

Waste Warriors: How to achieve low waste community events

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Introduction

Waste management is a major issue when organising public events. A Western Australian report notes “Thousands of tonnes of waste are generated as a result of community events, much of which could be recycled to conserve resources” (RRC, 2011, p.1). Furthermore, there is a need to reduce waste as part of this broader approach to waste management for an event. So, how do event organisers embed low waste strategies into planning and implementing such community gatherings? This paper reports on waste management strategies employed at annual science and sustainability expos held at the Canning River Eco Education Centre (CREEC), Perth, Western Australia. The expos were one day community events held on a Sunday in August during National Science Week (NSWk).

These expos have been conducted annually, from 2009 to 2016. All expos were promoted as ‘low waste’ events, since effective waste management was considered a critical community science, sustainability and technology issue. From the beginning, the expos aimed to model how to conduct ‘low waste’ community events, in the context of a feast of science activities that challenged the senses and intellect. These challenges included investigating different approaches to waste management, with a focus on how everyone can make a difference to recycling and landfill outcomes. Waste minimisation strategies evolved with each Expo and the outcomes have been outlined in expo publications for each year:

- 2009 *Taste of Science* (Pearson & Lewis, 2009);
- 2010 *Dance of Science* (Lewis & Pearson, 2011);
- 2011 *Sound of Science* (Lewis, Gaschk & Pearson, 2011);
- 2012 *Colour of Science* (Lewis, Nielsen, Pearson & Baudains, 2012; Lewis, Bullimore, Pearson, Krupa & Gaschk, 2013);
- 2013 *Scents of Science* (Sneddon & Lewis, 2013; Lewis, Bullimore, Krupa, Gaschk & Pearson, 2014);
- 2014 *Touch of Science* (Lewis, Tero & Bullimore, 2015); and
- 2015 *Patterns in Science* (Lewis, E & C., Bullimore, Krupa, Gaschk & Pearson, 2016).

The current paper aims to analyse the waste findings from all eight years, including the 2016 expo, *Wired for Science*, and draw overall conclusions related to the success of the waste management strategies implemented.

Planning, implementation and evaluation of the expos was achieved through a successful partnership between NSWk, CREEC, City of Canning, South East Regional Centre for Urban Landcare (SERCUL), the Australian Association for Environmental Education-WA Chapter (AAEE WA), the Department of Parks and Wildlife and The Forever Project. NSWk funding was supplemented by financial and in-kind support from other major and minor partners who supported the events.

One major waste initiative was the development of the waste education stall, 'Watch your Waste' in 2009 (Figure 1). Over the years, in addition to funding support from NSWk, expo waste minimisation initiatives were enhanced by a number of grants: the Keep Australia Beautiful (KAB) Beverage Container Recycling Community Grant (2012); and the Western Australian Waste Authority Community Grant Scheme (2013/14) which was managed in partnership with the City of Cockburn. KAB funding enabled the purchase of fifty Keep Cups to reduce the use of disposable coffee containers, the creation of the "Sam the Can" costume to promote the recycling of aluminium cans, and the development of a number of education posters (Figure 2). These initiatives were implemented in various settings, including the expos. Likewise, The Waste Authority and City of Cockburn funds enabled the design and construction of a mobile, community waste education trailer and the development of a range of education resources including information panels, games and activities to promote waste wise attitudes and behaviours (Figures 3 & 4). This financial support enhanced the waste education activities that could be offered in a wide range of community settings, including the expos.



Figure 1. *Watch Your Waste* stall in action.



Figure 2. Resources developed under the KAB grant including costumes, posters and a litter sculpture.



Figure 3. The Mobile Waste Education Trailer.



Figure 4. Attendees enjoying the recycling and wetlands games that illustrate the impact of waste.

Expo Waste Management Strategies

The Expo Planning Committee included representatives from CREEC, SERCUL and AAEE WA. The committee met on a monthly basis most of the year, planning, conducting and evaluating each expo. 'Low waste' initiatives were embedded into the pre-expo, during expo and post-expo phases.

Pre-expo strategies included the marketing and promotion of the event as 'low waste'; the preparation of information and signage; and the selection of stall holders that supported the overall philosophy of the low waste event. During the expos, a range of initiatives were implemented including the provision of a two-bin system with signage to encourage the separation of waste (Figure 5) and activities that provided participants with many opportunities to engage in a wide range of hands-on, interactive experiences which were designed to enhance waste understandings. Post-expo initiatives included conducting an audit of the waste generated at the end of the expo, as well as other evaluations. The range of strategies adopted to enhance waste education and appropriate behaviours are presented in detail in Table 1. The table focusses on strategies, not the pre, during and post phases, as many strategies are applicable in more than one phase.

Table 1. Expo strategies to enhance the ‘low waste’ aim.

Strategy	On-ground Actions
Provision of ‘low waste’ information (Figures 1 & 5)	<ul style="list-style-type: none"> • Low waste information in pre-expo letters and briefing to presenters/stall holders. • Providing green (rubbish) and yellow (recycling) bins and encourage people to separate any waste they do have correctly, along with bin signage indicating how to dispose of waste correctly. • Bin monitors (volunteers) to observe and guide attendees about the correct disposal of waste. • Low waste posters. • Low waste expo program message. • Low waste outcomes reported at post-expo “Thank You” afternoon tea for volunteers and expo committee meetings.
Waste education trailer (Figures 2 & 3)	<ul style="list-style-type: none"> • Waste experts (volunteers) to engage face-to-face with the public on waste issues. • Display posters and information leaflets. • Litter sculpture net showing waste found in waterways. • Give-aways such as rulers made from recycled ink cartridges. • Wide range of waste games and interactive activities, such as recycling, wetlands and waste separation games.
Expo stalls (Figure 4)	<ul style="list-style-type: none"> • “Watch Your Waste” stall to address a wide range of waste management actions like worm farming, composting, organic gardening and the sale of Keep Cups. • All stall holders informed in repeated contexts that the expos are low waste events and all stalls are strongly encouraged to adopt this approach. • Expo Planning Committee to approach presenters/stall holders who model ‘low waste, for example, wood off-cuts recycled into toys; art projects that recycle and reuse materials.
Waste surveys	<ul style="list-style-type: none"> • Volunteers interview expo attendees about waste understandings.
Activities modelling reuse and recycling (Figure 5)	<ul style="list-style-type: none"> • A wide range of activities to be provided for attendees that explicitly and implicitly promoted reuse and recycling. Include activities such as cardboard chaos, floating and sinking experiments using recycled objects, craft activities like clay turtles that are waste free, and recycled pavers for environmental artworks. • “Sam the Can” and the turtle costumes to be employed to promote recycling and discussions about the detrimental impact of waste on animals.
Low waste approach to the provision of food and water	<ul style="list-style-type: none"> • Provide water stations with reusable cups rather than disposable cups, with volunteers washing cups ready for reuse. • Provide one BBQ station where food items were purchased in bulk to minimise waste ‘packaging’.

	<ul style="list-style-type: none"> • Liaise with a nearby cafe to review waste management processes, with support given to café, including the provision of Keep Cups and bins to encourage correct waste separation behaviour.
Waste audits (Figure 6)	<ul style="list-style-type: none"> • Conduct end-of-expo waste audits to assess the effectiveness of the low waste messaging and correct separation of waste.

Numerous methods were employed to evaluate the effectiveness of the waste management strategies employed at the expos, including measurement of waste generated during the events, waste surveys, photographic evidence and anecdotal feedback. The surveys were administered during the expos. The effectiveness of these strategies will be discussed below.



Figure 5. The two-bin systems provided at the Expo with signage to help participants separate waste correctly.

Bin Audit Results 2009-2016

A waste audit was conducted at the end of each expo to assess the effectiveness of the signage, waste survey and other strategies employed. All waste from both the green and yellow bins was weighed in biodegradable/compostable bin liners, sorted and the level of contamination between recycled and non-recyclables recorded (Figure 6). Table 2 and Figure 7 present the cumulative waste results for the last eight years.



Figure 6. Expo volunteers auditing and weighing the content of biodegradable bin bags as part of the bin audit.

Table 2. Summary of Waste Audits 2009 – 2017.

Year	Number of Attendees	Compostable (Green Bin) (Kg)	Recyclable (Yellow Bin) (Kg)	Total Waste Generated (Kg)	Total waste to Landfill (Kg) Based on levels of Contamination	Total Waste Generated (Kg/person)
2009	~ 300	2.8	4.3	7.1	2.8	0.024
2010	~ 1000	11.6	3.9	15.5	1.0	0.016
2011	~ 1200	6.8	4.8	11.6	3.6	0.010
2012	2082	11.01	8.07	19.08	1.14	0.009
2013	~2500	6.25	5.98	12.23	1.43	0.005
2014	~3000	12.85	8.25	21.1	1.88	0.007
2015	2800	10.55	6.35	16.9	1.8	0.006
2016	3000	14.1	6.85	20.95	3.28	0.007
2017	3000	7.59	2.25	9.84	n/a	0.004

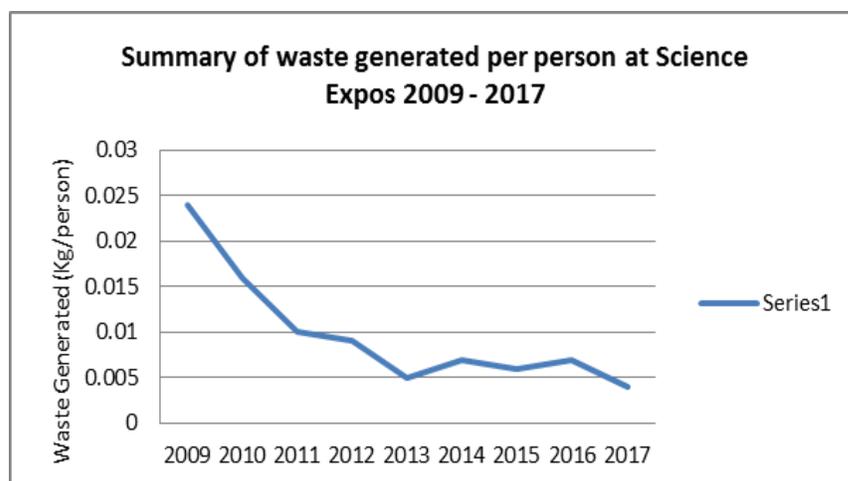


Figure 7. A graph illustrating the decline in waste generated per person over the Expo period 2009 – 2017.

Results show that despite increases in the number of attendees over the years, there has been an overall steady decline in the amount of waste generated at the events since 2009 from 0.024 kg/person to 0.006 kg/person in 2015. There was a slight increase in waste per/person in 2016. The level of contamination in the bins that year indicated there was an increase in compostable coffee cups and take-away waste from the nearby café. This identified the need to focus on the correct disposal of bio-cups in 2017, as the majority were in the yellow bin but they are not recyclable. Overall however, it appears that the ‘low waste’ initiatives to raise awareness about the importance of waste minimization, as well as how to correctly separate waste, were effective.

Waste Survey Results 2011 – 2016

Waste surveys were conducted during the expos by volunteers to collect data regarding the success of low waste event promotions and participants' knowledge about waste issues. Participants were asked whether they knew that the Expo was a 'Low Waste' event and what that meant to them. Results indicate that overall, the majority were aware that the event was 'Low Waste' (Figure 8) and had a broad understanding of the meaning.

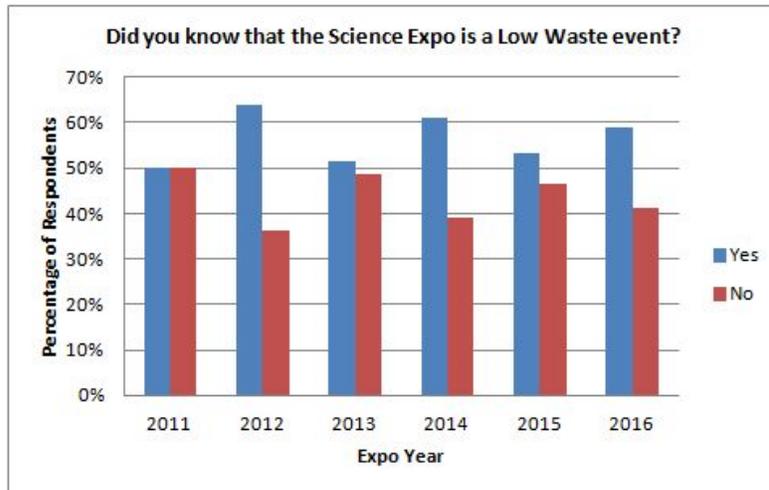


Figure 8. Participants' responses from 2011 - 2016 indicating whether they knew the Expo was a 'Low Waste' event.

What does a 'Low Waste' event mean to you? Some of the feedback included:

- *Reduced amount of things getting thrown out - cleaner environment;*
- *Education, clear signage, different bins, stalls that don't make a lot of waste;*
- *That the minimum amount of product is taken to landfill;*
- *Minimising waste & focus on recycling;*
- *A low waste event is an event that attempts to produce as little waste as possible;*
- *Reduced waste - less damage to the environment;*
- *Using less and recycling;*
- *Minimise the use of plastic goods;*
- *Not much plastics and excess rubbish;*
- *Minimising waste ending up in landfill; and*
- *Bring a bag, recycle waste.*

From 2012, participants were also asked whether they had visited the *Watch your Waste* stall and whether they found it interesting. Figure 9 shows that, of those who had visited the stall, the majority found the information presented interesting and Table 3 lists some of the information that was new to participants.



Figure 9. Responses to whether participants found the Watch your Waste stall interesting.

Table 3. Information that was new to participants.

Survey respondents were asked to describe a piece of information from the Stall that they didn't already know:

2011	Not included in survey
2012	<p><i>What we can place in which bin.</i></p> <p><i>All water that we use ends up in the river.</i></p> <p><i>That councils have different rules for recycling. That Canning council is not part of a regional council.</i></p> <p><i>Hazardous materials.</i></p> <p><i>Rules for household bins in metro area; bottles making plastic bags.</i></p> <p><i>Sustainable energy.</i></p> <p><i>Can discard lids from bottles in recycling & jars as no need to be pristine.</i></p> <p><i>Worm farming - maintenance for our worm farm.</i></p> <p><i>Do not place fluorescent lights in your recycling bin - contact local light recycler directly.</i></p>
2013	<p><i>The dolphin - strong impact on seeing it with the fishing line - good prop to initiate conversation - brought it to the child's level. Also photogenic and [photo is a] good reminder for the future.</i></p> <p><i>Separating correctly.</i></p> <p><i>Bat poo smells really bad.</i></p> <p><i>Kids learn catchment model, net with rubbish.</i></p> <p><i>Kids learned something.</i></p> <p><i>How much litter in the river.</i></p> <p><i>Littering impacts.</i></p>
2014	<p><i>Lids off milk containers.</i></p> <p><i>Compostable bin liners.</i></p> <p><i>Some of the recycle right features.</i></p>
2015	<p><i>Battery recycling.</i></p> <p><i>The biodegradable rubbish bags and rulers made of ink cartridges.</i></p> <p><i>Recycling process information.</i></p> <p><i>You can add shredded pizza boxes to a worm farm.</i></p> <p><i>Bio degradable bags.</i></p>

	<p><i>Compost [bags] in place of plastic bags.</i></p> <p><i>Compostable bin liners.</i></p> <p><i>Recycling cartridges into rulers.</i></p> <p><i>Compostable bags.</i></p> <p><i>Found the games great ideas, I could use in the classroom.</i></p> <p><i>Gizmo's escape.</i></p> <p><i>When litter hits the ocean, animals will suffocate, suffer and die.</i></p> <p><i>Water run-off.</i></p>
2016	<p><i>Learnt about anaerobic digestion of organic waste.</i></p> <p><i>The information that makes you more aware of the environment.</i></p> <p><i>Biodegradable rubbish bags.</i></p> <p><i>I liked the schematic of the anaerobic digester.</i></p> <p><i>That you can make rulers out of ink cartridges.</i></p> <p><i>Composting properly.</i></p> <p><i>Different councils process the waste differently.</i></p> <p><i>Kids learnt more about recycling.</i></p> <p><i>Where to dispose of polysterene.</i></p>

Knowledge questions within the survey included those asking participants about the relationship between recycling and greenhouse gases and whether they thought recycling reduced the impact of climate change. Results show that the majority of respondents thought that recycling reduced greenhouse gases, and apart from 2011, all respondents indicated that they thought recycling reduced the impact of climate change (Figures 10 & 11). This suggests that of those surveyed, the majority of respondents understood the relationship between recycling and climate change. When asked, survey respondents indicated that recycling was important to them (Figure 12).

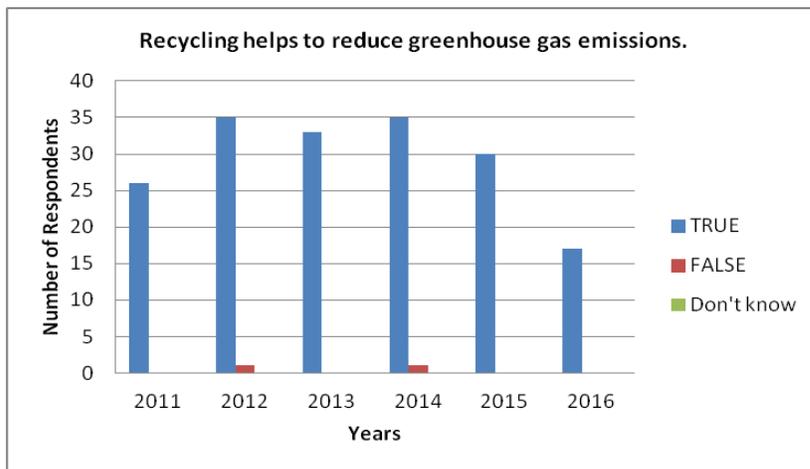


Figure 10. Responses from 2011 - 2016 to whether recycling helps reduce greenhouse gases.

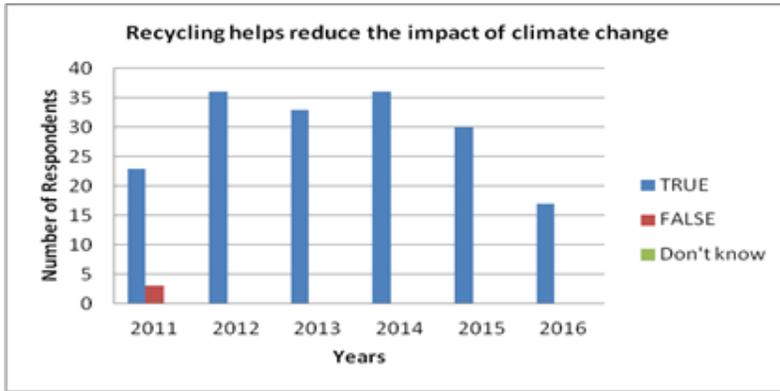
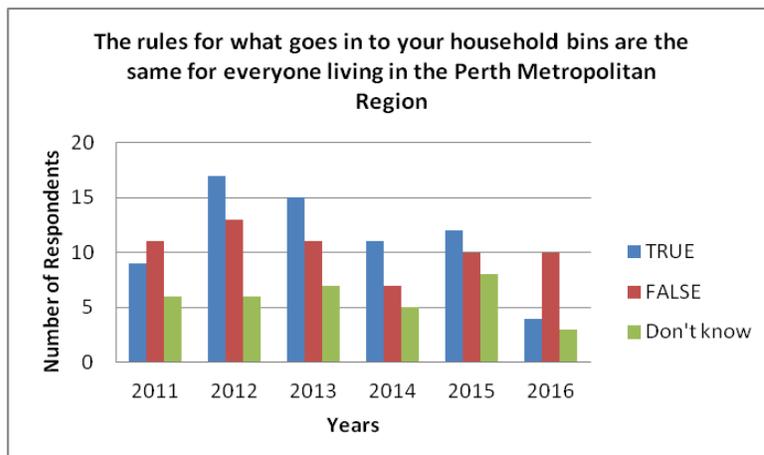


Figure 11. Responses to whether recycling helps reduce the impact of climate change.



Figure 12. Responses to whether separating waste is important to the participant.

Within the Perth metropolitan area, household waste is managed by a number of regional councils, each operating different processing facilities. As a result, the rules for how to separate household waste in the home vary depending on where people live. To help develop the information presented within the Watch your Waste stall participants were asked whether they thought the rules for separating their waste at home was the same throughout the Perth metropolitan area (Figure 13). This figure indicates that there has been consistent confusion about the rules for separating household waste and that up to 2015 the majority of respondents were incorrect, while in 2016 the majority of respondents answered correctly.



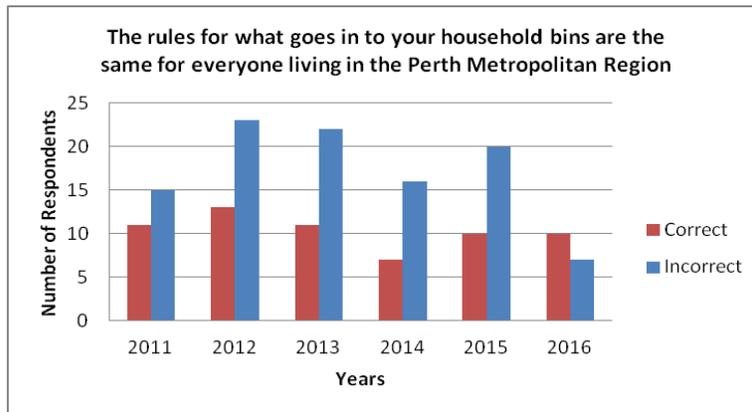


Figure 13. Responses indicating confusion about the recycling rules in the Perth Metropolitan Area.

These graphs show the effectiveness of various waste initiatives, with the majority of respondents being positively disposed to receiving waste messages. They also provide a broader understanding of participants' general knowledge about waste issues such as a lack of knowledge about rules for separating waste, and help direct the focus of future expo waste education initiatives. The results enabled organisers to evaluate initiatives implemented and provided feedback for planning future expos.

Photographic Evidence, Expo Surveys and Anecdotal Feedback

In addition to the waste survey, Expo participants were encouraged to complete an Expo feedback survey about the overall experience before leaving. Figures 14 - 16 illustrate results for some of the questions. Photographic evidence and anecdotal feedback reflect high levels of engagement across all age groups and backgrounds of the general public (Figure 14). Furthermore, expo survey findings indicated that attendees were very likely to have not previously attended such events, so the expos were providing information to new audiences (Lewis, Bullimore, Krupa, Gaschk, & Pearson, 2014). Anecdotal feedback reported to organisers provided another useful source of information about expo outcomes. Comments included:

- *Seeing families enjoying learning about the environment.*
- *So many good things for kids and adults to learn about!*
- *A fantastic community family atmosphere.*

This feedback supports the broad positive community impact of the expos.



Figure 14. Eco Faeries conducting a stall using natural and recycled materials, with a wide age range of participants.

Graphs (Figures 15 & 16) from the 2016 expo survey show high levels of enjoyment as well as a strong intention to attend a future expo. Overall expo satisfaction survey findings on 'level of enjoyment' of the event (2016, N = 75) and 'intention to attend again' are presented below.

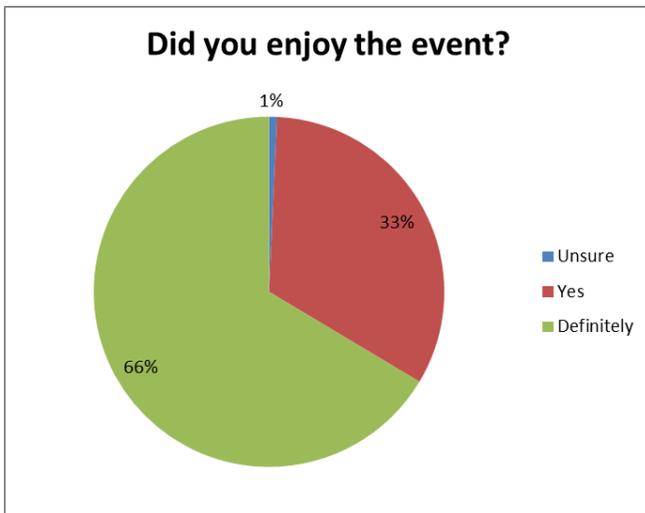


Figure 15. Graph showing participant responses for enjoyment of Expo.

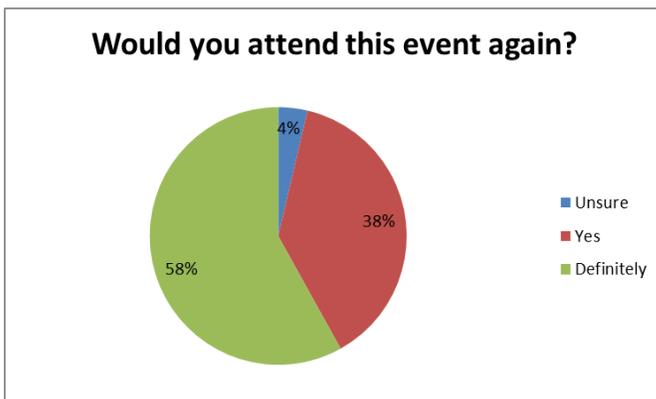


Figure 16. Graph showing participant responses for whether they would attend a future Expo.

Clearly such events capture the attention of the general public, thereby providing excellent opportunities to promote and model ‘low waste’ behaviours.

Outcomes

Outcomes of the low waste initiatives identified in Table 1 are summarised in Table 4. The provision of low waste information, access to the waste education trailer, activities at the Watch your Waste stall, materials used at other Expo stalls, the provision of low waste approaches to food and drink, activities modelling reuse and recycling, and conducting the waste surveys and audits all contributed to the success of low waste initiatives adopted at the Expos.

Table 4. Outcomes in terms of Expos low waste aim.

Strategy	Key Outcomes and Evidence
Provision of low waste information	<ul style="list-style-type: none"> • Presenters and stall holders attending the Expo Briefing and “Thank You” afternoon tea after the expo indicated how they personally contributed to the ‘low waste’ theme and made suggestions for improvements the following year. • Bin monitors indicated the majority of attendees used the correct bins for their waste. • 65% of the waste survey (2016) respondents said they had noticed the signs about how to dispose of waste at the expo. • Advertising banners used student’s artworks, thereby engaging children in expo themes and encouraged their attendance with their families. • Respondents to the waste surveys stated they knew the expo was a low waste event from: <ul style="list-style-type: none"> ➢ Expo flyer ➢ Advertising ➢ Posters ➢ Signage at event • The majority of waste survey respondents indicated understandings of the meaning of ‘Low Waste’ event. Typical comments were: <ul style="list-style-type: none"> ➢ An event which is held to raise waste awareness; ➢ Education, clear signage, different bins, stalls that don't make a lot of waste; ➢ Minimising waste & focus on recycling; ➢ Low waste flow to landfill; ➢ Teaching the community how to reduce waste; ➢ Eco-friendly activities that help the environment. • Typical comments from people attending the expo indicated they most enjoyed: <ul style="list-style-type: none"> ➢ Lots of free hands-on activities for kids; ➢ Fun with so much learning; and ➢ Everything!!
Waste education trailer and ‘Watch your Waste’ stall	<ul style="list-style-type: none"> • Volunteer waste experts reported public interest in waste issues raised by trailer displays. They experienced a continuous flow of visitors to the trailer throughout the

	<p>expos.</p> <ul style="list-style-type: none"> • The stall provided an opportunity to engage with the community and develop critical thinking about a range of issues associated with waste generation and management. • Give-aways such as rulers made from recycled ink cartridges were popular. • Waste games and interactive activities were popular and were in continuous use throughout the expos. • Compostable bin liners were given away to raise awareness about alternatives to plastic and were well received • Waste survey respondents indicated they found the waste stall interesting. ‘Watch your Waste’ stall presenters experienced a continual stream of visitors. The different expos focused on different aspects of waste management, such as worm farming, composting, organic gardening, waste technologies and impacts of litter. • Over 100 Keep Cups were sold at the expos and given away as prizes.
Expo stalls	<ul style="list-style-type: none"> • All stall holders were informed and strongly encouraged in repeated contexts that the expos were low waste events. Overall, the vast majority of stalls modelled this approach, for example: wood off-cuts recycled into toys and art projects reuse and recycle materials.
Waste surveys	<ul style="list-style-type: none"> • The waste survey has collected information on understandings about waste for 6 years (2011-2016), adding to information guiding the Expo Planning Committee. • Respondents indicated they were aware it was a low waste event. • People attending the ‘Watch your Waste’ stall were asked to describe a piece of information from that stall that they didn't already know. Table 3 listed a wide range of new understandings gained from attending the stall.
Activities modelling reuse and recycling	<ul style="list-style-type: none"> • Introduction of two-bin system with signage to encourage waste separation for Expo participants • Stalls and activities and selected for the expos used natural and recycled materials rather than commercial products. • A wide range of activities promoted reuse and recycling were provided at all expos, such as cardboard chaos, floating and sinking experiments using recycled objects, craft activities like making clay turtles that are waste free, making creatures out of seed pods and other natural materials, and recycled pavers for environmental artworks. • Costumes (aluminium can and turtle) attracted the attention of the attendees resulting in discussions about the impact of waste on the environment. Costume wearers were a novelty, being enthusiastically received as they walked around the expo engaging with the general public

	about these issues.
Low waste approach to the provision of food and water	<ul style="list-style-type: none"> Attendees used the water stations provided however expo survey feedback documented requests every year for soft drink and tea/coffee facilities. Expo organisers continued to provide the water option for health and waste minimisation reasons and have not responded to participant requests in this case. A BBQ station was provided and proved extremely popular, selling all stocks every year. Again expo survey feedback documented requests each year for more food stalls. Expo organisers continued to provide the BBQ option for waste minimisation and expo purpose reasons, so have not responded to participant requests in this case either. In 2015 a trial popcorn stall was permitted but it produced considerable litter and was not repeated. Attendees could obtain different food and drink options from a nearby café. Compostable cups and take-away food waste from the café appeared to negatively impact on expo waste per/person results. Discussions to reduce this waste will be conducted with the café owner before the next Expo.
Waste audit	<ul style="list-style-type: none"> Despite dramatic increases in the number of attendees over the eight years, there has been an overall steady decline in the amount of waste generated at the expos since 2009 from 0.024 kg/person to 0.006 kg/person in 2015. A slight increase in waste per/person in occurred in 2016 (0...7Kg/person) and appeared to be related to café sales not expo stalls. Despite this minimal increase, it can be considered that there is a low level of waste generation for an event of this size

The above evidence clearly demonstrates progress has been achieved by the various ‘low waste’ initiatives adopted at the expos. These initiatives sought to raise awareness about the importance of waste minimisation, correct waste separation behaviours and the need to reduce waste going to landfill. Despite this success, the Expo Planning Committee identifies new and ongoing issues of concern regarding waste management each year. Furthermore, it remains a challenge to measure long term participant outcomes in terms of whether it changed their behaviour in other contexts. These issues inform future decision making so that further improvements can be achieved.

Conclusion

A diverse spectrum of participants attended the expos which provided them with a wide range of hands-on, open-ended science and sustainability engagement opportunities. Expo waste findings show an overall steady decline in the amount of waste generated at the expos, despite large increases in the number of attendees. Evaluation findings demonstrated high levels of satisfaction by all stakeholders and activities that facilitated rich conversations. The organisation of the expo involved an innovative and holistic approach in which low waste initiatives were embedded in all decision-making and

activities. This was found to be highly effective in promoting the 'low waste' message to all age groups in a diverse community. Clearly, the 'low waste' initiatives employed at the expos resulted in significant reductions in waste going to landfill, while engaging the general public in meaningful discussions about waste management.

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