Analysis of landfill survey data

Final report

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1. Introduction

1.1 About this project

Periodically, the Waste Management Association of Australia (WMAA) undertakes surveys of landfills in Australia. Blue Environment understands that surveys were undertaken in 2006-07; in 2008; and in 2010. The surveys were similar but extra questions were added each time. Response rates have varied. The 2008 survey had a high response rate but the 2010 survey was unable to match this rate.

The Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) needs to have the best possible data on landfills for its 2013 National Waste Report. DSEWPaC therefore commissioned WMAA to:

- compile a single database comprising 2010 survey data where available, or otherwise 2008 survey data where available
- analyse the resultant database to determine the key characteristics of landfills and landfilling in Australia.

WMAA arranged for the two databases to be merged and commissioned Blue Environment to undertake the analysis. Blue Environment's method for undertaking the analysis comprised three steps:

1. Data preparation, involving cleansing, verification, manipulation and categorisation. This is reported in Section 2.
2. Numerical analysis of the results for all key questions relevant to DSEWPaC's needs. The results are tabulated in the appendix.
3. Interpretation and presentation of key results. This is given in Section 2.

1.2 A brief introduction to landfilling in Australia

Landfilling has been the most common pathway for waste management in Australia since the demise of urban incineration in the 1940s and 50s. Landfill siting, design, operation and post-closure management have undergone major changes during this period, especially since the 1990s, driven by tightening environmental regulation and economic pressures. As a result, the number of landfills has fallen, their average size has grown, their operational sophistication is greatly improved, and they are increasingly owned and operated by large private companies.

Except for small rural operations, landfills mostly operate under the close regulatory control of jurisdictional environmental regulators. These generally control siting and design through some kind of works approval process, and control operation through a licensing process. The pre-operational approval would ensure, for example, that buffer distances and access are appropriate or that the cells containing the waste are designed to minimise environmental risks through, for example, lining the cell walls and draining the cell floor to collection points. The licence would ensure that the site is managed to minimise environmental and amenity impacts through, for example, covering waste daily and monitoring and reporting of key environmental conditions. It would also ensure that the site is filled and rehabilitated to an agreed landform, and is monitored post-closure.

As the required environmental standards increased, the financial viability of smaller operations has been eroded and many have been replaced by transfer stations, from which waste is shipped to larger facilities. Transfer stations also allow recyclables to be removed, and mean that smaller vehicles do not need to go to the tip face. This means access roads do not need to be maintained to as high a standard, and also reduces the risk of injury. These changes have resulted in many small companies and local governments, at least in the larger centres, withdrawing from landfilling and ceding the responsibility to large companies, including multinationals such as SITA and Veolia.

Another significant change since the early 1990s has been the increase in materials recovery through recycling, composting and, to a lesser extent, energy recovery. Initially driven by public demand, these alternatives have gradually developed efficient systems for collecting wastes and processing them into valuable product streams. Most solid wastes in Australia are now recovered, rather than disposed in landfill.

Landfills are typically developed in old quarries. For quarry owners, a landfill provides a cost-effective means of rehabilitating their site. A new landfill is not popular with locals, and siting, planning and appeal processes may be lengthy. Including the additional time for design and construction, the time between a decision to seek to open a new landfill and the first waste accepted is typically several years.

Australia quarries more materials than it discards, so quarry space is being created quicker than waste could fill it. However, scarcity of capacity exists in some cities, including in Sydney and Perth, due to geographical and geological constraints. In other locations, too, landfill space is effectively scarce due to the social difficulty in obtaining approval for a new site, and because new sites are typically in more inconvenient locations than existing sites.

Landfill operators need to manage odour, leachate, fire risks, litter, traffic management and problem wastes (discussed in section 2). They need to engage with regulators, auditors and often neighbours, and to transfer collected landfill levies to the state. They need strong engineering capabilities or a relationship with consulting engineers to help with their design and construction work. They need financial planning that ensures they charge sufficiently to rehabilitate the site and pay for post-closure liabilities such as monitoring for up to 30 years. Other current issues for landfill operators include:

- *Landfill gas management* – landfill gas comprises about 50% methane, which can be explosive at some concentrations and which is also a greenhouse gas having a warming effect 25 times that of carbon dioxide (over the standard 100-year assessment timeframe). Methane leakage from a now closed landfill in Cranbourne, Melbourne in the late 2000s resulted in temporary advice to abandon scores of houses, leading to a greater regulatory focus on gas management across Australia. In addition, larger landfills are subject to the Carbon Pricing Mechanism and may be able to also generate credits through the Carbon Farming Initiative. This has improved the financial viability of gas collection and burning, and demand for the services of landfill gas companies such as EDL and LMS has greatly increased. The regulatory framework for carbon pricing has proven complex, and many landfill operators have struggled to come to terms with the implications for pricing and reporting.
- *Resource recovery* – landfills need to meet community expectations and commercial opportunities for resource recovery, including the operation of resource recovery centres, tip shops and waste pre-processing. The large waste companies are seeking opportunities to offer an integrated waste management package that gives preference to resource recovery, with landfills as a 'last resort'.
- *Climatic variation* – wet weather in Melbourne during 2010 and 2011 resulted in major problems with odour and very high leachate volumes. In Queensland, landfillers have needed to cope with sudden very large volumes of waste due to disasters, especially Cyclone Yasi and the Brisbane floods.
- *Hazardous waste* – it is increasingly difficult to obtain approval for a landfill accepting wastes with higher levels of hazard classification.

2. The data set and its management

WMAA provided Blue Environment with a Microsoft Excel file with separate worksheets containing the results of the 2008 and 2010 surveys, and the combined results. The combined results were generated by using the 2008 data as the base year and replacing all entries where the 2010 data were 80% or more complete. The resulting database contained information about 517 sites.

2.1 Data cleansing and verification

The data were cleansed and verified through a range of processes.

Sites were identified that appeared to be duplicates (1 site), error entries (3), closed landfills (2) or transfer stations (13). These nineteen facilities were deleted from the database. A range of other tests of the database were carried out to check for consistency or realism. Anomalies were adjusted where reasonable assumptions could be made; otherwise the relevant entries were deleted. Examples of these adjustments and deletions included:

- not accepting a report that a site compacted waste when it services only 300 people (regular compaction would not be feasible)
- assuming a small site with a recorded area of 36,000 ha meant to report 36,000m^3, or 3.6 ha
- adjustments so that the quantity of the various waste types added to 100% of the total.

These adjustments are recorded in the Microsoft Excel analysis workbook submitted to WMAA.

2.2 Data manipulations and categorisations

Various manipulations and categorisations were undertaken to prepare the data for analysis. These are fully documented in the workbook submitted to WMAA.

Where waste was reported in cubic metres (mainly at small sites), the figures were converted to tonnage figures using the assumed densities tabulated below.

Table 1: Assumed densities of waste delivered, by type

Waste type	Density (t/m^3)
MSW and C&I	0.4
C&D	0.8
asbestos	0.6
sludge	0.7
soil	1.1
hazardous waste	0.8
clinical waste	0.4

Responses to some questions were grouped to a single response. For example, various questions about the type of cell liner were grouped to derive a single answer to the question ‘does your site have a cell liner’?

Sites were classified into size groups through reference to their reported annual inputs or, where those figures were not provided, through reference to the population serviced. Threshold values for population serviced that are commensurate with each tonnage threshold were determined through reference to the average tonnes per person, calculated at all sites where both data categories were available (see Table 2).

Table 2: Size classifications

Size class	Annual tonnes	OR	Population serviced	Av. t/person in size class based on known data
Very small	≤1,000		≤250	0.19
Small	1,001 to 20,000		250 to 5,000	0.18
Medium	20,001 to 100,000		5,000 to 50,000	0.56
Large	≥100,000		≥50,000	0.48

In considering resource recovery, waste types were grouped according to whether they are 'problem wastes' or 'non-problem wastes'. Problem wastes were defined, for the purpose of this report, as those materials for which the primary motivation for resource recovery is to avoid problems in landfill. Problem wastes comprise oil, paint, mattresses, tyres and gas bottles. Oil and paint are liquids and are generally banned from landfill disposal due to environmental risks; mattresses and tyres are operationally problematic because they obstruct compaction by 'floating' in landfills; gas bottles represent and occupational health and safety risk. For the remaining non-problem wastes, the motivation for resource recovery is for the financial and environmental benefits of recirculating the materials back into the economy.

2.3 Overview of the final data set

The resultant data set covers 498 landfills, comprising 141 for which the 2010 data set was used and 357 for which the 2008 set was used. On average, each survey question received no response from 19% of landfills (97), and even the question with the highest net response rate had 15% non-respondents (77). A significant number of entries in the 2008 database were apparently landfills that were identified and contacted but did not formally respond. Most of these are likely to be small.

The comprehensiveness of the survey's coverage could be considered from the perspective of the proportion of landfills covered or the proportion of waste covered.

Assessing the proportion of landfills covered is likely to be less useful since there is a large number of very small sites and marginal problems with the definition of what should be counted as a landfill. It is noted that GeoScience Australia reports a considerably larger number of landfills than the 498 included in the survey data.

The proportion of waste covered by the survey could be assessed by comparison with the reported tonnages with those reported in the draft report *Waste and Recycling in Australia 2012.* In all, 334 surveyed sites reported receiving 16.74 million tonnes. The draft *Waste and Recycling in Australia 2012* report estimates waste to landfill in Australia in 2009/10 at 21.27 million tonnes, suggesting that the WMAA landfill database covers about 79% of the total waste to landfill. The WMAA survey team reported confidence that their coverage of overall waste to landfill was higher that this proportion, based on their successful targeting of larger sites. It is noted that 164 sites did not report waste quantities but these are likely to be accepting only small waste quantities (58 of these sites reported the population they service, the average of which was around 3,000 people, representing a small or very small site). The voluntary nature of the WMAA survey data may have led to inaccurate reporting of tonnages.

Despite the uncertainties about the comprehensiveness of the data, the results of the analysis provide a good snapshot of landfilling and landfill practices in Australia.

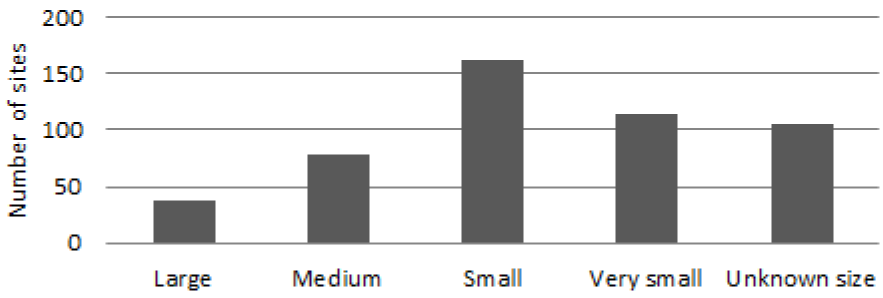
3. Data analysis

The data were analysed in a Microsoft Excel workbook that was submitted to WMAA. This workbook contains information that is commercial-in-confidence, and is therefore not available for publication. Collated responses to individual questions are given in the appendix.

3.1 Landfill sizes and distributions

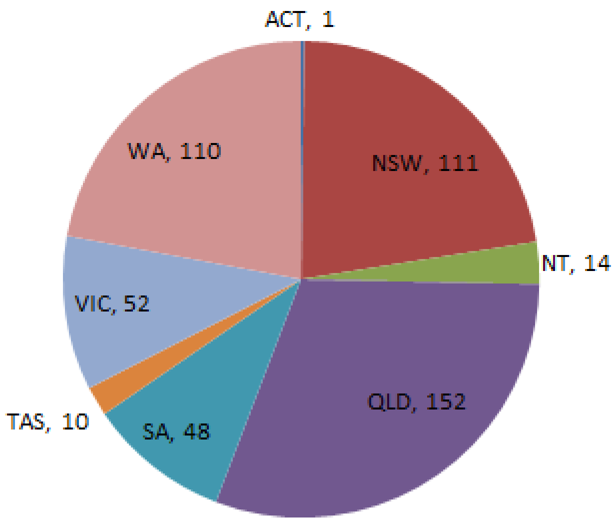
The bulk of Australia's landfills are small or very small. Thirty-eight sites (8%) are known to be large and 78 (16%) are known to be medium. The 21% of unknown size are likely to be mostly small or very small (see Figure 1).

Figure 1: Reported numbers of Australian landfills by size class



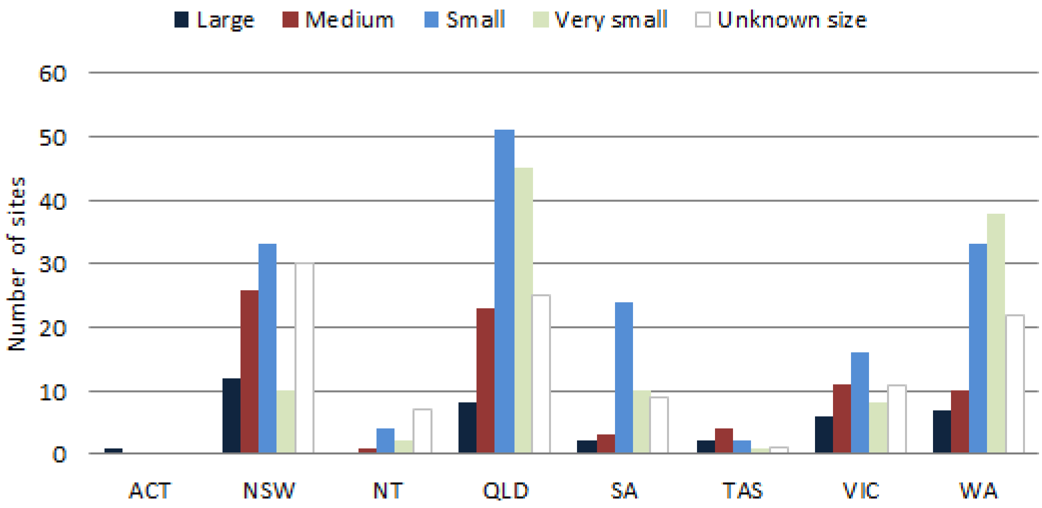
Queensland reports the most sites, followed by NSW and Western Australia (see Figure 2). This is consistent with the size and population distribution in each of these jurisdictions.

Figure 2: Reported numbers of Australian landfills by jurisdiction



Queensland, Western Australia and South Australia have relatively high proportions of small sites. This matches their highly dispersed populations (see Figure 3). Victoria and Tasmania have a high proportion of large and medium sites. NSW has the most large sites, matching its relatively large population (see Figure 3).

Figure 3: Reported number of Australian landfills by size class and jurisdiction

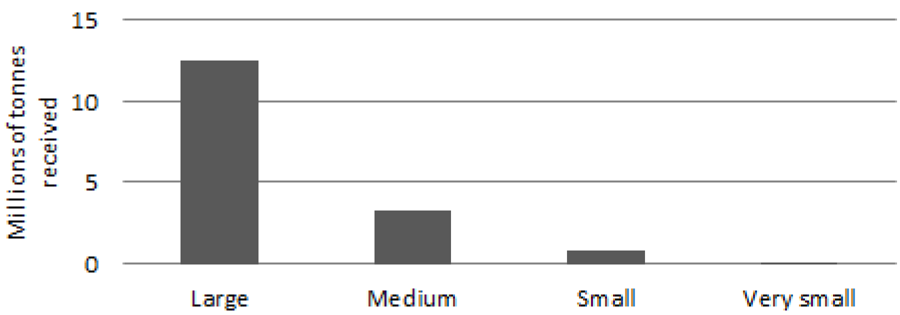


Only 84 landfills reported the year they opened and 79 reported the year they expect to close. The average year of opening was 1982 and average year of closing was 2025. The average medium and small site is older than the average large site. In most jurisdictions, the average large site is less than 10 years old.

3.2 Tonnages and distributions

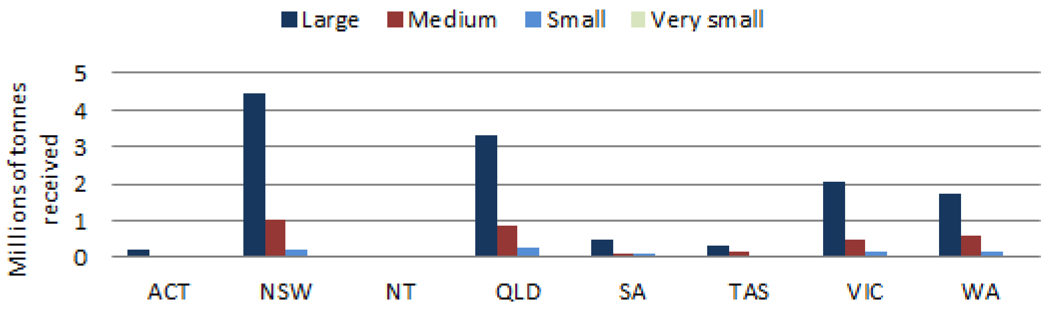
The 8% of Australia's landfills that are classified as large accept 75% of the waste (see Figure 4). These are the sites servicing the major cities. Medium-sized landfills accept 20% of the waste, small sites receive 5% and the very small sites accept only 0.2%.

Figure 4: Reported tonnes of waste deposited by landfill size class



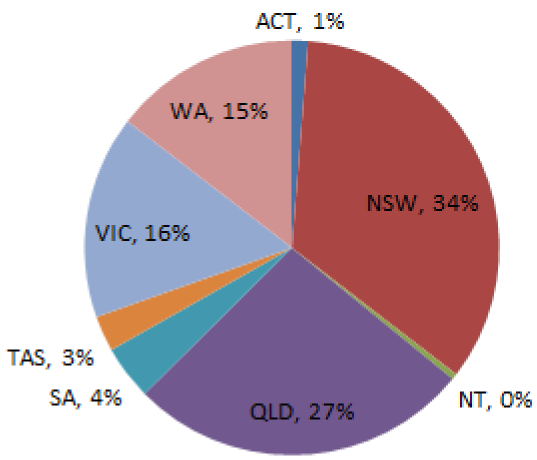
Similar patterns can be observed in every jurisdiction (see Figure 5).

Figure 5: Reported tonnes of waste deposited by landfill size class and jurisdiction



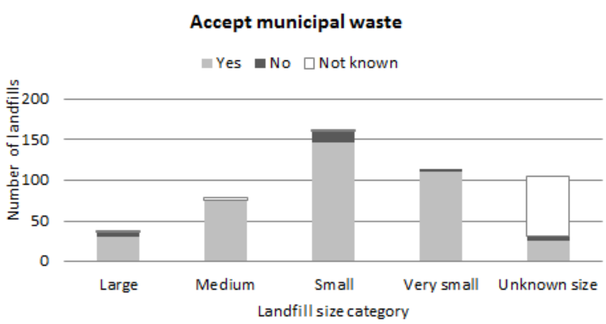
NSW generated more waste to landfill than the other jurisdictions, corresponding with its status as the most populous state. Queensland, surprisingly, generated much more waste to landfill than Victoria (4.5Mt compared with 2.7Mt). This is inconsistent with the draft results of *Waste and Recycling in Australia 2012*, which put the 2009/10 tonnages at 4.2Mt for Queensland and 4.4Mt for Victoria (see Figure 6).

Figure 6: Reported proportional tonnes by jurisdiction

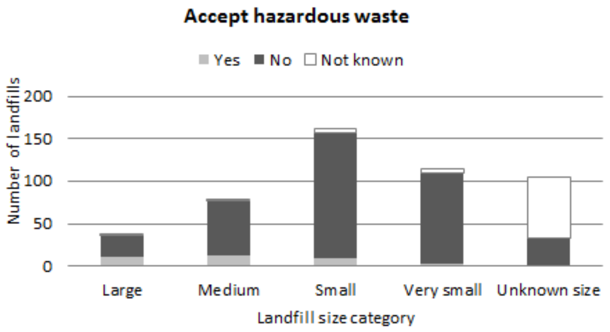


3.3 Other landfill characteristics

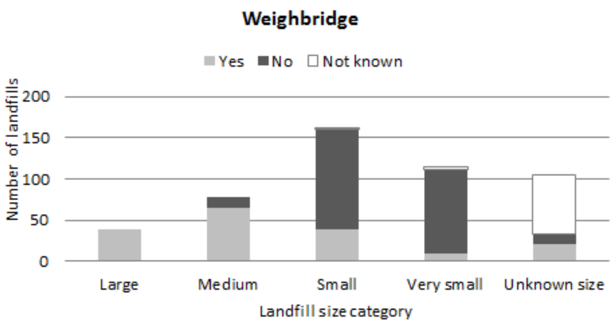
- 388 sites said they accepted MSW; only 30 said they did not.
- Those not accepting MSW would mostly be inert sites, which exist in several jurisdictions and accept mostly construction and demolition waste. These sites generally operate under less onerous regulatory controls.
- NSW also has a category of site that accepts only commercial waste.



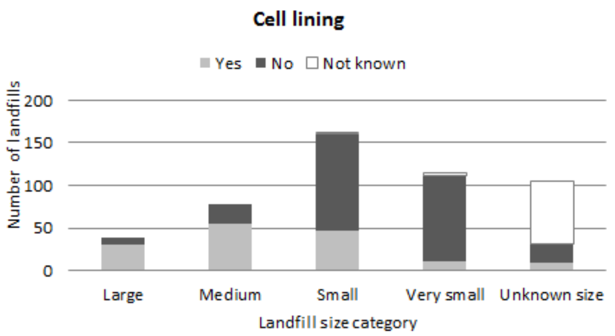
- 38 sites stated that they accepted hazardous waste; 377 said they did not.
- Large and medium sites represented about 2/3 of the sites accepting hazardous waste.
- Separate questions were asked about the acceptance of clinical waste and low level contaminated soil, so it is anticipated that most respondents would not have answered affirmatively for only those wastes.



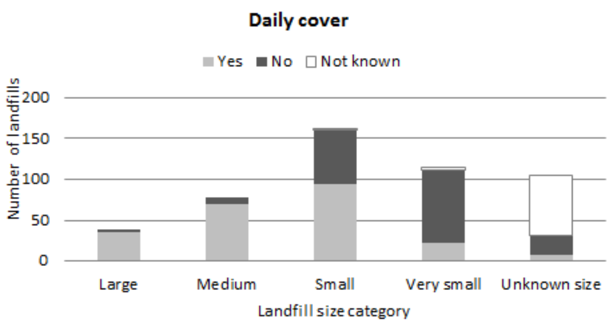
- 172 sites said they had a weighbridge; 248 said they did not.
- Possession of a weighbridge is strongly linked with site tonnage receipts. All the larger sites; 83% of medium sites; but less than 25% of small sites said they had one.
- Weighbridges are important for data collection, which is linked in many jurisdictions to landfill levy receipts.
- Some jurisdictions have provided funding for regional landfills to install weighbridges.



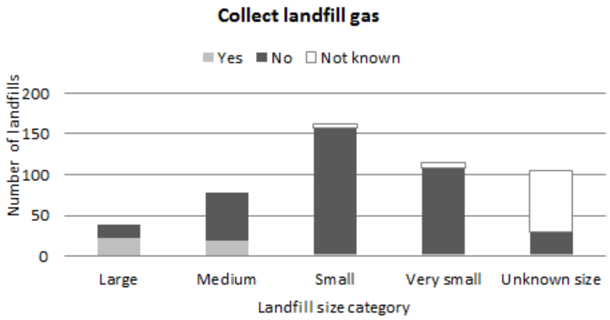
- 153 respondents stated that their sites had cell liners; 266 said they did not.
- Like weighbridges, cell lining is linked to landfill size. More than 80% of large sites and 70% of medium sites are lined, but only a minority of smaller sites are lined.
- Cell lining is important for protecting groundwater from leachate intrusion and helps prevent migration of landfill gas.
- Most jurisdictions require lining of new landfills, but there may be exemptions for small sites where the cost is prohibitive.



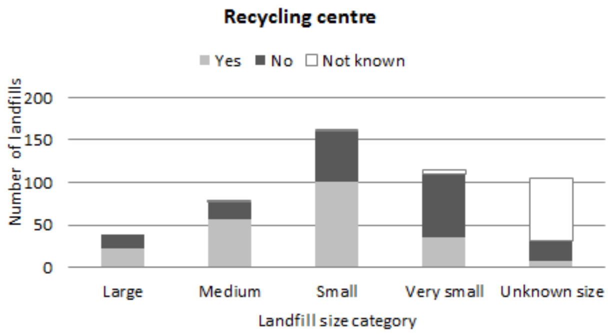
- 232 respondents said they covered their waste daily; 187 said they did not.
- Daily cover is standard practice at modern landfills to reduce odour, litter and vermin.
- The majority of large, medium and small sites said they cover waste – it is surprising that any do not.
- Most large sites obtain their cover on-site. Where this is not the case, obtaining cover material can represent a significant cost.
- Small sites may be unstaffed or have only periodic access to machinery for covering waste.



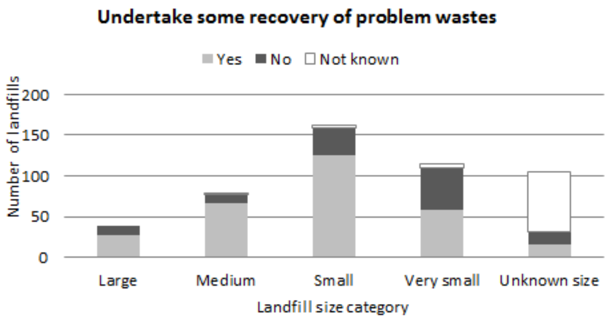
- 50 respondents said they collected landfill gas; 363 said they did not.
- Again, this practice is strongly linked to landfill tonnage receipts. 61% of large sites; 24% of medium sites; but only 2% of small sites collect gas.
- Gas recovery has been viable at large sites that generate electricity and renewable energy certificates.
- The practice became common between the mid-1990s and mid-2000s.
- Carbon policy is now driving additional investment in gas recovery.



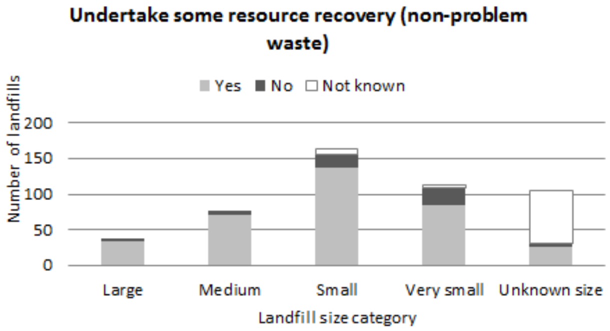
- 222 respondents – including a majority of large, medium and small sites – said they had recycling centres. 196 said they did not.
- Recycling centres provide several benefits:
  - capturing useful materials for recycling
  - providing a location for small vehicles to unload in a safe and accessible location
  - reducing the need to maintain access roads suitable for smaller vehicles.
- Some jurisdictions have provided grants for developing recycling or drop-off facilities at regional landfills.



- 294 respondents said they recovered some of the materials classified by Blue Environment as 'problem wastes' (see section 2.2). 122 said they did not.
- A majority of the sites answered in the affirmative in each size class.
- Many sites would recover these materials to provide for their disposal while not allowing them in landfill for compliance with licence or other conditions.
- It is likely that many sites not recovering these wastes do not accept them at all.

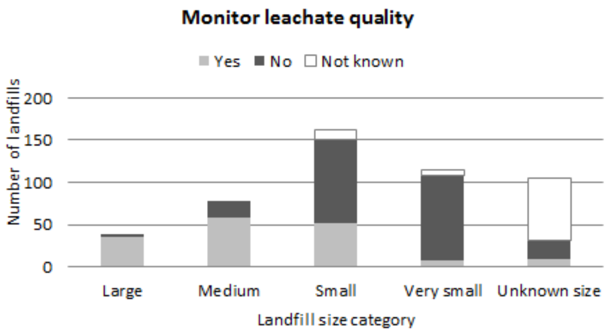


- An even stronger majority of 357 sites said they recovered 'non-problem wastes' (Blue Environment definition see section 2.2). Only 58 sites said they did not.
- The most common materials recovered, in descending order, are steel, bottles & cans, paper & cardboard, aluminium, concrete & bricks, green waste (on-site) and timber.
- It is often profitable to recover steel using a large magnet mounted on an excavator.

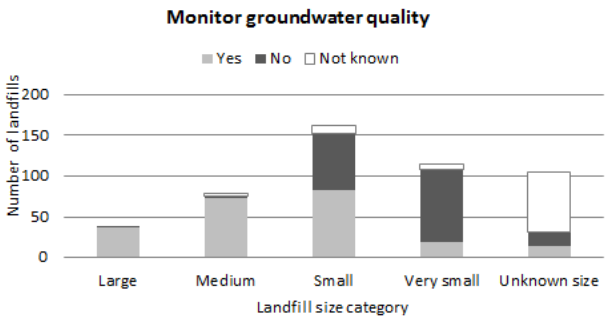


- 139 sites run a tip shop to sell collected items.

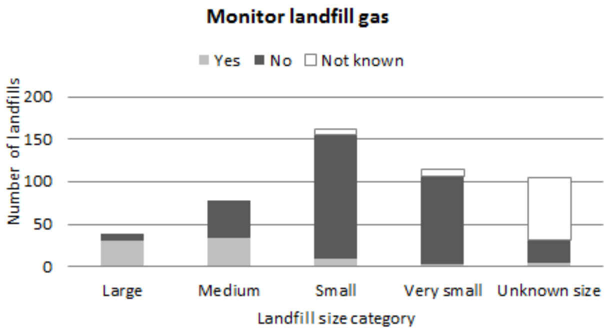
- 164 sites said they monitored leachate quality. 242 said they did not.
- Leachate monitoring (quality and depth) is generally a licence requirement applied to larger sites – only two of the 38 large sites that responded to this question did not monitor leachate quality.



- 226 sites said they monitored groundwater quality, while 180 said they did not.
- Monitoring of groundwater is more environmentally significant than leachate, since it looks for leachate leakage.
- All but three of the 113 large and medium-sized sites responding to this question said they monitor groundwater. This is generally undertaken as a licence requirement.
- Most sites would have several bores upstream and downstream of the site, and a regular monitoring program managed by specialist consultants.



- 80 respondents said they monitor landfill gas; 328 said they did not.
- Gas monitoring and management has become more strongly regulated, especially in Victoria, since the Cranbourne landfill problem of 2008-10.
- Traditionally the problem associated with landfill gas was odour, but the explosion risk is now more widely recognised.
- The greenhouse impacts of landfill gas are more commonly estimated through modelling than monitoring or measurement.



Appendix
Tabulated results from the data analysis

Table 3: Number of landfills by jurisdiction & size class

	Large	Medium	Small	Very small	Unknown size	All sizes
ACT	1	0	0	0	0	1
NSW	12	26	33	10	30	111
NT	0	1	4	2	7	14
QLD	8	23	51	45	25	152
SA	2	3	24	10	9	48
TAS	2	4	2	1	1	10
VIC	6	11	16	8	11	52
WA	7	10	33	38	22	110
All jurisdictions	**38**	**78**	**163**	**114**	**105**	**498**

Table 4: Millions of tonnes received per year by jurisdiction & landfill size class

	Large	Medium	Small	Very small	All sizes
NSW & ACT	4.68	1.05	0.21	0.00	5.93
NT	0.00	0.07	0.00	0.00	0.07
QLD	3.33	0.87	0.26	0.01	4.47
SA	0.47	0.12	0.11	0.00	0.71
TAS	0.29	0.17	0.01	0.00	0.46
VIC	2.07	0.45	0.13	0.00	2.65
WA	1.72	0.58	0.13	0.01	2.44
All jurisdictions	**12.6**	**3.3**	**0.8**	**0.0**	**16.7**

Table 5: Proportion of all the recorded waste received per year by jurisdiction & landfill size class

	Large	Medium	Small	Very small	All sizes
NSW & ACT	28%	6%	1%	0%	35%
NT	0%	0%	0%	0%	0%
QLD	20%	5%	2%	0%	27%
SA	3%	1%	1%	0%	4%
TAS	2%	1%	0%	0%	3%
VIC	12%	3%	1%	0%	16%
WA	10%	3%	1%	0%	15%
All jurisdictions	**75%**	**20%**	**5%**	**0%**	**100%**

Table 6: Numbers of landfills by characteristic

		Large	Medium	Small	V. small	Unknown	All sizes
Reported age	Av. age	19	28	28	33	30	27
	Yes	11	32	26	12	3	84
	No	27	46	137	102	102	414
Accept municipal waste	Yes	31	74	147	110	26	388
	No	6	1	13	4	6	30
	Not known	1	3	3	0	73	80
Accept hazardous waste	Yes	11	13	10	3	1	38
	No	26	64	148	107	32	377
	Not known	1	1	5	4	72	83
Weighbridge	Yes	38	65	39	9	21	172
	No	0	13	121	102	12	248
	Not known	0	0	3	3	72	78
Cell lining	Yes	31	55	47	11	9	153
	No	7	23	113	100	23	266
	Not known	0	0	3	3	73	79
Collect landfill gas	Yes	23	19	3	3	2	50
	No	15	59	155	106	28	363
	Not known	0	0	5	5	75	85
Recycling centre	Yes	23	56	101	35	7	222
	No	15	21	60	75	25	196
	Not known	0	1	2	4	73	80
Daily cover	Yes	36	70	95	23	8	232
	No	2	8	65	88	24	187
	Not known	0	0	3	3	73	79
Flare or power generation	Yes	24	15	0	1	2	42
	No	14	63	159	110	30	376
	Not known	0	0	4	3	73	80
Undertake some resource recovery (non-problem waste)	Yes	35	72	138	85	27	357
	No	3	6	19	25	5	58
	Not known	0	0	6	4	73	83
Undertake some recovery of problem wastes	Yes	27	67	126	58	16	294
	No	11	10	33	52	16	122
	Not known	0	1	4	4	73	82
Monitor leachate quality	Yes	36	58	52	8	10	164
	No	2	20	99	100	21	242
	Not known	0	0	12	6	74	92
Monitor groundwater quality	Yes	37	73	83	19	14	226
	No	1	2	69	90	18	180
	Not known	0	3	11	5	73	92
Monitor landfill gas	Yes	30	33	10	2	5	80
	No	8	45	145	104	26	328
	Not known	0	0	8	8	74	90

Table 7: Site area

	Licensed area (ha)	Capped area (ha)	Filling area (ha)
Sites reporting info	335	98	98
Average ha.	35.3	4.1	9.4

Table 8: Site type

	Hard rock quarry	Clay/shale quarry	Sand/gravel pit	Valley fill	Excavate & fill above ground	Small trench & fill	Balefill
Yes	48	38	62	46	180	169	3
No	325	330	316	326	212	200	358
No response	125	130	120	126	106	129	137

Table 9: Major waste streams received

	MSW	C&I	C&D
Yes	388	347	344
No	30	68	68
No response	80	83	86
Sites reporting % of this waste type received	284	275	273
Average % (not weighted by tonnes)	65%	25%	19%
Sites accepting only this material type	12	4	5

Table 10: Minor waste streams received

	Asbestos	Sludge	Low level contaminated soil	Hazardous	Clinical
Yes	217	73	120	38	36
No	201	343	298	377	376
No response	80	82	80	83	86
Sites reporting t	146	48	72	23	26
Total t	161,292	53,026	669,574	30,943	2,218
Average t	1,105	1,105	9,300	1,345	85

Table 11: Landfill controls

	Compacter	Dozer or loader	Excavator	Dump trucks	Water cart	Litter truck	Road sweeper
Yes	169	327	176	167	178	105	73
No	248	89	220	242	232	299	342
No response	81	82	102	89	88	94	83

Table 12: Site infrastructure

	Leachate collection	Leachate storage	LFG collection	Weigh-bridge	Security fence	Sealed roads	Wheel wash	Liner	Clay liner	HDPE liner	GCL	Stormwater ponds	Evap. ponds	Transfer station	Recycling centre	Visual screening
Yes	160	118	50	172	307	156	58	153	138	43	33	169	85	136	222	209
No	257	288	363	248	111	265	360	266	278	372	374	243	327	271	196	210
No response	81	92	85	78	80	77	80	79	82	83	91	86	86	91	80	79
	ML/yr	**ML**	**m3/mth**													
Sites reporting info	58	63	32													
Average	138	45	330,519													

Table 13: Environmental controls

	Fire control	Flare 09/10	Flare 08/09	Electricity generation	Waste inspection	Compaction	Daily cover	Litter nets	Leachate treatment	Odour control	Stormwater controls	Vermin control
Yes	283	13	29	35	318	283	232	235	64	67	247	215
No	136	117	336	378	102	135	187	185	349	345	172	188
No response	79	368	133	85	78	80	79	78	85	86	79	95
	# fires	**m3/mth**	**m3/mth**	**MWh/mth**								
Sites reporting info	199	23	32	43								
Average	2.0	68,133	83,957	61,665								
Total no. fires	404											

Table 14: Resource recovery – non-problem wastes

	Steel	Bottles & cans	Paper & cardboard	Non-ferrous metals	Reusables / tip shop	Green waste compost on-site	Green waste recovery offsite	Timber	Concrete & bricks	Waste pre-treatment	
Yes	338	258	230	215	139	145	119	133	165		9
No	77	155	182	195	270	266	274	264	242		398
No response	83	85	86	88	89	87	105	101	91		91
										On-site	**Off-site**
Sites reporting t	200	137	134	95		88	81	69	106	22	22
Total t recovered	111,790	23,738	37,150	9,202		386,407	486,354	48,404	555,096	30,452	6,400
Average t	559	173	277	97		4,391	6,004	702	5,237	1,384	291

Table 15: Resource recovery – problem wastes

	Mattresses	Tyres	Gas bottles	Waste oil	Paint
Yes	64	189	137	257	57
No	343	221	265	156	345
No response	91	88	96	85	96
Sites reporting L				150	44
Total L recovered				1,825,362	97,275
Average L				12,169	2,211
Sites reporting units	52	116	71		
Total units recovered	37,870	80,829	20,158		
Average units	728	697	284		

Table 16: Rehabilitation

	Clay cap	HDPE cap	GCL cap	Evapotransp. cap	Subsurface drains	Stormwater control	Progressive rehab.	Revegetation	Reuse	Erosion control cover
Yes	191	10	12	17	68	217	189	203	67	159
No	213	377	374	373	323	175	207	190	319	215
No response	94	111	112	108	107	106	102	105	112	124

Table 17: Monitoring

	Waste tonnage	Waste type	Annual volumetric survey	Settlement	Leachate quality	Groundwater quality	Groundwater bores	Stormwater	LFG	Odour	Dust
Yes	237	271	197	97	164	226	238	167	80	86	124
No	178	143	212	313	242	180	180	242	328	325	286
No response	83	84	89	88	92	92	80	89	90	87	88