



**FINAL REPORT**

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## Plastic Bags Ban Options – Cost Benefit Analysis

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Environment, Land, Water and Planning

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# Executive summary

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## Overview

Litter associated with single use plastic shopping bags is an issue of growing concern in Victoria and globally. The Victorian Department of Environment, Land, Water and Planning (DELWP) has engaged Marsden Jacob Associates (Marsden Jacob) to undertake a cost benefit analysis (CBA) and distributional impact assessment of options to reduce the use of plastic shopping bags in Victoria, with the aim of mitigating their adverse impacts on litter and the environment.

Based on our preliminary analysis, we find that taking action to reduce **all** plastic shopping bags and switching to reusable shopping bags is likely to deliver a net economic benefit to Victoria.

## Options and approach

Marsden Jacob has assessed the following options in the CBA:

- Option 1: status quo with no specific regulation or management of plastic shopping bags.
- Option 2: a ban on plastic shopping bags with a thickness of less than 35 microns, known as high density polyethylene (HDPE) shopping bags, and biodegradable shopping bags.
- Option 3: a ban on HDPE and biodegradable shopping bags and the major retailers agree to a voluntary code of practice on reducing the use of all other plastic shopping bags, referred to in this report as low density polyethylene (LDPE) shopping bags.
- Option 4: a ban on all plastic shopping bags (HDPE and LDPE) and biodegradable shopping bags.

HDPE shopping bags are the type of plastic shopping bags commonly available in supermarkets in Victoria, free of charge at the checkout. They are also commonly used in convenience stores and takeaway food outlets. LDPE shopping bags are more commonly available at boutique retail outlets such as apparel and electronic stores and department stores.

In this project Marsden Jacob conducted an assessment of the incremental costs and benefits of Option 2 to Option 4, relative to Option 1. We calculated the net present value (NPV) and the benefit cost ratio (BCR) of Option 2 to Option 4, over 5 year and 10 year timeframes. Under Option 2 to Option 4, we assumed a ban on plastic shopping bags is announced on 1 July 2017 and takes effect on 1 July 2018. Sensitivity analysis was also undertaken to test how the net results are affected by changes to key assumptions.

In the compressed timeframe available for this cost benefit analysis, we drew on publicly available information on the use and flow of plastic shopping bags, and costs and benefits associated with the different options. The sensitivity analysis shows that the results are highly sensitive to a number of assumptions, in particular the results are most sensitive to the assumed costs of plastic shopping bags and its alternatives due to the significant volume of plastic shopping bags in use.

## Results

Our key findings are:

- Option 1: Under the status quo (Option 1), with no specific management on the use of plastic shopping bags, the use of HDPE shopping bags would increase by about 1.61% per year from 2016-17 to 2026-27, with HDPE bag consumption increasing from approximately 1.6 billion bags per year to 1.9 billion bags per year. The use of LDPE shopping bags is assumed to increase by about 0.22% per year during the same period from about 130 million bags per year to 133 million bags per year.
- Option 2: Banning HDPE shopping bags and biodegradable bags under Option 2 delivers the weakest result of the three alternative options. We estimate a net economic benefit for Option 2 of \$2.0 million (NPV) over 10 years and a net economic cost of \$0.7 million (NPV) over 5 years. The BCRs over 10 years and 5 years are 1.01 and 0.99 respectively. Under Option 2, the benefits to consumers (reduced HDPE bag costs) and the environment (avoided litter) of banning HDPE bags are offset to some extent by an increase in the take-up of LDPE bags.
- Option 3: Banning HDPE bags and introducing a code of practice for LDPE bags under Option 3 delivers either a net economic benefit or net cost depending on the period of the analysis. In NPV terms, we estimated a net economic benefit for Option 3 of \$15.3 million over 10 years and a net economic cost of \$1.8 million over 5 years. The BCRs over 10 years and 5 years are 1.07 and 0.99 respectively. Compared to Option 2, there are additional benefits to consumers and the environment from consumers switching from LDPE to re-useable shopping bags.
- Option 4: Banning all plastic bags under Option 4 delivers the highest net economic benefit, with more consumers substituting reusable shopping bags for plastic shopping bags. We estimate a net economic benefit for Option 4 of \$64.4 million and \$28.5 million in NPV terms over 10 years and 5 years respectively. The BCRs over 10 years and 5 years are 1.28 and 1.26 respectively.
- Sensitivity analysis: The estimated NPV results are highly sensitive to assumptions about the costs of different types of shopping bags and the value of avoided litter. Sensitivity analysis applying different assumptions to these key variables gives results for Option 4 (for example) ranging from a net economic cost of \$88.2 million in NPV terms over 10 years, to a net economic benefit of \$221.0 million in NPV terms over 10 years (see Section 4.5).
- Consumers would ultimately bear the majority of the net benefit or cost under all options, ranging from a net economic cost to consumers of \$6.2 million in NPV terms over 10 years under Option 2, to a net economic benefit of \$55.3 million in NPV terms over 10 years under Option 4 (see Section 5).
- The retail industry would incur the highest cost under Option 3, about \$41.4 million in NPV terms over 10 years, under a voluntary code to reduce the use of LDPE shopping bags. The retail industry may ultimately pass these costs on to consumers.
- The community and the environment would benefit from reduced litter, ranging from \$10.0 million in NPV terms over 10 years under Option 2, to \$13.0 million in NPV terms over 10 years under Option 4.

Because of the time constraints associated with the project the results presented in this report should be regarded as preliminary. Subsequent analysis would benefit from industry consultation to gain a better understanding of plastic shopping bag consumption numbers and trends, and industry costs under the various options.

# 1. Introduction

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Marsden Jacob Associates (Marsden Jacob) has been engaged by the Victorian Department of Environment, Land, Water and Planning (DELWP) to undertake a cost benefit analysis (CBA) and distributional impact assessment of options to reduce the use of plastic shopping bags in Victoria. Specifically, we've been asked to assess the following options:

- Option 1: status quo with no specific regulation or management of plastic shopping bags.
- Option 2: a ban on plastic shopping bags with a thickness of less than 35 microns, known as high density polyethylene (HDPE) shopping bags, and biodegradable shopping bags.
- Option 3: a ban on HDPE and biodegradable shopping bags and the major retailers agreeing to a voluntary code of practice on reducing the use of all other plastic shopping bags, referred to in this report as low density polyethylene (LDPE) shopping bags.
- Option 4: a ban on all plastic shopping bags (HDPE and LDPE) and biodegradable shopping bags.

HDPE shopping bags are the type of plastic shopping bags commonly available in supermarkets in Victoria free of charge at the checkout. They are also commonly used in convenience stores, takeaway food outlets and many smaller retailers. LDPE shopping bags are more commonly available at boutique retail outlets such as apparel and electronic stores and department stores and tend to be thicker than HDPE bags.

For the CBA, we conducted an assessment of the incremental costs and benefits of Option 2 to Option 4, relative to Option 1. We calculated the net present value (NPV) and the benefit cost ratio (BCR) of Option 2 to Option 4, over 5 year and 10 year timeframes. Under Option 2 to Option 4, we assumed a ban on plastic shopping bags takes effect on 1 July 2018 after a 12 month transition period.

In the time available for the CBA, we drew on publicly available information on the use and flow of plastic shopping bags from previous reviews initiated by the former Environment Protection and Heritage Council (EPHC) and the National Litter Index. Publicly available information from other Australian jurisdictions that have introduced a ban on plastic shopping bags provided some data on the potential impacts of a ban. There were also some assumptions requested by DELWP.

The major costs and benefits relevant for our analysis include:

- savings from the cost of HDPE and biodegradable shopping bags;
- costs of alternative plastic shopping bags (including LDPEs and reusable bags);
- avoided litter costs; and
- avoided landfill operating costs.

The structure of the rest of this report is as follows:

- Chapter 2: background on previous reviews into plastic shopping bags and the experience of Australian jurisdictions that have implemented a ban on HDPE shopping bags.
- Chapter 3: discussion of the options.
- Chapter 4: results of our cost benefit analysis, including sensitivity testing.
- Chapter 5: distributional impacts from a ban under the options.

## 2. Background

Litter associated with single use plastic shopping bags is an issue of growing concern in Victoria and globally. In 2002, the former Environment Protection and Heritage Council (EPHC) sought to reduce the environmental impacts of plastic bags in Australia. Subsequently, a voluntary code of practice was entered into by major retailers in 2002 with the aim of reducing plastic shopping bags by 50%. The voluntary code of practice operated from 2003 to 2005. During that time, major retailers reduced plastic shopping bag use by between 41% to 44% through educational campaigns and making available alternative shopping bags.<sup>1</sup>

In 2006, the EPHC committed to phasing out plastic bags by the end of 2008 and to consider regulatory options to achieve this. However, in April 2008, after consulting on a Regulatory Impact Statement and considering that the costs would outweigh the benefits, the EPHC resolved not to take regulatory action to phase out plastic bags.<sup>2</sup>

Although the Australian Government decided not to take action, four states and territories subsequently decided to implement a ban on plastic shopping bags. South Australia, the Australian Capital Territory, Northern Territory and Tasmania have all implemented a ban on plastic shopping bags with a thickness of less than 35 microns, excluding biodegradable shopping bags and non-carry bags.

A rationale for government intervention on plastic shopping bags is discussed briefly below, followed by a summary of the experiences from the four jurisdictions.

### 2.1 Rationale for intervention

As with all government interventions, action taken by government to control the consumption and/or disposal of plastic bags can generally only be justified if market failure is occurring because the market is not delivering an efficient outcome. Intervention may also be justified if key government objectives (e.g. relating to the delivery of services, social equity etc.) can only be met through an intervention.

At a broad level there are four main types of market failures: externalities, information failures; public goods and natural monopolies (see Box 1). Government intervention on the consumption of single use plastic bags may be justified because littering of plastic bags harms social amenity and negatively affects the environment (e.g. ingestion of plastic by fauna). The costs of cleaning up litter and minimising its resultant environmental harm are mostly borne by governments. This means the costs are not borne by the producers or consumers of the bags so they do not have a financial incentive to minimise the littering.

It is important to note however, that **the presence of market failure does not of itself warrant government intervention**. Intervention can introduce its own distortions and can be costly, especially if the intervention is poorly targeted. Thus it is **important to establish that any proposed interventions by government are likely to produce net benefits to society** – detailed in later sections of this report.

<sup>1</sup> <http://www.scew.gov.au/resource/ephc-archive-product-stewardship>

<sup>2</sup> Ibid.

### Box 1: Types of market failure

**Externalities** occur when the economic activity of one organisation or individual generates a positive or negative impact for another without there being a market price associated with the impact.

**Information failures** occur when there is insufficient or inadequate information about issues such as price, quality and availability for consumers, firms or investors to make well-informed decisions.

**Public goods** are goods or services that are "nonrivalrous" and "nonexcludable", i.e. individuals cannot be effectively excluded from using them and use by one person does not reduce their availability to others. Examples include street lighting and public litter bins. The nature of a public good means that it will generally need to be provided by government.

**A natural monopoly** occurs when it is more efficient for one firm to supply a good or a service than it is for two or more firms to supply that service.

## 2.2 Experiences of other jurisdictions

### 2.2.1 South Australia

South Australia introduced a ban on plastic shopping bags with a thickness of less than 35 microns on 4 May 2009. The ban does not include biodegradable shopping bags (tested in accordance with a relevant standard).<sup>3</sup> The ban came into effect following a four-month transition period. During the transition period, retailers were required to provide alternatives to plastic bags.

All retailers are subject to the ban and penalties apply for a retailer found not complying. An independent review of the ban was conducted in November 2012.<sup>4</sup> Key findings included:

- 65% of surveyed consumers brought their own shopping bags to the supermarket and 24% of consumers purchased alternative bags from the supermarket.
- 50% of the retailers did not have any implementation issues. Some retailers cited issues such as additional costs from stocking different bags in different states, unused plastic bags, redesigning checkouts and additional theft.
- Retailers felt the Government's information and marketing campaign was important in the implementation of the ban.
- The purchase of bin liners increased following the ban, from 15% of surveyed customers purchasing bin liners to 80% of surveyed customers.
- 45% decrease in plastic bag litter count from 2008-09 to 2011-12.
- Strong compliance by retailers with less than 10% of retailers having failed part of an inspection with one expiation notice issued since 2008-09.<sup>5</sup>

<sup>3</sup>

[https://www.legislation.sa.gov.au/lz/c/a/plastic%20shopping%20bags%20\(waste%20avoidance\)%20act%202008/current/2008.45.un.pdf](https://www.legislation.sa.gov.au/lz/c/a/plastic%20shopping%20bags%20(waste%20avoidance)%20act%202008/current/2008.45.un.pdf).

<sup>4</sup>

[http://www.zerowaste.sa.gov.au/upload/resource-centre/publications/plastic-bag-phase-out/PBActReview\\_maspin\\_Nov2012\\_2%20-%20final.pdf](http://www.zerowaste.sa.gov.au/upload/resource-centre/publications/plastic-bag-phase-out/PBActReview_maspin_Nov2012_2%20-%20final.pdf).

<sup>5</sup>

DELWP advises that many of these are at shows and markets that attract interstate traders.

### 2.2.2 Australian Capital Territory (ACT)

The ACT introduced a ban on plastic shopping bags on 1 November 2011. The ban applies to plastic shopping bags with a thickness of less than 35 microns. Biodegradable shopping bags are not included in the ban. Similar to South Australia, the ACT provided a four-month transition period prior to the ban taking effect. Retailers must provide alternatives to plastic bags.<sup>6</sup>

Independent reviews of the ban were conducted in 2012 and 2014. In the 2012 review, the key findings were:<sup>7</sup>

- 84% of surveyed customers brought their own shopping bags compared to 44% prior to the ban.
- 41% reduction in the units of plastic shopping bags distributed by retailers, based on a sample of data collected from retailers.
- Strong compliance by retailers with four breaches detected since the ban.

In the 2014 review, the key findings were:<sup>8</sup>

- 79% of surveyed customers brought their own shopping bags most of the time and 17% of surveyed customers brought their own shopping bags some of the time.
- Significant increase in the sale of reusable boutique bags and “reusable woven bags”.<sup>9</sup>
- 36% reduction in landfill from all plastic bags (including single use, reusable plastic bags, bin liners, and a proportion of “reusable woven bags”).
- A drop in the amount of plastic bag litter found in audits, from an average of “22 plastic bags” before the ban to an average of “9 plastic bags” after the ban.
- Strong compliance by retailers with only four breaches detected since the commencement of the ban.<sup>10</sup>

A recent visit to the ACT by the project team revealed that some supermarkets are offering alternative plastic bags (typically LDPE) free of charge which confirms that some substitution is occurring.

### 2.2.3 Northern Territory (NT)

A ban on plastic shopping bags with a thickness of less than 35 microns was introduced in the NT on 1 September 2011 after a four-month transition period.<sup>11</sup> Biodegradable bags are not included in the ban. All retailers are required to comply.

An independent review of the ban was carried out in 2014.<sup>12</sup> Key findings included:

- 46% of shoppers brought their own bags and 38% obtained at least one bag from the store.

<sup>6</sup> <http://www.legislation.act.gov.au/a/2010-49/20110701-46318/pdf/2010-49.pdf>, Section 2.

<sup>7</sup> [http://www.environment.act.gov.au/\\_data/assets/pdf\\_file/0004/577057/12-26082\\_Plastic\\_bag\\_review\\_report.pdf](http://www.environment.act.gov.au/_data/assets/pdf_file/0004/577057/12-26082_Plastic_bag_review_report.pdf).

<sup>8</sup> [http://www.environment.act.gov.au/\\_data/assets/pdf\\_file/0017/602018/20140407-ESDD\\_BagBan\\_Report\\_2014\\_Final.pdf](http://www.environment.act.gov.au/_data/assets/pdf_file/0017/602018/20140407-ESDD_BagBan_Report_2014_Final.pdf)

<sup>9</sup> Reusable woven bags are manufactured from materials such as nylon, polypropylene or PVC.

<sup>10</sup> No new breaches since the 2012 review.

<sup>11</sup> <http://www.ntepa.nt.gov.au/waste-pollution/plastic-bag-ban>

<sup>12</sup> <https://ntepa.nt.gov.au/waste-pollution/plastic-bag-ban>

- 76% of observed retailers still offered an alternative plastic bag for free (thicker HDPE bags, LDPE bags or paper bags) to customers.<sup>13</sup>
- Retailers did not report major challenges, some of the issues faced included training staff, limited resources to implement the ban, and leftover stock of the banned plastic bags.
- Based on information provided by retailers, the estimated average annual sale of reusable shopping bags increased from 256,000 before the ban to over 7 million. Similarly, the estimated average annual sale of bin liners increased from 8 million to over 22 million.
- Based on information gathered for the National Litter Index, the average number of lightweight plastic bag found dropped from 41 before the ban, to 17 after the ban.

#### 2.2.4 Tasmania

A ban on plastic shopping bags (with a thickness of less than 35 microns) was introduced in Tasmania on 1 November 2013 and applies to all retailers. Biodegradable shopping bags that meet Australian Standard 4376 are not subject to the ban.<sup>14</sup>

No review of the Tasmanian Scheme has been identified.

#### 2.2.5 What can we learn from jurisdictions that have implemented bans?

Several key points emerge from reviews of the bans that have been implemented elsewhere in Australia:

1. The bans on plastic bags significantly reduced the incidence of plastic bag littering.
2. The bans on plastic bags increased the proportion of shoppers that brought their own shopping bags.
3. In the NT and ACT some supermarkets are offering alternative plastic bags free of charge which indicates that some substitution is likely to be occurring.
4. The plastic bag bans have significantly increased the number of bin liners that are being purchased.

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<sup>13</sup> 17 retail stores were observed.

<sup>14</sup> <http://epa.tas.gov.au/policy/plastic-bags>

## 3. Options to Reduce Plastic Bags

The Victorian Department of Environment, Land, Water and Planning (DELWP) has requested that four options associated with the consumption and littering of single use plastic shopping bags in Victoria be examined:

- Option 1: status quo with no specific regulation or management of plastic shopping bags.
- Option 2: a ban on high density polyethylene (HDPE) plastic shopping bags with a thickness of less than 35 microns, and biodegradable shopping bags.
- Option 3: a ban on HDPE and biodegradable shopping bags and the major retailers agreeing to a voluntary code of practice on reducing the use of all other plastic shopping bags, referred to in this report as low density polyethylene (LDPE) shopping bags.
- Option 4: a ban on all plastic shopping bags (HDPE and LDPE) and biodegradable shopping bags.

These four options form the basis of the CBA and are discussed in more detail below. We also discuss briefly the stakeholders impacted under each of the options, with further discussion on distributional impacts included in Chapter 5.

### 3.1 Option 1 – status quo

Under this option, the current policy environment will continue until 2026-27 (the end of the evaluation period for the purpose of the CBA). There is currently no specific regulation or management of plastic bag use and we assume that this situation will continue.

The use of plastic shopping bags has increased in recent years and, in the absence of a ban, we assume an increasing trend in the use of plastic shopping bags over the evaluation period (based on forecast population growth and confidential data from previous analysis for other jurisdictions).

### 3.2 Option 2 – ban on HDPE and biodegradable shopping bags

A ban on plastic shopping bags with a thickness less than 35 microns is announced 1 July 2017 with a 12-month transition period, which means the ban would come into effect on 1 July 2018. The ban would apply to all retailers. Biodegradable plastic shopping bags would also be subject to the ban, however, all other types of non-carry HDPE bags (plastic bags without handles) – such as barrier bags - would be excluded, as would any other type of plastic bag such as bin liners, garbage bags and reusable polypropylene bags.

As experienced by other jurisdictions that have implemented a ban on HDPE bags, the Government will incur costs in legislating and enforcing the ban, and in conducting an education campaign for retailers and consumers. The retail industry will incur set up costs. Consumers may face additional costs from purchasing alternative bags (re-useable bags and/or LDPE bags). Consumers may also face additional costs to purchase plastic ‘bin liners’ used for the disposal of household waste, noting that household waste disposal is currently an important secondary use of HDPE bags.

### 3.3 Option 3 – ban HDPE and biodegradable shopping bags and major retailers agree to a code of practice to reduce use of LDPE shopping bags

This option is the same as Option 2 in assessing a ban on HDPE and biodegradable shopping bags. Additionally, under this option we assume major retailers would agree to a new voluntary code of practice to reduce the use of LDPE shopping bags by 50% by 2021 (from 2019). Under the 2002 national Code of Practice for the Management of Plastic Bags, major retailers agreed to reduce the use of HDPE bags by 50% by providing information to customers and by providing alternatives to HDPE bags in store. Under a new code of practice, the major retailers would similarly agree to provide information to customers about alternatives to LDPE bags, provide alternatives to LDPE bags in store, and provide LDPE recycling receptacles in store.

The stakeholders impacted under this option are broadly the same as Option 2. However, there would be a greater impact on department stores and similar retailers which tend to provide LDPE rather than HDPE bags to customers.

### 3.4 Option 4 – ban all plastic shopping bags

Under this option, all HDPE and LDPE shopping bags designed to carry goods from retailers where they were bought would be banned, including biodegradable bags. The ban would be announced on 1 July 2017 with a 12-month transitional period, which means the ban would take effect from 1 July 2018.

The stakeholders impacted under this option are broadly the same as Option 3.

## 4. Cost Benefit Analysis

This chapter presents the results of the cost benefit analysis (CBA) and compares the performance of options using two key metrics:

- Net Present Value (NPV), which is the Present Value (PV) of economic benefits delivered by the option less the PV of economic costs incurred.
- Benefit Cost Ratio (BCR), which is the ratio of the PV of economic benefits to PV of economic costs.

The NPV measures the expected benefit (or cost) to society of implementing the policy option expressed in monetary terms, whereas the BCR identifies the option that provides the highest benefit per unit of cost.

We conducted the CBA based on guidelines by the Victorian Department of Treasury and Finance and the estimates presented in this chapter are calculated on a Victorian basis. Our evaluation period is 2016-17 to 2026-27, with implementation of the options, including bans on the relevant plastic bags, assumed to take effect from 1 July 2018. Costs and benefits of Option 2 to Option 4 are assessed incrementally to Option 1 (status quo) over 5 year and 10 year timeframes. We have also conducted sensitivity analyses on the CBA results to test parameter values that could materially change the overall net result.

### 4.1 Key findings

The key findings from our analysis are:

- Option 1: Under the status quo (Option 1), with no specific management on the use of plastic shopping bags, the use of HDPE shopping bags would increase by about 1.61% per year from 2016-17 to 2026-27, with HDPE bag consumption increasing from approximately 1.6 billion bags per year to 1.9 billion bags per year. The use of LDPE shopping bags is assumed to increase by about 0.22% per year during the same period from about 130 million bags per year to 133 million bags per year.
- Option 2: Banning HDPE shopping bags and biodegradable bags under Option 2 delivers the weakest result of the three alternative options. We estimate a net economic benefit for Option 2 of \$2.0 million (NPV) over 10 years and a net economic cost of \$0.7 million (NPV) over 5 years. The BCRs over 10 years and 5 years are 1.01 and 0.99 respectively. Under Option 2, the benefits to consumers (reduced HDPE bag costs) and the environment (avoided litter) of banning HDPE bags are offset to some extent by an increase in the take-up of LDPE bags.<sup>15</sup>
- Option 3: Banning HDPE bags and introducing a code of practice for LDPE bags under Option 3 delivers either a net economic benefit or net cost depending on the period of the analysis. In NPV terms, we estimated a net economic benefit for Option 3 of \$15.3 million over 10 years and a net economic cost of \$1.8 million over 5 years. The BCRs over 10 years and 5 years are 1.07 and 0.99 respectively. Compared to Option 2, there are additional benefits to consumers and the environment from consumers switching from LDPE to re-useable shopping bags.

<sup>15</sup> The benefit to consumers of reduced HDPE bags are offset by the purchase of reusable bags and bin liners.

- Option 4: Banning all plastic bags under Option 4 delivers the highest net economic benefit, with more consumers substituting reusable shopping bags for plastic shopping bags. We estimate a net economic benefit for Option 4 of \$64.4 million and \$28.5 million in NPV terms over 10 years and 5 years respectively. The BCRs over 10 years and 5 years are 1.28 and 1.26 respectively.
- Sensitivity analysis: The estimated NPV results are highly sensitive to assumptions about the costs of different types of shopping bags and the value of avoided litter. Sensitivity analysis applying different assumptions to these key variables gives results for Option 4 (for example) ranging from a net economic cost of \$88.2 million in NPV terms over 10 years, to a net economic benefit of \$221.0 million in NPV terms over 10 years.

Because of the time constraints associated with the project the results presented in this report should be regarded as preliminary. We have conducted sensitivity analysis to address the uncertainties underlying the assumptions. Subsequent analysis would benefit from industry consultation to gain a better understanding of plastic bag consumption numbers and trends, and industry costs under the various options.

## 4.2 Approach to the analysis

The costs and benefits associated with Options 2 to 4 have been assessed incrementally to Option 1 (status quo) over 5 year and 10 year timeframes. We calculated the NPV and BCR for each alternative option incrementally to the status quo.

Economic impacts (costs and benefits) are assessed in our model. This means financial transfers, if any, between stakeholder groups are excluded from the analysis because they do not result in a net economic cost or benefit.

In the time available for this CBA, we did not undertake a comprehensive new materials flow analysis. Instead, we estimated the use of plastic shopping bags from available survey data on their ultimate fate – landfill, litter and recycling – cross-checking these estimates with data from previous analyses.

## 4.3 Key Assumptions

A detailed list of assumptions is included under Appendix A. Some key assumptions that underpin the analysis are discussed below.

### 4.3.1 Use of shopping bags

In our analysis, we focused on HDPE, LDPE and reusable bags as the main types of shopping bags. We estimate that biodegradable bags make up about 0.3% of the use of shopping bags in Victoria. Given this low percentage, for the purpose of our CBA, biodegradable bags have been included with HDPE shopping bags, i.e. we did not separately account for them.

Based on data from the National Litter Index, Victorian plastic bag consumption estimates and studies undertaken in NSW,<sup>16</sup> we estimated the amount of different types of shopping bags that end up in landfill, recycling and litter as in 2014-15. We then estimated a growth rate for HDPE and LDPE bags based on forecast population growth in Victoria and confidential data from

<sup>16</sup> APC Waste Consultants, *Audit of Plastic Bags in Household, Public Litter and Café/Restaurant Waste Bins and Stormwater Pits*, 2016.

similar studies undertaken in other jurisdictions around Australia. We estimate that under the status quo (Option 1), the use of HDPE shopping bags would increase by about 1.61% per year during our evaluation period from approximately 1.6 billion bags per year in 2016-17 to approximately 1.9 billion bags per year in 2026-27. The use of LDPE shopping bags would increase by 0.22% per year during the same period from about 130 million bags to about 133 million bags.

We have assumed the proportion of shopping bags that end up in landfill, recycling and as litter remains constant in our evaluation period and applies under all options.

#### 4.3.2 Impact of a ban on plastic shopping bags

Under Option 2, we assume the following impacts based on data from Australian jurisdictions that have introduced a ban on HDPE shopping bags:

- About 90% of consumers switch to LDPE and reusable bags (we assume 30% switch to LDPE and 60% switch to reusable bags), and the rest of consumers decide not to use a shopping bag at all due to their small purchase.
- The use of plastic, purpose made, garbage bin liner bags increases by 275% as consumers who were using HDPE shopping bags for household waste disposal prior to the ban now switch to purpose made bin liners.

Where a ban on plastic bags applies under Option 2 (HDPE), Option 3 (HDPE) and Option 4 (HDPE and LDPE), we assume the ban reduces the use of HDPE, biodegradable and LDPE bags by 10% during the transitional period. Following the implementation of the ban, we assume the use of HDPE, biodegradable and LDPE bags reduces by 95% by 2022-23, and by 99% by 2026-27. Most of the jurisdictions that have a ban on HDPE shopping bags reported a high level of compliance based on sample audits of retailers. However, the level of compliance is dependent on the level of enforcement. Under Option 3, the use of LDPE bags reduces by 50% by 2021 and remains constant thereafter.

#### 4.3.3 Plastic bag litter

##### Quantity of litter

Base year estimates of the quantities of plastic bag litter were derived from surveys of two types of plastic bag litter in Victoria undertaken as part of the National Litter Index (NLI).<sup>17</sup>

- ‘Bags - supermarket type light weight carry bags’, assumed to be HDPE bags; and
- ‘Bags - heavier glossy typically branded carry bags’, assumed to be LDPE bags.

The survey data was then scaled up to obtain state wide estimates of litter for HDPE and LDPE using the same scaling up factor sourced from previous studies.<sup>18</sup> Estimates derived in this way for 2014-15 are approximately:

- 9.6 million bags of HDPE littered (about 1% of total HDPE bags);<sup>19</sup> and

<sup>17</sup> Macgregor Tan Research, 2015. National Litter Index Annual Report 2014/ 2015. Prepared for Keep Australia Beautiful National Association.

<sup>18</sup> See Marsden Jacob Associates, 2013. Distributional and Cost Benefit Analysis for the Packaging Impacts Decision Regulation Impact Statement: Assumptions Report.

- 1.0 million bags of LDPE littered (about 1% of total LDPE bags).

NLI plastic bag data for the past 10 years does not reveal a clear trend. In the absence of a clear trend, estimates of litter in future years under the base case were therefore derived by assuming the base year rate of litter remains constant in the evaluation period.

#### Litter destination – land and marine

Numerous studies point to substantial potential ecological, amenity and productive impacts of plastics entering the marine environment.<sup>20</sup> Noting this, an estimate has been made of the total quantity of plastic bag litter that enters the marine environment. This was done by applying estimates of plastic packaging marine litter, sourced from a previous study,<sup>21</sup> to derive an estimate of ‘flexible packaging’ marine litter’. NLI litter data, previously mentioned, was then used to derive an estimate of the proportion of flexible packaging marine litter that is plastic bags (44%). This estimate was used in turn to derive an estimate of the proportion of plastic bag litter entering the marine environment – estimated at 48%, with the remaining 52% of plastic bags remaining on land, including in waterways.

#### Willingness to pay - value of reduced litter

Households and the broader community place a value on litter reduction. At present there is a paucity of information available on the damage costs of litter, especially litter entering the marine environment, and/or the community’s willingness to pay (WTP) to reduce that litter. Marsden Jacob has recalibrated estimates of the WTP of households to reduce public place litter, derived through a previous choice modelling survey.<sup>22</sup>

There is substantial uncertainty attached to the estimates of WTP derived from the previous study. We have taken a more conservative approach to estimating the community’s WTP to avoid litter based on the cost of voluntary litter clean-up activities, with the imputed value of a volunteer’s labour providing a shadow price for the economic cost of litter. Based on our previous studies conducted for the NSW Government and the Australia Government, we have derived a ‘most likely’ WTP value for avoided litter of \$1,876 per tonne or about 1 cent per bag for HDPE bags and 3 cents per bag for LDPE bags.<sup>23</sup>

There are reasons to believe that this value could substantially understate the value of reducing litter in the marine environment:

- 
- <sup>19</sup> This is within the range of 30-50 million HDPE bags littered Australia wide (equivalent to 7-12 million in VIC on a per capita basis), estimated in the Hyder report on Plastic Retail Carry Bag Use undertaken for the EPHC in 2007.
- <sup>20</sup> See for example: Jeftic, L, Sheavly, S and Adler, E, 2009. Marine Litter: A Global Challenge, UNEP, Nairobi; and APEC Marine Resources Conservation Working Group, 2009. Understanding the Economic Benefits and Costs of Controlling Marine Debris in the APEC Region, APEC.
- <sup>21</sup> Marsden Jacob Associates, 2013. Distributional and Cost Benefit Analysis for the Packaging Impacts Decision Regulation Impact Statement: Assumptions Report.
- <sup>22</sup> PwC, 2010. Estimating consumers’ willingness to pay for improvements to packaging and beverage container waste management, Environment Protection and Heritage Council.
- <sup>23</sup> Avoided costs of cleaning up litter by local councils are captured in this value. Costs of avoiding litter or cleaning up litter incurred by local councils in Victoria are in the order of \$400 to \$900 per tonne depending on the clean up method, type of litter and location. The community’s WTP to avoid litter is estimated to be higher than actual clean-up costs.

- evidence from available surveys indicates that people are especially concerned about litter on beaches and other aspects of the marine environment;<sup>24</sup> and
- available evidence suggests that the cost of cleaning up litter in marine environments could be roughly 5 to 60 times the cost of cleaning up land based litter.<sup>25</sup>

Noting these points, we have derived a separate shadow price estimate for the economic cost of marine litter, based on cost of voluntary clean-up activities that were specifically focussed on the marine environment (beaches and underwater sites) in Australia.<sup>26</sup> We estimate a most likely WTP value for avoided marine litter of \$36,512 per tonne,<sup>27</sup> equivalent to about 20 cents per bag for HDPE bags and 55 cents per bag for LDPE bags.<sup>28</sup>

A great deal of uncertainty is attached to both the land and marine litter values. Sensitivity analysis is therefore applied to testing low and high values for avoided litter of:

- land litter – \$1,101 per tonne (low), \$17,811 per tonne (high)
- marine litter – \$20,060 per tonne (low), \$91,124 per tonne (high).<sup>29</sup>

## 4.4 Results

The results from our initial analysis are presented in Table 1. Banning HDPE shopping bags and biodegradable shopping bags under Option 2 delivers a net economic benefit of \$2.0 million in NPV terms over a 10 year period. Both Option 3 and Option 4 deliver a net economic benefit in NPV terms over a 10 year period, with a net benefit of \$15.3 million for Option 3 and \$64.4 million for Option 4. The results under a 5 year timeframe are worse than under a 10 year timeframe as implementation costs are incurred upfront and the benefits stream is reduced under a 5 year time frame compared to 10 years.

The results suggest most of the environmental benefits occur through Option 2 and don't increase substantially in Options 3 and 4.

<sup>24</sup> See for example, APEC Marine Resources Conservation Working Group, 2009. Op Cit

<sup>25</sup> Jambeck et al., 2015; 'Plastic waste inputs from land into the ocean', in *Science* Vol. 347, Issue 6223, pp. 768-771; Jeftic et al., 2009, Op. Cit; Macgregor Tan Research, 2015, Op Cit; Ocean Conservancy, 2016, *30<sup>th</sup> Anniversary International Coastal Cleanup Annual Report*

<sup>26</sup> Ibid

<sup>27</sup> This is a central estimate of cleaning up litter in coastal areas (beaches, bays and estuaries) and the open ocean. Costs of cleaning up litter in coastal areas range from \$11,778 to \$27,252 per tonne (central estimate \$20,060). Costs of cleaning up litter in the open ocean range from \$53,501 to \$123,793 per tonne (central estimate \$91,124). These estimates were drawn from data on voluntary clean-up activities undertaken in the marine environments (see in particular Jeftic et al., 2009).

<sup>28</sup> We note that these estimates are still substantially less than the \$1.00 per bag applied in the 2006 CBA of options to phase out plastic bags for the EPHC.

<sup>29</sup> Note the extra high values attributed to the high end estimates (relative to most likely estimates) acknowledges the fact that plastic bag litter has a very high volume to weight ratio.

**Table 1: Results of cost benefit analysis (\$2016)**

	10 year		5 year	
	NPV \$m	BCR	NPV \$m	BCR
Option 2	2.0	1.01	-0.7	0.99
Option 3	15.3	1.07	-1.8	0.99
Option 4	64.4	1.28	28.5	1.26

Source: Marsden Jacob analysis

The major costs and benefits that drive the net result are shown in Table 2. The largest benefit from a ban on plastic shopping bags under all options is the reduced cost of HDPE shopping bags. This benefit is offset by the cost of alternative bags that are needed to replace HDPE shopping bags. Under Option 2, the cost of replacement LDPE bags partly offsets the benefits from the reduced use of HDPE shopping bags. Under Option 3 and Option 4, the additional benefit from the reduced use of LDPE shopping bags also results in an overall net benefit over 10 years, and a net benefit for Option 4 over 5 years.

**Table 2: Major costs and benefits under a 10 year timeframe (NPV, \$m, \$2016)**

	Option 2	Option 3	Option 4
Reduced cost of HDPE and biodegradable shopping bags	146.7	146.7	146.7
Cost of LDPE shopping bags	-55.0	73.4	138.3
Cost of reusable bags	-68.5	-143.9	-200.3
Cost of bin liners	-29.4	-29.4	-29.4
Avoided litter cost – land	0.7	0.5	0.5
Avoided litter cost – marine	6.7	8.5	9.4
Avoided landfill cost	2.7	3.0	3.0
Cost of implementing the code of practice		-41.0	

Source: Marsden Jacob analysis.

Note: Positive values reflect benefits and negative values reflect costs in the analysis.

These results differ from the earlier analysis undertaken by the EPHC (refer to Section 2), because the NPV and BCR outcomes are positive for Options 3 and 4. The key factors that explain the difference are:

- the assumed cost of alternative bags has decreased substantially since 2008;
- the assumed cost of bin liners has decreased substantially since 2008;
- we have not assumed any substitution with paper bags;<sup>30</sup>
- additional infrastructure costs to retailers associated with providing re-useable bags is now assumed to be negligible – the necessary infrastructure is now largely in place;
- because the relevant infrastructure is now in place there is no additional time cost imposed on consumers associated with using re-useable bags. This has been confirmed in reviews undertaken by jurisdictions that have already implemented a ban; and
- production of single use plastic bags is mainly overseas.

<sup>30</sup> We have found no discussion of substitution with paper bags in other jurisdictions that have introduced a ban on plastic shopping bags.

## 4.5 Sensitivity analysis

As a CBA is based on a series of assumptions, there is a degree of uncertainty around the results. We conducted sensitivity testing to clarify which assumptions can materially change the overall result.

### 4.5.1 Discount rate

In accordance with guidelines by the Victorian Department of Treasury and Finance,<sup>31</sup> the stream of costs and benefits (in real terms) has been discounted using a real discount rate of 4%. We conducted sensitivity testing using a real discount rate of 7%. Table 3 shows the impacts of these differing rates.

**Table 3: Net results under different discount rates over a 10 year time frame (\$2016)**

Discount rate	Option 2		Option 3		Option 4	
	NPV \$m	BCR	NPV \$m	BCR	NPV \$m	BCR
4% (base case)	2.0	1.01	15.3	1.07	64.4	1.28
7%	1.4	1.01	11.7	1.06	54.4	1.27

Source: Marsden Jacob analysis.

### 4.5.2 Cost of shopping bags

We tested ranges of different shopping bag costs for their impact on the net result, as well as the cost of bin liners.<sup>32</sup> The ranges for the different bags are:

- HDPE bags: 1.0c (low), 1.2c (likely), 1.4c (high).
- LDPE bags: 7.0c (low), 15c (likely), 24c (high).
- Reusable bags: 65c (low), 85c (likely), \$1.05 (high).
- Bin liners: 1.0c (low), 1.2c (likely), 1.6c (high).

In our analysis, we estimated a conservative range of net benefits by using the low estimates of HDPE and LDPE bag costs, and high estimates of reusable bag costs and bin liner costs. Conversely, we estimated a less conservative range of net benefits by using high estimates of HDPE and LDPE bag costs and low estimates of reusable bag costs and bin liner costs.

The analysis presented in Table 4 shows that the net results are highly sensitive to the cost of the different types of bags, due to the high volume of shopping bags used.

The sensitivity analysis also indicates that Options 3 and 4, while likely to result in higher NPVs and BCRs than Option 2, are also more risky as they require a greater amount of change than Option 2 and with more uncertainty.

<sup>31</sup> Department of Treasury and Finance, *Victorian Guide to Regulation, Toolkit 2 Cost Benefit Analysis*, July 2014.

<sup>32</sup> As discussed in Chapter 5, we assumed the costs of shopping bags are ultimately borne by consumers.

**Table 4: Net results under different shopping bag costs over a 10 year time frame (\$2016)**

	Option 2		Option 3		Option 4	
	NPV \$m	BCR	NPV \$m	BCR	NPV \$m	BCR
Likely (base case)	2.0	1.01	15.3	1.07	64.4	1.28
Low net benefit	-18.8	0.88	-90.6	0.65	-88.2	0.69
High net benefit	14.3	1.09	121.1	1.68	221.0	2.20

Source: Marsden Jacob analysis.

#### 4.5.3 Willingness to pay (WTP) to avoid litter

As discussed in Chapter 3, there is a degree of uncertainty around the value of avoided litter from a ban on plastic shopping bags. We tested the following ranges of benefits:

- Avoided cost of land litter: \$1,101 per tonne (low), \$1,876 per tonne (most likely), \$17,811 per tonne (high).
- Avoided cost of marine litter: \$20,060 per tonne (low), \$36,512 per tonne (mostly likely), \$91,124 per tonne (high).

The analysis in the table below shows that WTP estimates make a material impact on the net result, but their impact is not as significant as the cost of shopping bags. Indeed, even if the value of avoided marine litter was set at \$0 per tonne, the BCR of Option 3 under the 'likely' scenario only marginally declines from 1.07 to 1.03.

**Table 5: Net results under different willingness to pay scenarios over a 10 year time frame (\$2016)**

	Option 2		Option 3		Option 4	
	NPV \$m	BCR	NPV \$m	BCR	NPV \$m	BCR
Likely (base case)	2.0	1.01	15.3	1.07	64.4	1.28
Low	-1.3	0.99	11.3	1.05	59.9	1.26
High	17.9	1.12	32.0	1.15	82.9	1.36
Avoided marine litter = 0	-4.7	0.97	6.8	1.03	54.9	1.24

Source: Marsden Jacob analysis.

#### 4.5.4 Plastic shopping bag use

Given the large volume of HDPE shopping bags in use and that our estimate of the number of HDPE shopping bags in Victoria has been derived from different sources, we tested scenarios where the number of HDPE shopping bags in use at the start of our evaluation period is 10% lower and 10% higher than our base case. As shown in Table 6, whilst the net results are sensitive to the number of HDPE bags in use, the impact is not significant.<sup>33</sup>

<sup>33</sup> In the low scenario, a net cost is estimated under Option 2 as less HDPE shopping bags are phased out (from a lower base).

**Table 6: Net results under different HDPE shopping bags in use scenarios over a 10 year time frame (\$2016)**

	Option 2		Option 3		Option 4	
	NPV \$m	BCR	NPV \$m	BCR	NPV \$m	BCR
Likely (base case)	2.0	1.01	15.3	1.07	64.4	1.28
Low (-10%)	-1.3	0.99	9.9	1.05	60.1	1.27
High (+10%)	5.3	1.03	20.7	1.09	68.6	1.28

Source: Marsden Jacob analysis.

## 4.6 Concluding remarks

The results presented above should be regarded as preliminary. Further analysis would benefit from consultation with the retail industry to gain a better understanding of plastic bag consumption numbers and trends, and industry costs under the various options.

Further analysis could also include a life cycle comparison of costs, including externalities for plastic shopping bags and their substitutes. However, quantifying externalities would likely be difficult and increase the uncertainty of the analysis without having a significant impact on the overall result, if new valuation studies are not commissioned.

## 5. Distributional impacts

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In this chapter, we discuss the stakeholders affected under each of the options. We assess the distribution of costs and benefits in net present value (NPV) terms among stakeholder groups.

### 5.1 Findings

The key findings from our analysis (see Table 8) are:

- Consumers would ultimately bear the majority of the net benefit or cost under all options, ranging from a net economic cost to consumers of \$6.2 million in NPV terms over 10 years under Option 2, to a net economic benefit of \$55.3 million in NPV terms over 10 years under Option 4.
- The retail industry would incur the highest cost under Option 3, about \$41.4 million in NPV terms over 10 years, under a voluntary code to reduce the use of LDPE shopping bags. The retail industry may ultimately pass these costs on to consumers.
- The community and the environment would benefit from reduced litter, ranging from \$10.0 million in NPV terms over 10 years under Option 2, to \$13.0 million in NPV terms over 10 years under Option 4.

### 5.2 Stakeholders

The key stakeholders affected by options to reduce the use of plastic shopping bags are:

- Victorian Government;
- retail industry;
- consumers;
- wholesalers/importers of shopping bags; and
- community / environment.

The impact on different stakeholder groups from each option is presented in Table 7. Under all options, the Victorian Government and the retail industry would incur implementation and compliance costs. The retail industry may ultimately pass these costs onto consumers.

Currently, the cost of plastic shopping bags (HDPE and LDPE) is included in the retail cost of products purchased by consumers. In our analysis, we assumed the benefits from the reduced cost of HDPE and LDPE shopping bags would be ultimately be passed on to consumers. Under Option 2, consumers face additional costs from LDPE shopping bags as they switch from HDPE shopping bags. Under Option 3 and Option 4, consumers benefit from switching away from LDPE shopping bags.

**Table 7: Overview of costs and benefits of options and stakeholders affected**

	Option 2	Option 3	Option 4	Stakeholder
<b>Costs</b>				
Introduce legislation	X	X	X	Government and retail industry
Introduce code of practice		X		Government and retail industry
Consumer education campaign	X	X	X	Government and retail industry
Industry set up costs	X	X	X	Retail industry
Monitoring and compliance costs (ban)	X	X	X	Government and retail industry
Monitoring costs (code of practice)		X		Government and retail industry
Cost of reusable bags	X	X	X	Consumers
Cost of replacement bin liners	X	X	X	Consumers
Cost of LDPE bags	X			Consumers
Loss of producer surplus	X	X	X	Importers of shopping bags
<b>Benefits</b>				
Reduced cost of HDPE bags	X	X	X	Consumers
Reduced cost of LDPE bags		X	X	Consumers
Avoided litter	X	X	X	Community/environment
Avoided landfill operating costs		X	X	Community/environment
Improved environment	X	X	X	Community/environment

### 5.3 Distributional impact under each option

As shown in Table 8, consumers and the general community would bear most of the net benefit or cost under each of the options. Under Option 3, the retail industry would initially bear the implementation costs under a code of practice to reduce the use of LDPE shopping bags.

Although it is likely that retailers would pass on the cost to consumers, we cannot be certain because it is a voluntary code and not all retailers will be involved. So, for the purpose of this analysis it has been assumed that the development and implementation costs for the voluntary code (refer to Appendix) will be borne by the retailers.

**Table 8: Distribution of impact under a 10 year time frame (NPV, \$m, \$2016)**

	Option 2	Option 3	Option 4
VIC Government	-0.9	-0.9	-1.7
Retail industry	-0.5	-41.4	-0.6
Consumers	-6.2	46.8	55.3
Importers	-0.4	-1.1	-1.5
Community / Environment	10.0	11.9	13.0

*Source: Marsden Jacob analysis.*

## Appendix A Model Assumptions

**Table 9: General assumptions**

Category	Value	Source
Discount rate	4%	Victorian Department of Treasury and Finance guidelines
Evaluation period	2016-17 to 2026-27	
Base year	2016	
Inflation	1.01 2014-15 to 2015-16 1.25 2005-06 to 2015-16	Australian Bureau of Statistics
Conversion between plastic bag unit and weight	1 HDPE bag = 5.5gms 1 LDPE bag = 19.93gms 1 Biodegradable bag = 12.5gms 1 reusable bag = 120.65gms	Hyder Consulting Pty Ltd, Plastic Retail Carry Bag Use, 2006 and 2007 Consumption, Final Report, 7 February 2008 Nolan-ITU Pty Ltd, Plastic Shopping Bags – Analysis of Levies and Environmental Impacts, Final Report, December 2002 Marsden Jacob analysis
Conversion between types of bags	1 LDPE bag = 10 HDPE bag 1 reusable bag = 91 HDPE bag	Nolan ITU (2002)
Price of HDPE bag	1.2c (likely) 1.0c (low) 1.4c (high)	Marsden Jacob analysis
Price LDPE bag	15.0c (likely) 7.0c (low) 24.0c (high)	
Price of reusable bag	85c (likely) 65c (low) 105c (high)	
Price of bin liners	1.2c (likely) 1.0c (low) 1.6c (high)	

**Table 10: Use of plastic shopping bags**

Category	Value	Source
Number of HDPE bags in Victoria in 2015	1,531 million	Marsden Jacob analysis
Number of LDPE bags in Victoria in 2015	129 million	
Number of reusable bags in Victoria in 2015	19 million	
Number of biodegradable bags	3 million	
Fate of HDPE bags	95% landfill; 4% recycled; 1% litter	
Fate of LDPE bags	91% landfill; 8% recycled; 1% litter	
Fate of biodegradable bags	97% landfill; 3% recycled; 0% litter	
Fate of reusable bags	91% landfill; 9% recycled; 0% litter	
Number of bin liners	Increase by 10% in 2017-18 and 275% in 2018-19 and held constant thereafter for Option 2 to Option 4	Based on data from NT where sale of bin liners increased from 8 million to 22 million
<b>Option 1</b>		
Growth of HDPE bag use (per annum)	1.61%	Marsden Jacob analysis based on population growth in Victoria
Growth of LDPE bag use (per annum)	0.22%	Previous studies by Marsden Jacob
Growth of reusable bag use (per annum)	0.02%	
<b>Option 2</b>		
Growth of HDPE bag use	Reduce by 10% in 2017-18. Reduce by 85% in 2018-19 (from 2017-18). Reduced by 95% by 2022-23 (from 2016-17)	
LDPE bag use	Growth rate per Option 1 plus 30% of HDPE reduction	
Reusable bag use	Growth rate per Option 1 plus 60% of HDPE reduction 10% of consumers decide not to use a bag (based on SA experience)	

Category	Value	Source
<b>Option 3</b>		
Growth of HDPE bag use	Reduce by 10% in 2017-18. Reduce by 85% in 2018-19 (from 2017-18). Reduced by 95% by 2022-23 (from 2016-17)	
LDPE growth rate	-20.6% in 2018-19 to 2020-21 0% thereafter	
Reusable bag use	Growth rate per Option 1 plus 90% of HDPE and LDPE reduction 10% of consumers decide not to use a bag	
<b>Option 4</b>		
Growth of HDPE bag use	Reduce by 10% in 2017-18. Reduce by 85% in 2018-19 (from 2017-18). Reduced by 95% by 2022-23 (from 2016-17)	
Growth of LDPE bag use	Reduce by 10% in 2017-18, 85% in 2018-19 and reduced by 95% by 2022-23	
Reusable bag use	Growth rate per Option 1 plus switch from HDPE and LDPE	

**Table 11: Cost and benefit assumptions (incremental to Option 1)**

Category	Value	Source
Vic Government		DELWP
- Implementation	\$0.145 million 2016-17	
- Consumer education and information	\$0.6 million in 2017-18	
- Enforcement	\$0.1 million 2018-19; \$0.05 million 2019-20 to 2021-22 Note costs for Option 4 is double	
Retail industry	Similar costs to Vic Government	
- Consumer education	\$0.25 million in 2017-18	Cost of signage across major retail stores
- Code of Practice	\$8.3 million 2017-18 to 2019-20; \$4.2 million thereafter	Based on Hyder Consulting (2008) and analysis by Marsden Jacob
Consumers		
- Additional time at	-	Assume zero, no significant issues

Category	Value	Source
checkout		identified in other jurisdictions.
Importers		
- Loss in producer surplus	1.8%	No major manufacturers of plastic bags or reusable bags in Victoria.
Community		
- Avoided litter WTP – land (per tonne), 51.6%	\$1,876 (likely) \$1,101 (low) \$20,060 (high)	Previous studies by Marsden Jacob
- Avoided litter WTP – marine (per tonne), 48.4%	\$36,512 (likely) \$21,437 (low) \$91,124 (high)	
- Avoided landfill operating costs (per tonne)	\$54.7	Previous studies by Marsden Jacob
- Reduced contamination of recycle	-	Limited
Environment		
- Improved environment from reduced litter (per tonne)	\$1.39	Previous studies by Marsden Jacob
- Avoided landfill externalities	-	Limited - previous avoided landfill cost studies