provided in full in the appendices below.

- Appendix A: Survey design for Local Government agencies (councils)
- Appendix B: Survey design for community organisations
- Appendix C: Survey design for State Government agencies
- Appendix D: Survey design for private businesses

Figure 1 Survey methodology



Results

The survey results were extrapolated to the State when data and a robust extrapolation method were available. The results indicate that litter management is a net cost to the NSW economy of more than $162.6m (Table 2).

The results are conservative, as they do not seek to estimate the cost of the sub groups for which data was not provided (e.g. private businesses: supermarkets), or for sub groups that robust extrapolation methods could not be derived for (e.g. community organisations).

Of the data extrapolated, local government agencies bear the largest cost of litter management, at approximately $135.3m or 83% of the total litter management costs estimated for the State. Community organisations are the second largest contributor, with an estimated cost of $17.8m or 11% of total litter management costs.

Table 2 Extrapolated results to NSW for 2014/2015

Stakeholder group	Sub group		Extrapolation/method	Net cost ($)
Local Government agencies (councils)	Coastal: Regulated	Y	Population	$73,194,524
	Coastal: Unregulated	Y	Population - Coastal Regulated	$1,466,665
	Non Coastal: Regulated	Y	Population	$35,479,397
	Non Coastal: Unregulated	Y	Population	$25,127,942
			Sub total	$135,268,528
Community organisations	Local Community Organisation	N	No method; totals used	$1,028,844
	State-wide Organisation	N	No method; totals used	$16,793,118
			Sub total	$17,821,962
State Government agencies	Crown Lands	N	Insufficient data	Unknown
	Health	N	Insufficient data	Unknown
	National Parks	Y	Visitation	$3,389,995
	Other	N	Insufficient data	Unknown
	Parks (e.g. Centennial Park)	N	Insufficient data	Unknown
	Recreational Infrastructure (e.g. Sydney Olympic Park Authority)	N	No method; totals used	$603,642
	State Forests	N	No method; totals used	$88,960
	Transport Infrastructure (e.g. RMS)	N	No method; totals used	$2,889,960
	Utility Infrastructure (e.g. Sydney Water)	N	Insufficient data	Unknown
			Sub total	$6,972,557
Private businesses	Food Franchises	N	Stores	Unknown
	Office Blocks	N	Tenants	Unknown
	Parking Lots	N	Area	Unknown
	Private Transport Infrastructure	N	Area	Unknown
	Shopping Centres	N	Shoppers	Unknown
	Stadiums	N	Events; attendees	Unknown
	Supermarkets	N	Shoppers	Unknown
	Universities	Y	Enrolments	$2,609,453
	Warehouses	N	Employees	Unknown
			Sub total	$2,609,453
All			Total	$162,672,500

Recommendations

Drawing upon the preliminary study's findings and lessons, the following recommendations have been made to inform the design of the secondary stage of this study, and/or any future litter cost studies:

1. Allow as much time as possible to collect and validate data;
2. Allow for face-to-face discussions with respondents wherever possible;
3. Sign confidentiality agreements with private businesses to improve data capture from the private sector;
4. Provide a clear incentive to stakeholders (especially State Government agencies and private businesses) to participate in the survey;
5. Ensure the survey design best reflects the data format recorded by stakeholders;
6. Provide guidance to respondents using fact sheets and definitions to facilitate data capture; and
7. Replicate the survey on an annual basis.

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Glossary

Abbreviation	Definition
CBA	Cost Benefit Analysis
CDL	Container Deposit Legislation
CDS	Container Deposit Scheme
CHF	Swiss Francs
CRI	Container Recycling Institute
CUAD	Clean Up Australia Day
DPI	NSW Department of Primary Industries
EPA	Environment Protection Authority
FY	Financial Year
MRA	MRA Consulting Group
NGO	Non-Governmental Organisation
NSW	New South Wales
NT	Northern Territory
SA	South Australia
UK	United Kingdom
USA	United States of America
US$	US Dollars
£	British Pounds

1. Background

In February 2015, the NSW State Government announced that it would introduce a Container Deposit Scheme (CDS) from July 2017 (NSW Government, 2015). The State Government has established an advisory committee and a series of working groups to obtain stakeholder feedback and to seek advice on the most cost effective structure and implementation model for a CDS. This process will seek to incorporate and learn from the Northern Territory (NT) and South Australian (SA) CDS models.

To make a decision about the form and implementation of the CDS, a cost benefit analysis (CBA) must first be performed. One component of this CBA is analysing the cost of littered containers in NSW (those likely to be eligible for return under the NSW CDS). Littered containers are a subset of the total litter managed in NSW.

The NSW Environment Protection Authority (NSW EPA) engaged MRA Consulting Group (MRA) to quantify the cost of littered CDS material in NSW. There are various costs associated with managing the CDS-related component of litter in NSW, including (but not limited to):

- Education (labour and materials);
- Enforcement;
- Infrastructure and equipment (e.g. bins, signs, gloves, PPE etc.);
- Movement and haulage equipment (e.g. street sweepers, trucks etc.)
- Clean-up labour (both paid labour and volunteer time); and
- Disposal/recovery.

The study sought to capture the costs of litter against these categories for all stakeholders. The study was conducted in two stages:

1. A literature review of national and international studies that seek to quantify the cost and impact of litter; and
2. A preliminary study of the current costs of litter management in NSW.

This study involved distributing online surveys to identified members of four stakeholder groups:

- Councils;
- State Government agencies;
- Community groups; and
- Private businesses.

Respondents were asked to provide the amount that their organisation spent on litter management in the 2014/15 financial year (FY), labour time spent on litter management, and an average weighted labour cost. Where data for the 2014/15FY was not available, respondents were asked to provide figure for an 'average' 12 month period.

This data has formed the basis of a base estimate of the annual cost of litter management in NSW. The data and findings presented in this preliminary study have not been quantified for NSW before. It should be noted that given the strict timeframes of this preliminary study, the data gathered was limited and the results are thus conservative. Extending the timeframe of this study will likely increase the range and quality of the data obtained and extrapolated to the State.

2. Review of past litter cost studies

All relevant studies found concur that it is difficult to accurately quantify the direct cost of managing litter. Direct litter cleaning costs are commonly aggregated with other costs (for example street sweeping and illegal dumping), and are borne by many different organisations, including:

- Local Government agencies (councils);
- Local, national and federal park authorities;
- Highway agencies and operators;
- Volunteer groups; and
- Private businesses and entities.

In addition to the direct costs borne by authorities and communities, there are indirect costs associated with litter, including reduction in real estate values, negative impacts on tourism and road traffic accidents (e.g. punctured tyres from broken glass bottles).

This section summarises key studies from Australia and abroad that have attempted to identify the cost of litter management. A summary of these studies is provided below (Table 3).

Table 3 Summary of past litter cost studies

Study	Data year	Author	Location	Key findings	Reference
Victorian Local Government Annual Survey	2010-2011FY data	Sustainability Victoria	Victoria, Australia	Annual cost of litter and street sweeping to local governments and expenses related to maintenance of litter bins, traps and litter clean up	(Sustainability Victoria, 2013)
Victoria Litter Report	2005, 2007, 2009, 2010, 2011	Sustainability Victoria	Victoria, Australia	Beverage composition of litter has increased	(Sustainability Victoria 2012)
Cost of littering in the UK	Unclear	Keep Britain Tidy and Eunomia	UK	Cost of litter management including direct and indirect litter costs	(Keep Britan Tidy , 2013) (Keep Britain Tidy , 2012)
Exploring the Indirect Costs of Litter in England	2013	Eunomia	England	Indirect litter costs, which includes both internal and external costs	(Eunomia , 2014)
Exploring the Indirect Costs of Litter in Scotland	2013	Eunomia	Scotland	Indirect litter costs, which includes both internalised and external costs	(Eunomia, 2014)
Estimating Beverage Container Litter Quantities and Clean-up Costs in Michigan	2015 (meta analysis)	Container Recycling Institute (CRI)	Michigan, USA	Litter clean-up cost savings due to CDS	(CRI, 2015)
Cost of litter study in Switzerland	2011	Federal Office for the Environment	Switzerland	Total cost for cleaning litter and distribution of costs by litter composition	(Federal Office for the Environment , 2011)
2009 National Visible Litter Survey and Litter cost study	2008	Keep America Beautiful	USA	Annual direct and indirect litter clean-up costs	(MidAtlantic Solid Waste Consultants, 2010)

2.1 Sustainability Victoria surveys

2.1.1 Victorian Local Government Annual Survey 2010/11

In 2010-2011, the Victorian Local Government Annual Survey was conducted by Sustainable Victoria to assess the State's delivery of waste management and recycling services to households by local government.

The survey provides a regular measure of local government waste disposal efficiency as well as sustainability together with the cost and yield performances of the services. In addition to collecting data on waste collection and disposal services, it addresses:

- Litter bin and litter trap collection and disposal;
- Litter clean up services; and
- Street sweeping.

The electronic survey was dispatched in September 2011. All 79 local governments in Victoria completed the survey on Sustainability Victoria's website (representing a 100% response rate). Sustainability Victoria also conducted rigorous follow-up with individual local governments to validate all data entries. Responses were also circulated among regional education officers and waste management group executive officers for additional verification. The above procedures and extensive data analysis process allowed Sustainability Victoria to recognise and rectify anomalies in the original survey responses.

The survey found that the annual cost of litter and street sweeping to local governments was over $83 million (or $15.03 for every person in the state). Expenses related to the maintenance of litter bins, gross pollutant traps and litter cleaning totalled more than $28 million, while street sweeping services cost more than $55 million.

2.1.2 Victorian Litter Report

The Victorian Litter Report does not identify costs related to litter management, however it does provide information on key litter indicators for public place locations throughout Victoria. Having been piloted in 2003 as the Victorian Littering Monitoring Protocol and repeated in 2005, 2007, 2009, 2010 and 2011, the Victorian Litter Report allows the comparison over time of a number of relevant measures including litter count and composition.

The Victorian Litter Report compiles research conducted in 216 sites and uses the Clean Community Assessment Tool. All Victorian Litter Reports have found a consistency in the composition of items found littered on the ground. Although cigarettes are the primary littered item, beverage is also a significant stream that has increased over time from 22% (2003) to 29% (2011).

2.2 Keep Britain Tidy

Keep Britain Tidy is a UK charity that conducts research and manages a number of programs aiming to reduce litter and safeguard the environment and public place amenity.

One of its campaigns, 'Which Side of the Fence are You on?' was designed to showcase the burden placed on councils by litter.

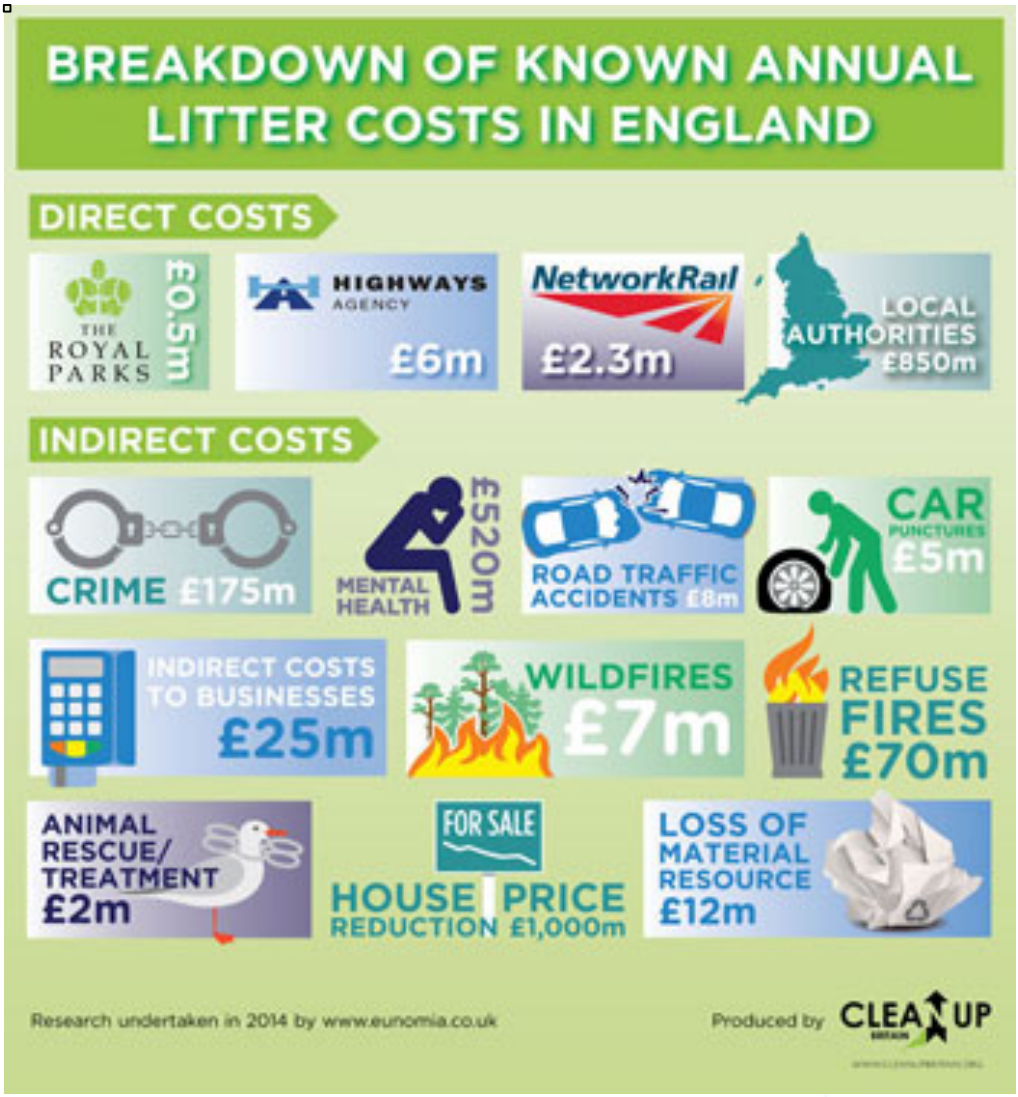
Keep Britain Tidy has produced numerous publications that estimate the cost of litter management at £858 million a year. Although this figure has been quoted since 2010 and has been picked up by numerous newspapers[1], other NGOs[2] and local government[3], MRA could not identify the original report or analysis

[1] http://www.telegraph.co.uk/news/earth/earthnews/7897112/Britains-litter-epidemic-costs-almost-1bn-every-year.html
[2] http://www.localgov.co.uk/Winning-the-fight-against-litter/39196
[3] http://www.gedling.gov.uk/wasterecyclingenvironment/streetcleaninglitter/litter/

behind this figure. Keep Britain Tidy reaffirms this figure by cross-referencing it in a circular manner in a number of its reports, including in the 2012 *The Little book of Litter*.

The report has been included here as it is now widely accepted as a valid estimate, including by the House of Commons, Communities and Local Government Committee[4]. The Keep Britain Tidy direct cost estimates along with the Eunomia estimates on indirect costs (discussed below) have been combined by another charity, Clean up Britain, to create an infographic aiming to summarise the actual cost of litter in England (Figure 2).

Figure 2 Clean up Britain infographic summarising the annual cost of litter in England



2.3 Eunomia, Exploring the Indirect Costs of Litter in England

Eunomia Research & Consulting Ltd. (Eunomia) was engaged by Keep Britain Tidy to explore the indirect costs of litter in England. For this study, direct costs of litter are the costs to local authorities and other statutory bodies of engaging in the clean up of litter and clearance of flytipping (illegal dumping), including

[4] House of Commons, Communities and Local Government Committee, 2015. Litter and fly-tipping in England, Seventh Report of Session 2014–15. http://www.publications.parliament.uk/pa/cm201415/cmselect/cmcomloc/607/607.pdf

additional treatment/disposal of the waste. In contrast, indirect costs are those that impact other entities in the economy, nature and wildlife.

Some of these indirect costs are already 'internalised' within existing market transactions. For example, the cost of dealing with injuries to the public caused by litter is borne by individuals or the National Health System while repairing damage to vehicles from accidents caused by litter (such as tyre punctures) is borne by individuals or their insurances.

Other costs are not currently internalised and are referred to as 'externalities'. Table 4 provides a consolidated version of the key potential impacts and possible costs, drawing upon the table in the report's text. In its report, Eunomia proceeded to provide a best estimate for each of the impact areas.

Table 4 Range of estimates of annual indirect costs by impact area

Impact area	Cost range (£ per annum)	Comments
Internalised Costs		
Crime (overall costs)	£3.48m to £348m	Based on evidence associated with litter as a causal factor in crime.
Police Time	£480,000 to £48m	Based on evidence associated with litter as a causal factor in crime.
Mental wellbeing (overall costs)	£105m (0.1% of total costs) to £10.5bn (10% of total costs)	Based on assumptions linking local environmental quality to mental wellbeing.
Anti-depressants	£279,000 (0.1% of total costs) to £27m (10% of total costs)	The proportion of the costs of anti-depressants that could reasonably be considered to be attributable to a littered environment.
Road Traffic Accident Costs	£7.8m to £51m	Based on assumptions due to litter as a cause of accidents.
Punctures	£389,000 to £38.9m	Car and bike due to litter (typically glass).
Rail Network	£1,166 to £576,000	Based on evidence of damage to rail infrastructure, associated delays and vermin control.
Vermin – Damage from Rats	£10,450 to £20.9m	Based on evidence relating to the damage caused by rats, and the proportion of the population whose existence can be attributed to edible litter.
Vermin – treatment costs of rats	£34,000 to £3.4m	Based on evidence relating to the expenditure on tackling rats, and the proportion of the population whose existence can be attributed to edible litter.
Vermin – damage from pigeons	£21,000 to £2.1m	Based on evidence relating to the damage caused by pigeons, and the proportion of the population whose existence can be attributed to edible litter.
Indirect costs to business	Above £4.5m	This is based solely on the expenditure of McDonald's restaurants on anti-litter activities.

Impact area	Cost range (£ per annum)	Comments
Wildfires	£738,000 to £73.8m	Due to limited data it is not possible to place a high level of confidence in this figure.
Refuse fires	Approximately £70.6m	Based on the average secondary outdoor fire cost and the estimated number of refuse fires attributed to loose refuse in England.
Loss of material resource	Approximately £12.8m	Figure will vary based on material prices and recycling rate.
Wildlife and livestock	Approximately £958,410	Limited data available for impacts on livestock in England.
Voluntary clean-ups	Approximately £825,500	Based on valuation of volunteer time involved in.
House prices	£1bn	If 1% of the housing stock devalued by 2.7% due to litter.
External Costs		
Local disamenity	£702m to £7.6bn	Intuitively this would be higher than the valuation of the disamenity of beach litter alone. In the absence of further research it is not possible to reduce this range. The true value is likely to be closer to the higher end of the range.
Beach Litter disamenity	£521m to 1.1bn	Encompassing both use and non-use values. Based on conservative estimates, so may be higher. Further research to provide greater understanding on the relative weight of use and non-use values would be required.
Greenhouse gas damage costs	£3.2m	GHG benefits foregone from material that is currently littered and sent for disposal, rather than being appropriately discarded and recycled.

2.4 Eunomia, Exploring the Indirect Costs of Litter in Scotland

Eunomia was engaged by Zero Waste Scotland to explore the indirect costs of litter in Scotland. The approach adopted was similar to the study exploring the Indirect Costs of Litter in England. Of the internalised costs the largest categories relate to, in descending order:

- Property values (as an illustration, if 1% of Scotland's housing stock were devalued by 2.7% due to litter this would equate to £100 million loss);
- Mental health (approximately £53 million);
- Crime (up to £22.5 million);
- Road Traffic Accidents (approximately £1 million);
- Wildfires (approximately £1 million);
- Punctures (approximately £1 million); and
- Rats (approximately £1 million).

However, with the exception of the impacts in respect of property values, mental health and crime, these internalised costs are considerably lower than the estimates of the key external costs, which are as follows:

- Local disamenity (£73-770 million); and

- Beach litter disamenity (£50-100 million).

2.5 Container Recycling Institute, Estimating Beverage Container Litter Quantities and Clean-up Costs in Michigan (meta analysis)

This paper authored by CRI looks at litter clean-up efforts and associated costs in Michigan, and attempts to determine the proportion of litter comprising discarded beverage containers. Although the report is not a comprehensive body of work based on site surveys, it draws upon other research.

It concludes that, as a result of Michigan's CDS and assuming it reduces beverage container litter by 2.5%, relevant entities are collectively saving at least US$8.3 million per year on litter clean-up costs. In addition, it estimates potential savings of $4.6 million per year from injury prevention and reduced farm damage. The sum of these is $12.9 million per year in Michigan. As the current CDS in Michigan only covers carbonated beverage containers, it is concluded that greater cost savings would be achieved if the scheme expanded to include more types of containers.

The study highlights that cost estimates for the management of litter are based on current clean-up costs. However, the governmental agencies and NGOs involved in litter management do not have the capacity to clean up all litter. The study therefore concludes that the real cost of cleaning up litter and ensuring that harmful items are being kept out of waterways is unknown.

2.6 Federal Office for the Environment, Cost of litter study in Switzerland

To identify the cost of providing litter collection and litter clean up services, Switzerland's Federal Office for the Environment conducted a country-wide study. The main objectives were to quantify the actual cost of litter in Switzerland and to investigate the composition of litter, looking at take-away food packaging, drinks containers, newspapers, flyers and cigarettes. Prior to this study, the cost data was largely unknown and only rough estimates were available.

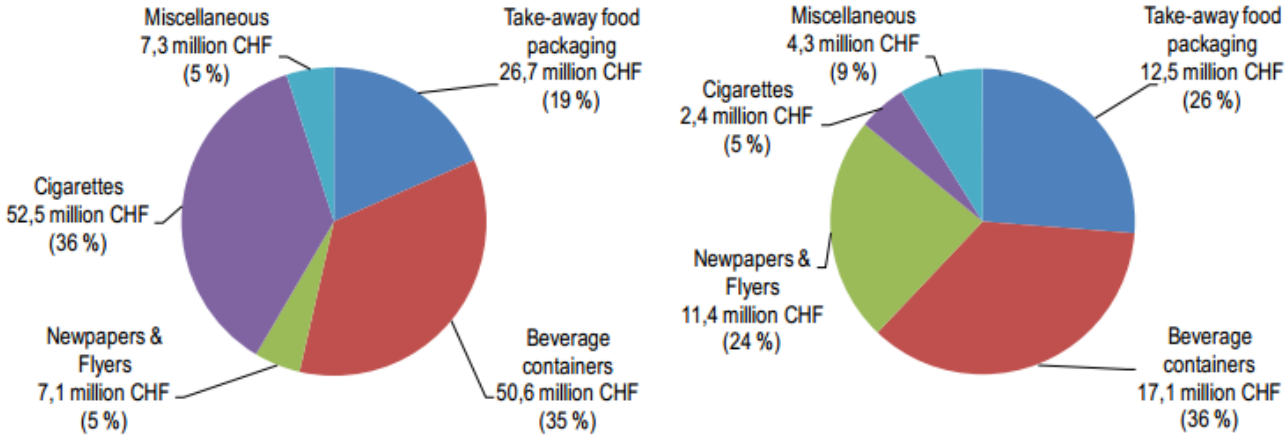
The primary data collection method was a survey of public authorities. A sample of 40 communities and nine public transport services was selected as representative of the country. The selected communities and transport services varied in size and were distributed across Switzerland. The collected data was used to extrapolate the litter costs for the entire country. Litter clean up costs were surveyed for the following location categories:

- Category I: Towns and peri-urban centres in metropolitan areas;
- Category II: Touristic, industrial and/or agricultural types of medium-size communes;
- Category III: Rural, industrial and/or agricultural tertiary communes; and
- The public transport sector (including railway stations):
    - Long-distance;
    - Regional; and
    - Local.

The following key findings were reported:

- Total cost for cleaning litter was 192 million francs (CHF) in the year 2010. Of this, 144 million CHF (75%) was due to litter-dropping in residential areas and 48 million CHF (25%) was due to litter-dropping in the public transport sector.
- In residential areas, more than 50% of litter costs (77 million CHF) were attributed to food and beverage packaging and other objects associated with fast food (serviettes, plastic cutlery, etc.) while 36% was attributed to cigarettes (Figure 3).

Figure 3 Litter related cleaning costs proportioned by litter component (Switzerland cost of litter study)



2.7 Keep America Beautiful, 2009 National Visible Litter Survey and Litter Cost Study

Keep America Beautiful[5], is a USA non-profit organisation established in 1953 that provides the expertise, programs and resources to help people prevent litter, reduce waste, increase recycling, and protect the environment. The organisation has commissioned numerous reports on litter, with the 2009 National Visible Litter Survey and Litter Cost Study, prepared by MidAtlantic Waste Consultants, being the largest litter study in the USA. The work focused on:

- Statistically representative and defensible estimates of the quantity and characterisation of visible litter on USA roadways;
- Detailed investigation into the quantity and characterisation of visible litter on selected non-roadway sites; and
- National estimates of the direct and indirect cost of litter abatement expended by USA municipalities, institutions, residents, and businesses.

For the litter survey part of the study the authors visited a randomised, representative sample of USA roadways, acquiring 243 samples and 180 non-roadway samples. The latter were selected opportunistically and included construction sites, loading docks, storm drains, recreational and shopping areas as well as transition points. The study detected a decrease in litter along highways from 1961 to 2009 and identified tobacco products as the most prevalent aggregate litter item, comprising roughly 38% of all litter. Fast food packing, snack packaging, and other packaging items comprised 41% of litter 10cm or greater in size while plastic litter, including beverage containers, had increased significantly.

2.7.1 Direct costs

To investigate the estimated direct costs of litter borne by a wide range of public and private entities, the project utilised a series of surveys of national databases of governments, institutions, and businesses. After stratifying the identified entities to account for population size, 412 entities were surveyed over the phone

[5] www.kab.org

to provide direct cost information. Large companies employing more than 1,000 people were unrepresented as those contacted did not provide meaningful information.

Annual direct litter clean-up costs were estimated at over US$11.5 billion for the whole of the USA (Table 5). Businesses were found to be footing the bulk of this by spending US$9.1 billion for litter management. Government agencies including councils were the second biggest contributor spending as much as US$1.3 billion on litter abatement. The report concluded that in government agencies, litter cleaning is often a hidden cost within employee expenses or other projects, which makes it difficult to determine the actual cost.

Table 5 Direct cost of litter clean up in the USA

Entity type	Cost (million US$)
State governments	$363
Counties	$185
Municipalities	$797
Educational	$240
NGOs	769
Businesses	$9,128
Total	**US$11,482**

2.7.2 Indirect costs

The indirect litter costs surveys reflected less statistically rigorous questioning of 30 entities. Large companies were not represented.

In contrast to the Eunomia work, this study did not seek to quantify the costs in terms of lost revenue or monetary cost to society. Instead it surveyed homeowners, realtors and business development officials to assess the perceived damaged caused by litter to the value of real estate, the decision of an employer to locate in a community, and whether litter deters customers from entering a business.

2.8 Green Cities California, 2010. White Paper on the Methodology for Analysing the Cost of Litter Clean-up Efforts

The Green Cities California White Paper was prepared to assist local and state policymakers in California to identify appropriate methodologies to use when conducting litter clean-up cost assessments (as well as costs associated with these) in order to inform local and state governments about the true impact of improper disposal of waste, including littering.

Plastic bags and their contribution to littering and associated management costs were a second focal point of the work. The report outlined a variety of litter cost assessment approaches depending on available funds and time. Simple assessments based on scaling available national state, or other regional data were proposed as a solution for governments without sufficient funds to develop complete bottom-up analyses. Other methods such as field surveys involving full litter characterisation can increase costs but will generate better data (Figure 4). The white paper provides useful information for informing the development of litter assessment studies and can be used to inform a future NSW project.

Figure 4 Overview of methodologies that can be used for estimating the cost of litter management

2.9 Summary

A number of different methods for collecting litter information and cost related data have been employed by past studies. Surveys targeting councils, NGOs and other entities involved in litter management are commonly used to collate cost related information. However, different survey methods and tools have been employed by different studies.

Common survey methods include telephone surveys, electronic surveys and in-person surveys while literature reviews often relied on data from other jurisdictions that could not be accurately applied to the study area. A common method for improving relevancy was to combine previous databases with additional consultations and the survey in question.

3. Litter survey methodology

To obtain data on the costs of litter management across NSW, MRA conducted a litter cost study. MRA surveyed a range of stakeholders on the costs of litter management to their organisation in 2014/2015.

3.1 Identification of stakeholder groups and stakeholders

Stakeholders relevant to the study were categorised into the following stakeholder groups:

1. Local Government agencies (councils);
2. Community organisations;
3. State Government agencies; and
4. Private business.

All stakeholders operated within NSW. Although some also operated beyond NSW, data was only collected in relation to NSW litter activities. The stakeholder groups are listed above in the order of data quantity and expected data quality.

3.2 Survey development

MRA drafted a tailored survey for each stakeholder group. Survey Monkey® was used to prepare and distribute the surveys in consultation with NSW EPA. The surveys are provided in full in the appendices below.

- Appendix A: Survey design for Local Government agencies (councils)
- Appendix B: Survey design for community organisations
- Appendix C: Survey design for State Government agencies
- Appendix D: Survey design for private businesses

Where possible, the type and quantity of data accepted by each survey question was restricted. These design features assisted to streamline the data collection and verification stages. Open-ended questions were provided at the conclusion of the survey to allow respondents to provide additional information as needed.

The surveys comprised a mix of compulsory and optional questions, recognising that the quantity and type of data provided by each stakeholder was likely to vary significantly.

3.3 Survey distribution, support and verification

All survey respondents were offered telephone support and the option of providing MRA with raw data, which MRA offered to analyse and interpret in order to complete the survey on behalf of respondents. State agencies were also offered the option of a face-to-face meeting to discuss the survey and the data available to them.

Despite the constraints of the survey (see Section 4), MRA received responses from all four stakeholder groups. For all survey respondents who provided completed responses (many respondents provided incomplete responses, completing only their contact details), MRA contacted the respondent directly to discuss and verify the data. This process proved to be vital for improving data quality. Through discussions, the data and survey questions were clarified and survey responses were modified – in some instances significantly.

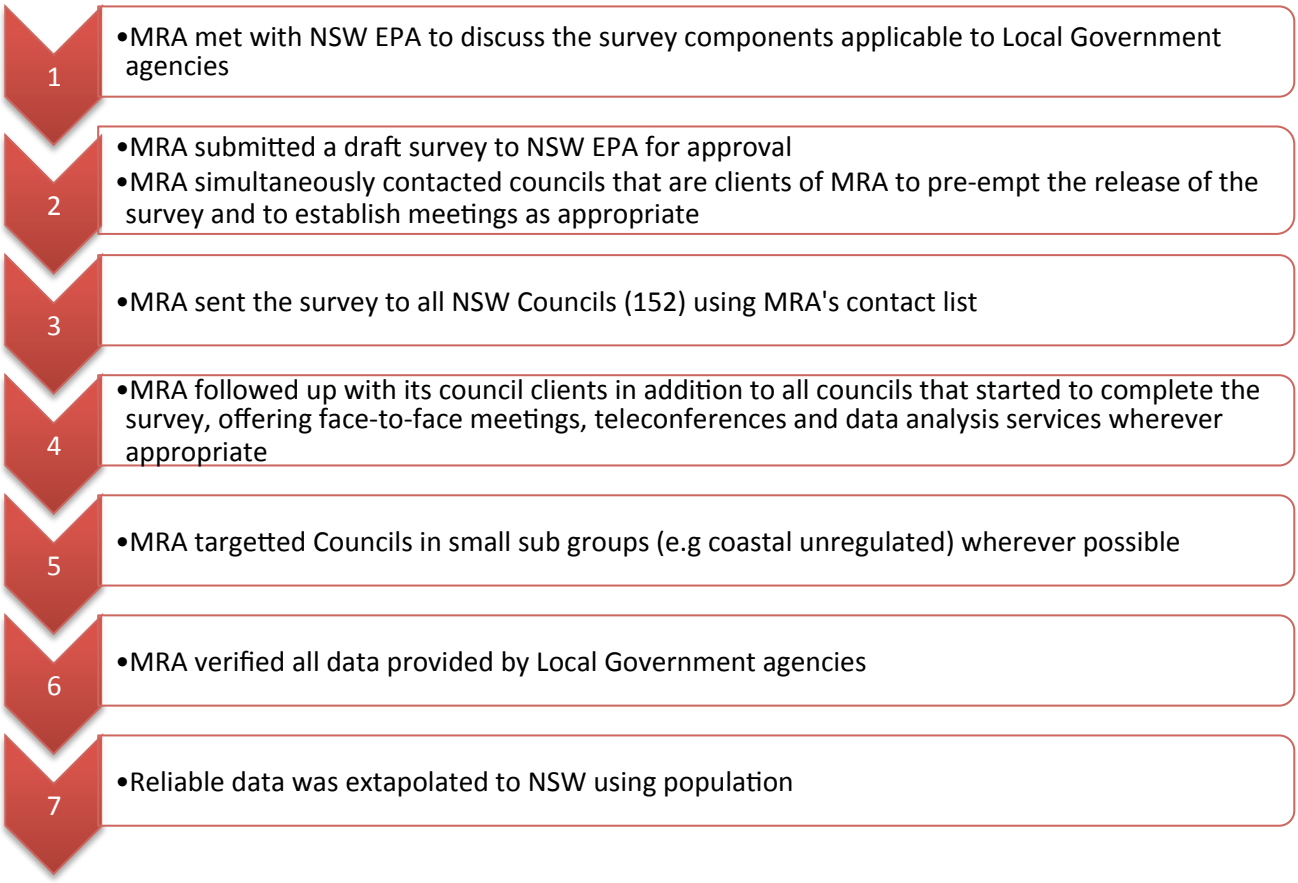
The verification process also proved to be an important way to identify survey responses that were not sufficiently reliable for inclusion in the final analysis. Responses that contained inaccurate data, did not provide relevant information, or were largely incomplete were discarded.

3.3.1 Local government agencies (councils)

Local government agencies' litter management costs are considerable, given councils' roles as the primary agencies responsible for the delivery of residential waste management services and the cleanliness of public spaces in townships.

MRA employed a tailored process when engaging with local government agencies (councils) (Figure 5).

Figure 5 Local government agency (councils) survey methodology



Only one local government agency took up the offer of a face-to-face meeting. This seemed to be a very helpful process and provided the opportunity for a range of council representatives to meet and ask questions to clarify the task at hand. The pro-activeness witnessed by this council can be partly linked to the council's interest in CDL and its advocacy for the introduction of a CDS in NSW.

MRA's council clients were followed up directly and offered further support compiling their data and responding to the survey. For all other councils in unique regions or that had submitted complete or partially complete surveys (more than just basic contact details) were contacted directly to offer assistance. MRA worked carefully to ensure that local government agencies from each of the following regions were targeted:

- Coastal: regulated;
- Coastal: unregulated;
- Non-coastal: regulated; and
- Non-coastal: unregulated.

MRA identified a number of hurdles to obtaining complete and reliable data during this process; these are discussed below in Section 4.

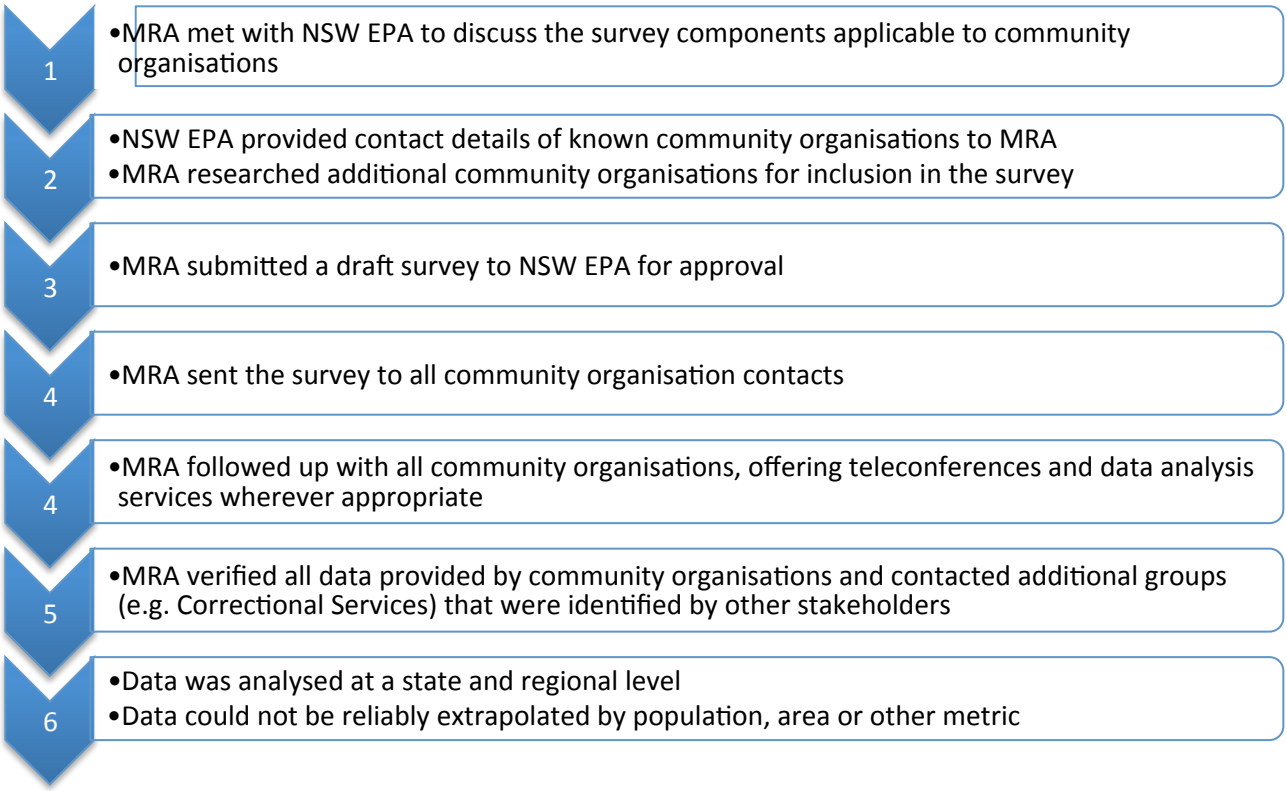
Ultimately, 21 councils provided complete responses. All of these 21 councils were contacted by telephone, and often with follow up emails, in order to verify the data provided. Ultimately, **MRA was able to rely on 18 council responses**.

3.3.2 Community organisations

Nine community groups that play a significant role in litter management in NSW were identified in consultation with NSW EPA. These included national organisations with a NSW branch or chapter. Where applicable, surveys were sent to both head offices and regional groups or chapters to improve the chances of data being provided.

MRA employed a tailored process when engaging with community organisations (Figure 6).

Figure 6 Community organisation survey methodology



Ultimately, reliable data was collected and analysed from **six community groups**. This included Clean Up Australia Day (CUAD), Keep NSW Beautiful and Tangaroa Blue Foundation, each of which capture data from a broad range of smaller community groups and activities.

Community groups were the most responsive and enthusiastic survey respondents. They also appeared to have relevant data at hand, facilitating a simple and effective verification process.

An important part of the community group survey and verification process was identifying and taking steps to avoid the possibility of double-counting data. CUAD manages comprehensive data for all registered CUAD events. During the verification process, MRA excluded or amended volunteer data from some smaller community groups, as well as local and State Government agencies, in order to exclude data that was already captured within the CUAD data set.

The community consultation process also revealed that there are likely a very significant number of community groups that contribute *some* time and resources to litter management each year, but most likely only through participation in formal activities such as CUAD and Keep NSW Beautiful Day. This meant that collecting data through CUAD and Keep NSW Beautiful was the best way to obtain comprehensive

State-wide data. However, conversations with these groups revealed that smaller community groups that record CUAD and/or Keep NSW Beautiful activities likely have members engaging in ad-hoc litter activities throughout the year. These are individually so minor and/or informal that they are not reported or recorded. The information obtained is therefore considered to be conservative.

The community group survey also revealed another significant player in litter management: Corrective Services NSW. A number of groups reported that volunteer hours were conducted by Corrective Service teams. MRA contacted and worked closely with Corrective Services to request:

- Total hours spent by people through the Corrective Services Community Service program; and
- Total hours spent, and associated labour costs, of Corrective Services staff that manage and supervise this program.

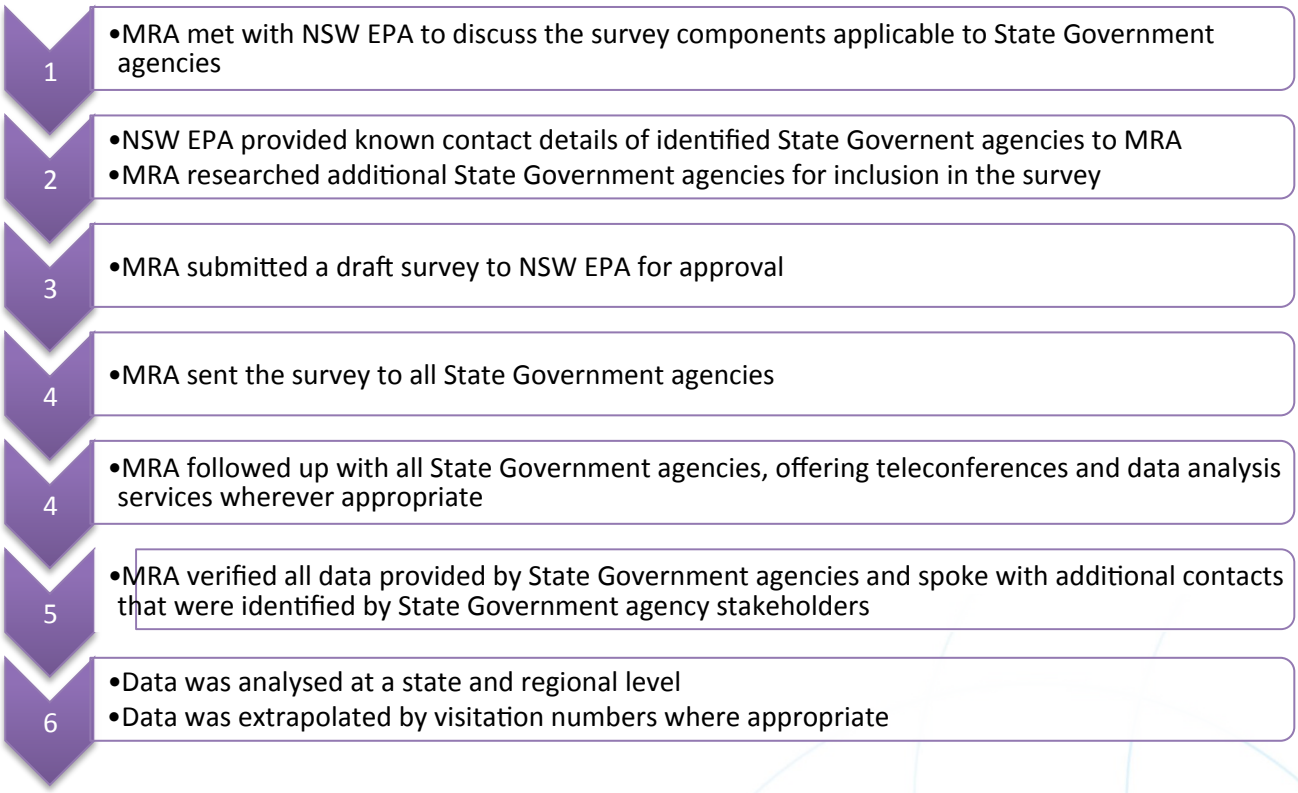
Unfortunately, at the date of this report, the release of this data was still subject to internal approval processes at Corrective Services and could not be included in the analysis.

3.3.3 State Government agencies

Fourteen State Government agencies were identified for receipt of the survey. Difficulties faced obtaining results were similar to those faced by local government agency respondents (timeframe, data availability etc.) (see section 4 for more information).

MRA employed a tailored process when engaging with State Government agencies (Figure 7).

Figure 7 State Government agency survey methodology



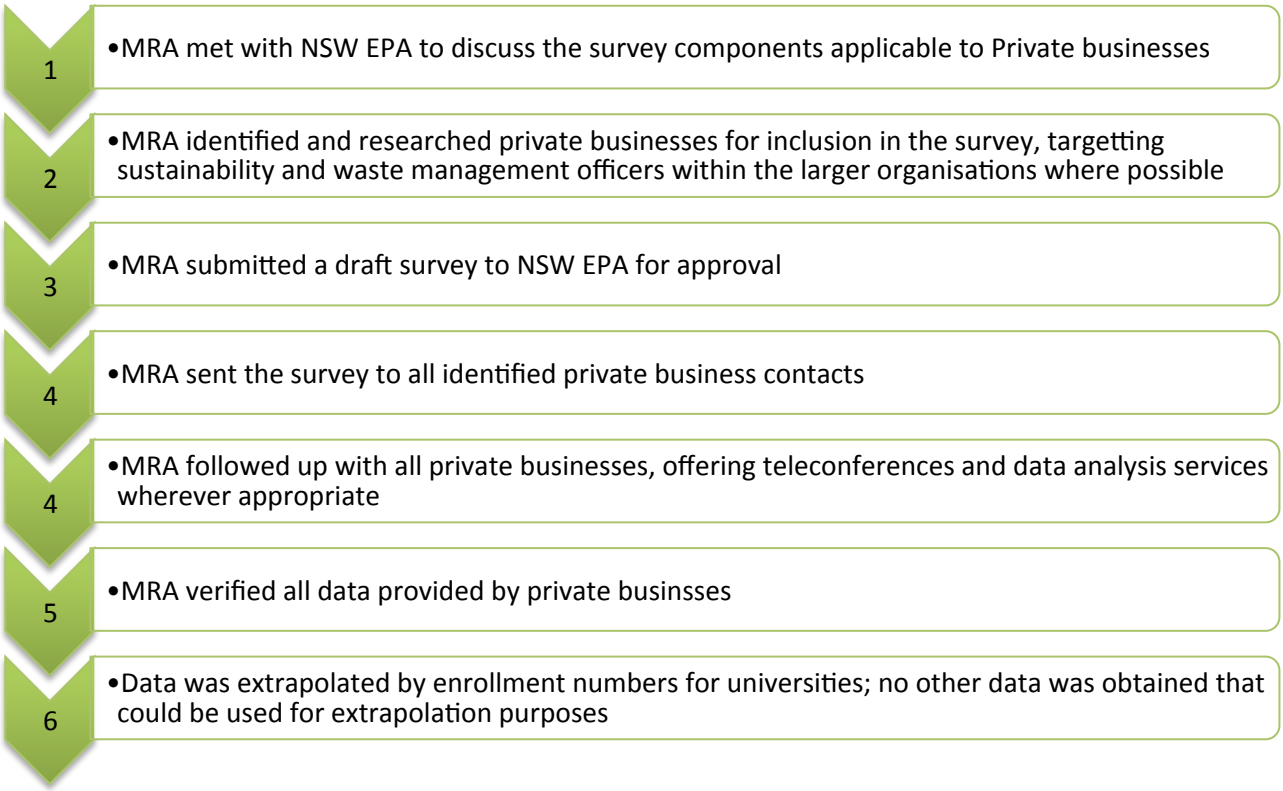
Ultimately, MRA collected and verified data from **six stakeholders across four agencies.**

One of the agencies is the National Parks and Wildlife Service. Within this group, MRA received seven completed surveys, three of which contained data that was reliable enough to be included for analysis.

3.3.4 Private business survey

Private business proved to be the most difficult stakeholder group to obtain reliable data from, mirroring the experience of international studies identified in the literature review. In total, MRA approached 17 private businesses including the major universities located in Sydney, a number of shopping centre operators and major national supermarkets. Business sectors were identified initially based on assumed level of activity in relation to litter.

Figure 8 Private business survey methodology



Two organisations formally declined to participate – one because they did not manage waste and the other due to time constraints. Many did not respond to calls or emails and did not respond to the survey.

In total, **three private business respondents** could be used in the analysis, all of which were universities.

MRA encountered difficulty identifying and engaging with the appropriate contacts within businesses. At least one respondent mentioned commercial in confidence concerns with providing data. MRA expects that this, combined with the short timeframe and limited incentive to respond, contributed to the lack of data obtained from stakeholders in this group. Private businesses area also less likely to take a formal position on CDL when their core business operations are not waste orientated.

3.3.5 Was the data reflective of a 'representative' year?

The process of collecting data for a particular year carries with it the risk of capturing anomalous or unusual cost items, thereby creating inaccuracies in attempts to extrapolate or generalise the data.

During the data collection and verification process, discussions with respondents served to minimise the risk of capturing such anomalies by requesting average expenses and seeking additional information when large or small costs were noted. The risk of any large-scale anomalies present in the 2014/2015FY data set is therefore believed to be minimal.

MRA is also unaware of any significant events or incidences during the 2014/2015FY that would or could significantly impact overall litter expense calculations. Examples of events or incidents that might result in an anomaly include:

- NSW hosting the Olympic Games or other similar-scale events that warrant improved visual amenity; or
- Large-scale natural disasters that may have required a significant clean-up effort by a range of organisations.

In order to be certain, the following questions were asked of the respondents after data was verified:

1. Was the data you provided for litter management costs in the 2014/2015FY representative of a typical year for your organisation?
2. If the data you provided was not specific to 2014/2015, but simply represented an average annual cost estimate, please confirm this.
3. If the data was specific to 2014/15 but was not representative of a typical year, please briefly note any unusual increases or decreases in cost that were captured in your data.

In doing so, MRA also offered all respondents the opportunity to discuss this question by telephone.

Of the 33 respondents across all stakeholders, 28 provided responses to these questions in the time allowed. The results are summarised in Table 6 below. The only anomaly identified across the respondents was funding obtained from NSW EPA for litter grants (which was unique to 2014/15 and therefore not representative of a typical year's litter costs). This was applicable to three Local Government agencies. As this data was captured separately in the survey and was excluded from the analysis, it has no bearing on this study's findings.

The results indicate that the data obtained and extrapolated for 2014/2015 is a fair representation of the annual costs of litter management to the NSW economy.

Table 6 Additional verification process

Stakeholder group	Survey respondents	Respondents to verification questions	Number that provided 2014/15 data	Confirmation that 2014/15 was a typical year	Number that provided average annual data
Local Government agencies	18	15	10	8	5
Community organisations	6	6	3	3	3
State Government agencies	6	5	3	3	2
Private Business	3	2	2	2	1
TOTAL	**33**	**28**	**18**	**16**	**11**

4. Data constraints and qualifications

Three common constraints were cited by stakeholders that were engaged in the study to obtain preliminary cost information:

- **Timeframe:** Due to the strict timeframes specified in the brief, respondents were initially given only a few days to complete the surveys. Virtually all respondents made note that the short timeframe made it difficult to provide reliable data.
- **Timing:** The surveys were distributed during school holidays. Many of the staff members operating across all of the stakeholder groups (particularly Local Government and State Government agencies) who had access to the relevant data were on leave or reported that they were struggling to find time to collect data due to absentee colleagues.
- **Relevant data:** Many respondents advised that they did not collect any relevant data; and/or did not collect data in the form specified in the surveys. This had a range of consequences, including:
    - Respondents required significant support and guidance in terms of how to identify and capture data that could be used for the purposes of the study. With a longer time frame, more intensive support and a staged data-collection process, this would have been feasible.
    - Much of the data involved cost estimations, with councils extracting costs and labour time attributable to litter from broader data sets.
    - Many respondents indicated a reluctance to provide estimates, preferring to not provide data rather than to provide potentially inaccurate data.
    - Many agencies use waste service providers to manage all or some waste and recycling streams. Since private contractors were often reported as being engaged to conduct a range of activities, respondents found it difficult to provide the specific data sought for litter, as it was incorporated into much broader fee structures.

In addition to the above, each of the stakeholder groups cited unique constraints; and qualifications these are described in the following sections.

4.1 Local government agencies (councils)

The following constraints and qualifications are relevant to the data provided by local government agencies and the consequent analysis of the data for the preliminary report:

- The data was typically spread across multiple internal departments and the quality of data collection was highly variable. This made it difficult for a significant number of councils to respond to all questions with complete answers.
- Some council responses were incomplete. In those instances, only the questions for which data was provided and verified were included in the analysis.
- In NSW there are only two councils (i.e. 1.3% of all NSW councils) that fall within the category of Coastal Unregulated (Eurobodalla Shire Council and Bega Valley Shire Council). For this reason, MRA attempted to work closely with both of these councils to obtain data for this council subset. Due to the restraints listed previously, data was not received in time from either of the two councils for inclusion. The average cost of litter management per person for Coastal Regulated councils was applied to this small subset for extrapolation purposes.
- There are several outliers in the data given the range in the cost per person reported by councils. All efforts were made to verify the data. Due to the small sample size, these outlying council results remain within the analysis.
- The vast majority of data provided should be considered as estimations. Also, metrics and units varied from council to council, requiring normalisation and additional analysis from MRA.

- The values observed across regions demonstrate a noticeable difference in the net cost per person for Coastal Regulated ($20.63) and Non-Coastal Unregulated ($27.17) on the one hand, and Non-Coastal Regulated ($11.94) on the other hand. These results warrant additional investigation.

Many councils were supportive of the survey and committed to sending information through in the coming weeks. MRA expects additional councils would provide data in the future if given both adequate time and support.

4.2 Community organisations

The following constraints and qualifications are relevant to the data provided by community organisations and the consequent analysis of the data for the preliminary report:

- The community sector is divided into two organisation types: large scale (NSW wide) and small scale (local/regional community groups).
- The large-scale organisations had readily available data, capture a wide range of litter management activities, and were willing to participate in the survey.
- The local groups tended to have less (or no) reliable data, as litter was not necessarily the primary focus of the organisation, data was difficult to quantify and/or the "catchment area" of litter activities was difficult to define.
- The primary organisation that is missing from the data is Corrective Services. During the course of the survey, it came to MRA's attention that a Corrective Services Community Service program provides labour for litter management purposes to a significant number of Local Government agencies and community organisations. Corrective Services indicated a willingness to participate in the survey but ws unable to provide data within the time frame specified for the purpose of this preliminary report.
- Data from several of the small-scale community organisations was captured within the larger organisations' data sets. Once this overlap was identified, data from such small-scale organisations was excluded.

Data from the small-scale community organisations could not be extrapolated to the state level by area or volunteer numbers, as the catchment areas and frequency of collection is not consistent across NSW. The survey totals have therefore been provided as the total results for NSW.

4.3 State Government agencies

The following constraints and qualifications are relevant to the data provided by State Government agencies and the consequent analysis of the data for the preliminary report:

- Data provided by the National Parks and Wildlife Service was extrapolated based on visitation numbers for known National Parks. When data was received for multiple sites within a single region and visitation data was unavailable for all sites, park areas were used to approximate the contribution per visitor per park.
- For individual National Parks for which cost data was provided but visitation numbers were unavailable, the data was excluded from extrapolation calculations.
- The key State Government agencies that were unable to complete the survey during the time frame provided or who could not be contacted included: Crown Lands (DPI - Lands), Transport NSW, Sydney Harbour Foreshore Authority, Sydney Water, Catchment Management Authorities, NSW Health, Centennial and Moore Park Trust, Zoological Parks Board and Ministry of Health. These individual stakeholders comprise the subgroups identified in the analysis.
- Wherever possible, multiple divisions within these organisations were contacted in an effort to obtain data.

The costs incurred by other State Government agencies are likely to be significant and should not be excluded from the CBA.

4.4 Private business

The following constraints and qualifications are relevant to the data provided by private businesses and the consequent analysis of the data:

- Despite the significant costs associated with litter management in the private sector, only three universities were able to respond to the survey within the timeframe allowed. This value was used to estimate the cost of litter management to the university sector.
- Identifying the correct contact in each organisation was challenging.
- The costs of litter management were typically embedded in contractor costs, which were charged to various divisions within each private business.
- Private companies were more reluctant to provide data without clear protection of confidentiality given the commercially sensitive nature of the information requested.

The results of the preliminary study are very conservative for private businesses.

The above constraints and qualifications will be considered by MRA in the design of the secondary stage of this study.

5. Results summary

After the data verification phase (before the final verification email process described in section 3.3.5), each of the survey respondents were categorised into a sub group, to facilitate extrapolation of quantitative data (if possible) across NSW.

5.1 Survey analysis

The survey results, comprising 33 verified survey responses (across the four stakeholder groups) show a net cost to the respondents of more than $38.5m in 2014/2015 (Table 7).

Table 7 Survey results for 2014/2015

Stakeholder group	Sub group	Number of verified survey responses	Net cost ($)
Local Government agencies (councils)	Coastal: Regulated	5	$8,321,100
	Coastal: Unregulated	0	Unknown
	Non Coastal: Regulated	3	$4,425,492
	Non Coastal: Unregulated	10	$2,819,364
	Sub total	18	$15,565,956
Community organisations	Local Community Organisation	4	$1,028,844
	State-wide Organisation	2	$16,793,118
	Sub total	6	$17,821,962
State Government agencies	Crown Lands	0	Unknown
	Health	0	Unknown
	National Parks	3	$552,859
	Other	0	Unknown
	Parks (e.g. Centennial Park)	0	Unknown
	Recreational Infrastructure (e.g. Sydney Olympic Park Authority)	1	$603,642
	State Forests	1	$88,960
	Transport Infrastructure (e.g. RMS)	1	$2,889,960
	Utility Infrastructure (e.g. Sydney Water)	0	Unknown
	Sub total	6	$4,135,421
Private businesses	Food Franchises	0	Unknown
	Office Blocks	0	Unknown
	Parking Lots	0	Unknown
	Private Transport Infrastructure	0	Unknown
	Shopping Centres	0	Unknown
	Stadiums	0	Unknown
	Supermarkets	0	Unknown
	Universities	3	$1,018,134
	Warehouses	0	Unknown
	Sub total	3	$1,018,134
All	Total	33	$38,541,472

5.2 Extrapolation analysis

The data obtained for all local government sub groups, in addition to National Parks and Universities was extrapolated to the State, as a robust method of extrapolation could be justified in these cases. For all other sub groups, survey totals were used. The results indicate that litter management is a net cost to the NSW economy of more than $162.2m per annum (Table 8).

The results are very conservative, as they do not seek to estimate the cost of the sub groups for which data was not provided (e.g. private businesses: supermarkets), or for sub groups that robust extrapolation methods could not be derived for (e.g. community organisations).

Of the data extrapolated, local government agencies bear the largest cost of litter management, at approximately $134.3m or 83% of the total litter management costs estimated for the State. Community organisations are the second largest contributor, with an estimated cost (when volunteer time is valued at $30/hour (Greater Sydney Local Land Services, 2015) of $17.8m or 11% of total litter management costs.

Table 8 Extrapolated results to NSW for 2014/2015

Stakeholder group	Sub group	Extrapolation/method		Net cost ($)
Local Government agencies (councils)	Coastal: Regulated	Y	Population	$73,194,524
	Coastal: Unregulated	Y	Population - Coastal Regulated	$1,466,665
	Non Coastal: Regulated	Y	Population	$35,479,397
	Non Coastal: Unregulated	Y	Population	$25,127,942
			Sub total	$135,268,528
Community organisations	Local Community Organisation	N	No method; totals used	$1,028,844
	State-wide Organisation	N	No method; totals used	$16,793,118
			Sub total	$17,821,962
State Government agencies	Crown Lands	N	Insufficient data	Unknown
	Health	N	Insufficient data	Unknown
	National Parks	Y	Visitation	$3,389,995
	Other	N	Insufficient data	Unknown
	Parks (e.g. Centennial Park)	N	Insufficient data	Unknown
	Recreational Infrastructure (e.g. Sydney Olympic Park Authority)	N	No method; totals used	$603,642
	State Forests	N	No method; totals used	$88,960
	Transport Infrastructure (e.g. RMS)	N	No method; totals used	$2,889,960
	Utility Infrastructure (e.g. Sydney Water)	N	Insufficient data	Unknown
			Sub total	$6,972,557
Private businesses	Food Franchises	N	Stores	Unknown
	Office Blocks	N	Tenants	Unknown
	Parking Lots	N	Area	Unknown
	Private Transport Infrastructure	N	Area	Unknown
	Shopping Centres	N	Shoppers	Unknown
	Stadiums	N	Events; attendees	Unknown
	Supermarkets	N	Shoppers	Unknown
	Universities	Y	Enrolments	$2,609,453
	Warehouses	N	Employees	Unknown
			Sub total	$2,609,453
All			Total	$162,672,500

5.3 Statistical Analysis

MRA understands that NSW EPA wishes to obtain statistically robust data for the purpose of inclusion in the CBA. All efforts were taken to improve the reliability of the data obtained in the survey.

5.3.1 Local Government agencies (councils)

The key metric for data obtained from Local Government agencies is the net cost of litter management per person. This is listed for each verified council response (Table 9). The responses are grouped by their corresponding sub group.

Using this information, it is possible to calculate the confidence interval for the entire Local Government agency stakeholder group (Note: State and regional analyses have both been provided). The results show that there is a 95% chance that the net cost of litter management per person borne by Local Government agencies is between $10.47 and $24.99 per person (Table 9). This equates to a cost between $78m and $187 to all Local Government agencies (councils).

More detailed analysis at the sub group level shows a similar result, with a total cost estimate between $72m and $198m (Table 10).

As the sample size is small in both analyses, the confidence interval is large. In order to improve the quality of the data, additional survey responses would be required to increase the sample size and reduce the confidence interval.

Table 9 Local Government agency data results for NSW (net cost per person)

Region	Response	Net cost per person $	Sample size N	Weighted Mean x*	Weighed Standard Deviation σ	Desired confidence level %	Confidence interval $	True population mean (lower) $	True population mean (upper) $	Total cost to Local Government agencies (lower) $	Total cost to Local Government agencies (upper) $
Coastal: Regulated	Council 5	$19.33	18	$17.73	$15.40	95%	±$7.26	$10.47	$24.99	$78,705,121	$187,845,082
Coastal: Regulated	Council 6	$21.09									
Coastal: Regulated	Council 13	$1.02									
Coastal: Regulated	Council 14	$20.33									
Coastal: Regulated	Council 18	$29.95									
Non Coastal: Regulated	Council 11	$6.72									
Non Coastal: Regulated	Council 12	$16.85									
Non Coastal: Regulated	Council 17	$10.88									
Non Coastal: Unregulated	Council 1	$6.87									
Non Coastal: Unregulated	Council 2	$48.64									
Non Coastal: Unregulated	Council 3	$121.58									
Non Coastal: Unregulated	Council 4	$201.49									
Non Coastal: Unregulated	Council 7	$64.76									
Non Coastal: Unregulated	Council 8	$43.29									
Non Coastal: Unregulated	Council 9	$17.38									
Non Coastal: Unregulated	Council 10	$1.45									
Non Coastal: Unregulated	Council 15	$20.28									
Non Coastal: Unregulated	Council 16	$23.09									

Table 10 Local Government agency data results by region (net cost per person)

Region	Response	Net cost per person	Sample size	Weighted Mean	Weighed Standard Deviation	Desired confidence level	Confidence interval	True population mean (lower)	True population mean (upper)	Total cost to Local Government agencies (lower)	Total cost to Local Government agencies (upper)
		$	N	x*	σ	%	$	$	$	$	$
Coastal: Regulated	Council 5	$19.33	5	$20.63	$7.32	95%	±$6.54	$14.08	$27.17	$50,972,615	$98,349,763
	Council 6	$21.09									
	Council 13	$1.02									
	Council 14	$20.33									
	Council 18	$29.95									
Non Coastal: Regulated	Council 11	$6.72	3	$11.94	$4.57	95%	±$5.28	$6.66	$17.22	$19,785,053	$51,173,741
	Council 12	$16.85									
	Council 17	$10.88									
Non Coastal: Unregulated	Council 1	$6.87	10	$27.17	$40.58	95%	±$25.66	$1.50	$52.83	$1,388,930	$48,866,954
	Council 2	$48.64									
	Council 3	$121.58									
	Council 4	$201.49									
	Council 7	$64.76									
	Council 8	$43.29									
	Council 9	$17.38									
	Council 10	$1.45									
	Council 15	$20.28									
	Council 16	$23.09									
	Total		18	-	-	-	-	-	-	$72,146,598	$198,390,459

5.3.2 Other stakeholder groups

The sample sizes for the remaining stakeholders were small in comparison to the Local Government agencies. In addition, it is more difficult to extrapolate the data obtained from the other stakeholder groups to the State.

For these reasons, it is not possible to perform an informative statistical analysis for all other day. The results are therefore a conservative estimate, based predominantly on the totals provided in the survey.

6. Recommendations

MRA suggests the following methods to maximise data collection and improve data quality for the design of the secondary stage of this study, and/or any future litter cost surveys.

1. **Allow sufficient time for the survey**

   A significant number of respondents indicated that lack of time to complete the survey was a barrier to participation. Many indicated that multiple people needed to be consulted, data needed to be extracted, and then results compiled in order to complete the survey. MRA believes that, given the complexities involved for many respondents and the limited resources available to dedicate to this task, four to six months (with scope for regular follow-ups and the options of face-to-face and telephone support) would enable greater data collection.

2. **Allow additional face-to-face discussions**

   The survey design allowed for a "hands on" approach to the survey in the sense that all local government agency participants were offered face-to-face meetings to assist with survey completion. However, only one respondent took up this opportunity. MRA considers this to be at least in part due to the tight time frames and pressures faced by the respondents. Given that the face-to-face meeting that took place was useful and resulted in data that was reliable and comprehensive, it is recommended that steps be taken to encourage this in the future (and time be allowed to make it more feasible).

3. **Sign confidentiality agreements with private businesses**

   At least one private business cited commercial in confidence restrictions when asked to provide data. MRA considers it likely that this would be a relevant factor for many private businesses. Additional time would also assist, as requests to release confidential information can take time to clear through relevant management channels.

4. **Provide a clearer incentive to stakeholders**

   Unless a stakeholder actively supported CDL, valued improved amenity and native habitats or was acutely aware of the impact that litter had on its organisation's' profit margins, they saw limited incentive to participate in the program. This was particularly true for State Government agencies and private businesses. Additional education or an incentive plan could improve the response rates of these stakeholder groups.

5. **Refine the survey design to better reflect data recorded by stakeholders**

   Many respondents indicated that the questions in the survey did not align closely with the format of their collected data. It may be possible, given more time, to design a more comprehensive survey that better reflects data that is readily available, or provide multiple means by which to enter the same data. This would in turn improve the reliability of data (reducing the need for estimates) as well as likely improve response rates.

   The findings of this study can inform future survey development. However, including additional questions in the survey may result in stakeholders being unwilling to participate, given the additional time that is perceived to be required. These trade offs much be balanced to achieve an optimum solution.

6. **Provide more guidance to respondents**

   In addition to a face-to-face meetings and teleconferences, respondents could also be provided with a guidance sheet or tool to assist in data identification and extraction. It may identify the likely

location of data, its form and methods to extract it and provide definitions for litter versus illegal dumping. Multiple respondents, as well as survey recipients who ultimately did not provide data, indicated they were reluctant to provide data unless they clearly understood that they were looking in the right places and extracting it appropriately.

7. **Replicate the survey**

   A more robust method to check if the data obtained for 2014/2015 is representative of an average year is to replicate the survey annually. This will provide additional data and stakeholders will become more familiar with the survey requirements and expectations.

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Appendix A Survey design for Local Government agencies (councils)

2014/2015 NSW EPA Council Litter Cost Survey

1. Survey Introduction

The NSW Government has committed to introducing a container deposit scheme in NSW by July 2017. The NSW Environment Protection Authority (EPA) is leading this work. As part of this, the EPA needs to understand the impact that container deposit schemes may have on the total effort and costs spent on litter management by key sectors in NSW. To date, only national estimates have been available.

MRA Consulting Group (MRA) has been engaged by the NSW EPA to survey, analyse and report on the costs of litter management in local government, community groups, state agencies and parts of the private sector for **2014/2015**.

This survey is a vital part of finding out how much litter costs the NSW community, and of then understanding the potential impact of a container deposit scheme. Your organisation's response to the survey is therefore an important contribution to the development of a container deposit scheme in NSW.

Thank you for taking the time to complete the survey. Should you have any questions regarding the survey, please do not hesitate to contact Roslyn Florie-George from MRA on 0447 803 955 or roslyn@mraconsulting.com.au.

2014/2015 NSW EPA Council Litter Cost Survey

2. Council Information

*** 1. Which NSW council do you represent?**

*** 2. What are your contact details?**

Name:

Email Address:

Phone Number:

3. Which department/area/s of council has/have prime responsibility for litter management and education?

2014/2015 NSW EPA Council Litter Cost Survey

3. 2014/2015 Council Costs

*** 4. What were Council's weighted average LABOUR COSTS ($/hour) for managing litter?**

Weighted average labour cost ($/hour):

*** 5. What were Council's LABOUR TIME (hours per annum) for managing litter?**

Litter infrastructure (e.g. installation of bins, maintenance of bins/signs/streetsweepers, landscaping to reduce litter):

Litter collection / clean-up costs (e.g. parks, roads, public place clean-up, streetsweeping, gross pollutant traps):

Litter disposal costs (e.g. truck drivers, landfill staff):

Litter enforcement activities (e.g. issuing fines, litter patrols, community engagement, admin support):

Litter education and community engagement (e.g. social media management, creative design, education programs):

*** 6. What were Council's EXPENSE COSTS ($) for managing litter?**

Litter infrastructure (e.g. signage, purchase of bins and landscaping materials):

Litter collection / clean-up costs (e.g. gloves, litter grabbers, other PPE, streetsweeping):

Litter disposal costs (e.g. gate fees at disposal facility):

Litter enforcement activities (e.g. stationery, vehicle use):

Litter education and community engagement (e.g. flyers, advertisements):

*** 7. Did Council receive any REVENUE from litter fines?**

- ◯ Yes (please complete Question 8 below)
- ◯ No
- ◯ Unsure

8. If you answered "Yes" to Question 7, how much REVENUE ($) did Council receive from litter fines?

Revenue ($):

*** 9. Did Council receive an EPA Litter Grant or use Better Waste and Recycling funds for litter management in 2014/2015?**

- ◯ Yes (please complete Question 10)
- ◯ No
- ◯ Unsure

10. If you answered "Yes" to Question 9, how much funding did Council receive/use for litter management?

Funding ($):

11. What FINANCIAL ($) assistance did you give to other organisations to manage litter?

Landfill gate fee exemptions, collection exemptions ($):

Litter collection equipment PPE, bags etc ($):

Other ($):

12. What LABOUR (hr) assistance did you give to other organisations to manage litter?

Staff time (hour):

Other labour (hour):

Value of labour ($/hour - if different to weighted average labour costs provided previously):

13. Where does funding for Council's litter management come from (as a %)?

Residential rates (%):

Domestic waste management charge (%):

Business rates (%):

Fine revenue (%):

Other (%):

*** 14. Did Council record how much litter was collected?**

- ◯ Yes (please complete Question 15 below)
- ◯ No
- ◯ Unsure

15. If you answered "Yes" to Question 14, how much litter did Council collect?

Amount:

Unit (bag size, count, weight, other):

16. Is there any other information regarding Council's litter management efforts that has not been addressed in the questions above?

Appendix B Survey design for community organisations

2014/2015 NSW EPA Community Organisation Litter Cost Survey

1. Survey Introduction

The NSW Government has committed to introducing a container deposit scheme in NSW by July 2017. The NSW Environment Protection Authority (EPA) is leading this work. As part of this, the EPA needs to understand the impact that container deposit schemes may have on the total effort and costs spent on litter management by key sectors in NSW. To date, only national estimates have been available.

MRA Consulting Group (MRA) has been engaged by the NSW EPA to survey, analyse and report on the costs of litter management in local government, community groups, state agencies and parts of the private sector for **2014/2015**.

This survey is a vital part of finding out how much litter costs the NSW community, and of then understanding the potential impact of a container deposit scheme. Your organisation's response to the survey is therefore an important contribution to the development of a container deposit scheme in NSW.

Thank you for taking the time to complete the survey. Should you have any questions regarding the survey, please do not hesitate to contact Roslyn Florie-George from MRA on 0447 803 955 or roslyn@mraconsulting.com.au.

2014/2015 NSW EPA Community Organisation Litter Cost Survey

2. General Information

*** 1. Which community organisation do you represent?**

*** 2. What are your contact details?**

Name:

Title:

Email Address:

Phone Number:

*** 3. What type of community organisation do you represent?**

- [ ] Volunteer
- [ ] Paid employment
- [ ] Both
- [ ] Other

Please specify

*** 4. What role/s does your community organisation play in managing litter?**

- [ ] Litter collection / clean up
- [ ] Litter education
- [ ] Litter enforcement
- [ ] Other

Please specify

*** 5. What AREA (square kilometres) of land does your community organisation manage litter across?**

Area (square kilometres):

*** 6. How frequently do you manage this area for litter (times per year)?**

Times per year:

2014/2015 NSW EPA Community Organisation Litter Cost Survey

3. 2014/2015 Costs

*** 7. How many VOLUNTEERS does your community organisation engage to assist with litter management?**

Volunteers (people):

*** 8. How many VOLUNTEER work hours did your community organisation contribute to litter management?**

Volunteer time (hours):

*** 9. How many PAID EMPLOYEES does your community organisation employ to assist with litter management?**

Paid employees (people):

*** 10. How many PAID EMPLOYEE work hours did your community organisation contribute to litter management?**

Paid employee time (hours):

*** 11. What was the weighted average LABOUR COST to your community organisation for all PAID EMPLOYEE hours?**

Weighted average cost ($/hours):

*** 12. What was the litter EXPENSE COST ($) to your community organisation?**

Litter expenses (e.g. gloves, insurance, litter grabbers, vehicles, PPE, disposal of litter, education materials etc):

*** 13. Did your community organisation receive any REVENUE from litter fines?**

- ◯ Yes (please complete Question 14 below)
- ◯ No
- ◯ Unsure

14. If you answered "yes" to Question 13, how much REVENUE ($) did your community organisation receive from litter fines?

Revenue ($):

15. Where does funding for your community organisation's litter management come from?

Funding sources:

*** 16. Did your community organisation record how much litter was collected?**

- ◯ Yes (please complete Question 17 below)
- ◯ No
- ◯ Unsure

17. If you answered "Yes" to Question 16, how much litter did your community organisation collect?

Amount:

Unit (bag size, count, weight, other):

18. Is there any other information regarding your community organisation's litter management efforts that has not been addressed in the questions above?

Appendix C Survey design for State Government agencies

2014/2015 NSW EPA State Government Agency Litter Cost Survey

1. Survey Introduction

The NSW Government has committed to introducing a container deposit scheme in NSW by July 2017. The NSW Environment Protection Authority (EPA) is leading this work. As part of this, the EPA needs to understand the impact that container deposit schemes may have on the total effort and costs spent on litter management by key sectors in NSW. To date, only national estimates have been available.

MRA Consulting Group (MRA) has been engaged by the NSW EPA to survey, analyse and report on the costs of litter management in local government, community groups, land management agencies and parts of the private sector for **2014/2015**.

This survey is a vital part of finding out how much litter costs the NSW community, and of then understanding the potential impact of a container deposit scheme. Your organisation's response to the survey is therefore an important contribution to the development of a container deposit scheme in NSW.

Thank you for taking the time to complete the survey. Should you have any questions regarding the survey, please do not hesitate to contact Roslyn Florie-George from MRA on 0447 803 955 or roslyn@mraconsulting.com.au.

2014/2015 NSW EPA State Government Agency Litter Cost Survey

2. General Information

*** 1. What agency do you represent?**

*** 2. What are your contact details?**

Name:

Email Address:

Phone Number:

*** 3. What role/s does your agency play in managing litter?**

- [ ] Litter collection / clean up
- [ ] Litter education
- [ ] Litter enforcement
- [ ] Other

Please specify

*** 4. What AREA (square kilometres) of land does your agency manage litter across?**

Area (square kilometres):

2014/2015 NSW EPA State Government Agency Litter Cost Survey

3. 2014/2015 Costs

*** 5. How many PAID EMPLOYEES did your agency employ to assist with litter management?**

Paid employees (people):

*** 6. How many PAID EMPLOYEE work hours did your agency contribute to litter management?**

Paid employee time (hours):

*** 7. What was the weighted average LABOUR COST to your agency for all PAID EMPLOYEE hours?**

Weighted average cost ($/hours):

*** 8. How many VOLUNTEERS did your agency engage to assist with litter management?**

Volunteers (people):

*** 9. How many VOLUNTEER work hours did your agency contribute to litter management?**

Volunteer time (hours):

*** 10. What was the litter EXPENSE COST ($) to your agency?**

Litter infrastructure (e.g. signage, purchase of bins and landscaping materials):

Litter collection/clean-up costs (e.g. gloves, litter grabbers, trucks, other PPE, streetsweeping):

Litter disposal costs (e.g. gate fees at disposal facility):

Litter enforcement activities (e.g. stationery, vehicle use):

Litter education and community engagement (e.g. flyers, advertisements):

*** 11. Did your agency engage private contractors to clean and manage litter at any of your sites?**

- ◯ Yes (please complete Question 12 below)
- ◯ No
- ◯ Unsure

12. If you answered "Yes" to Question 11, what was the TOTAL COST ($) to your agency of engaging PRIVATE CONTRACTORS to clean and manage litter at your sites?

Cost ($):

13. If you answered "Yes" to Question 11, did the private contractor(s) engaged to clean and manage litter also provide other services?

- ◯ Yes (please complete Question 14 below)
- ◯ No
- ◯ Unsure

14. If you answered "yes" to Question 13, approximately what PERCENTAGE of the TOTAL COST of engaging private contractors would you attribute to the contractor(s) cleaning and managing litter at your sites?

Percentage:

*** 15. Did your agency receive any REVENUE from litter fines?**

- ◯ Yes (please complete Question 16 below)
- ◯ No
- ◯ Unsure

16. If you answered "yes" to Question 15, how much REVENUE ($) did your agency receive from litter fines?

Revenue ($):

*** 17. Where does funding for your litter management come from?**

Funding sources:

*** 18. Did your agency record how much litter was collected?**

- ◯ Yes (please complete Question 19 below)
- ◯ No
- ◯ Unsure

19. If you answered "Yes" to Question 18, how much litter did your agency collect?

Amount:

Unit (bag size, count, weight, other):

20. Is there any other information regarding your agency's litter management efforts that has not been addressed in the questions above?

Appendix D Survey design for private businesses

2014/2015 NSW EPA Private Business Litter Cost Survey

1. Survey Introduction

The NSW Government has committed to introducing a container deposit scheme in NSW by July 2017. The NSW Environment Protection Authority (EPA) is leading this work. As part of this, the EPA needs to understand the impact that container deposit schemes may have on the total effort and costs spent on litter management by key sectors in NSW. To date, only national estimates have been available.

MRA Consulting Group (MRA) has been engaged by the NSW EPA to survey, analyse and report on the costs of litter management in local government, community groups, land management agencies and parts of the private sector for **2014/2015**.

This survey is a vital part of finding out how much litter costs the NSW community, and of then understanding the potential impact of a container deposit scheme. Your organisation's response to the survey is therefore an important contribution to the development of a container deposit scheme in NSW.

Thank you for taking the time to complete the survey. Should you have any questions regarding the survey, please do not hesitate to contact Roslyn Florie-George from MRA on 0447 803 955 or roslyn@mraconsulting.com.au.

2014/2015 NSW EPA Private Business Litter Cost Survey

2. General Information

*** 1. Which business/es do you represent?**

*** 2. What are your contact details?**

Name:

Email Address:

Phone Number:

*** 3. Please summarise your business' litter management activities (e.g. scope, area, collection practices, collection frequencies, education and enforcement).**

*** 4. Please describe your typical business site.**

Description (e.g. 'shopping centre'):

Size (in square metres):

*** 5. How many sites do you manage in NSW?**

Number of sites:

*** 6. How many of your sites do you manage litter at?**

Number of sites:

2014/2015 NSW EPA Private Business Litter Cost Survey

3. 2014/2015 Costs

*** 7. How many PAID EMPLOYEES did your business employ to assist with litter management?**

Paid employees (people):

*** 8. How many PAID EMPLOYEE work hours did your business contribute to litter management?**

Paid employee time (hours):

*** 9. What was the weighted average LABOUR COST to your business for all PAID EMPLOYEE hours?**

Weighted average cost ($/hour):

*** 10. What was the litter EXPENSE COST ($) to your business?**

Litter expenses (e.g. litter bins, skip bins, gloves, litter grabbers, insurance, PPE, disposal of litter, education materials etc):

*** 11. Did your business engage private contractors to clean and manage litter at any of your sites?**

- ○ Yes (please complete Questions 12-13 below)
- ○ No
- ○ Unsure

12. If you answered "Yes" to Question 11, what was the TOTAL COST ($) to your business of engaging PRIVATE CONTRACTORS to clean and manage litter at your sites?

Cost ($):

13. If you answered "Yes" to Question 11, did the private contractor(s) engaged to clean and manage litter also provide other services?

- ◯ Yes (please complete Question 14 below)
- ◯ No
- ◯ Unsure

14. If you answered "Yes" to Question 13, approximately what PERCENTAGE of the TOTAL COST of engaging private contractors would you attribute to the contractor(s) cleaning and managing litter at your sites?

Percentage: _____

*** 15. Did your business record how much litter was collected?**

- ◯ Yes (please complete Question 16 below)
- ◯ No
- ◯ Unsure

16. If you answered "Yes" to Question 15, how much litter did your business collect?

Amount: _____

Unit (bag size, count, weight, other): _____

17. Is there any other information regarding your agency's litter management efforts that has not been addressed in the questions above?