

# Recovered Resources Market Bulletin

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Victorian Market Intelligence Pilot Project (edition #01)



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# 1. Market snapshot

## 1.1. Overview of kerbside recovery and the challenges

A high-level overview of kerbside material flows and the market challenges are outlined in the following table. Across the rest of the publication the problems, markets and possible solutions are examined in more detail.

Table 1.1 – Market snapshot

MRF <sup>1</sup> recovery	Sorted quantity (t)	Proportion	Destination(s)	Approx. \$ per tonne	The market challenges
Paper & paperboard	320,000 (341,665*)	54%	154,000 tonne export (30% drop on 2016–17) 170,000 t to local processing	\$120 for boxboard \$20 for mixed paper & paperboard \$220 newsprint & magazine \$240 old corrugated cardboard	Most Victorian kerbside paper is sorted into a single 'mixed paper' product. Australia's paper mills are not able to accept more of this product, and the international markets have collapsed.
Glass packaging	110,000 (172,565*)	18%	All to local processing	-\$30 /tonne for mixed glass	Most Victorian glass packaging is sorted into a single 'mixed glass' product. This has been a very low value product for many years. Glass fragments contaminate other materials.
Plastic packaging	40,000 (51,547*)	7%	35,000 t to export (10% drop on 2016–17) 5,000 t to local processing	\$400 for PET (1) \$600 for HDPE (2) \$110 for mixed (1–7) -\$20 for mixed (3–7)	Markets for clean PET and HDPE are good, but around a third of plastics are sorted into a 'mixed plastic' product. The international markets for the mixed plastics have collapsed.
Metal packaging	20,000 (25,336*)	4%	~100% to export	\$140 for steel cans \$1000 for aluminium	Markets for aluminium and steel packaging are fine.
Contamination and sorting losses	100,000	17% (6.5%*)	All to landfill	-\$130 for landfill	Around 15–20% of material going into MRFs is sent to landfill. This is made up of unrecyclable contaminants (sorting loses), lost recyclables (mostly glass – 62,000 tonnes). This landfill component is a significant cost impost on MRF operators.
<b>Total</b>	<b>590,000</b>				This is the total amount going in and out of Victorian MRFs in 2017–18.

<sup>1</sup> Data is for 2017–18. Derived by Envisage Works from 2018-19 ABS data, extrapolated 2016-17 SV (2018), and industry consultation. \*Pre-sorted materials SV (2018)

## 1.2. Kerbside recycling markets snapshot

**Highlight 1** – The fall in value of mixed paper and mixed plastics arising from kerbside recycling has reduced the sale value of kerbside recovered materials by around \$60–\$80/tonne since the beginning of 2018. This has been a significant hit to the kerbside recycling sector. Most of this loss is due to a fall in the value of mixed paper.

**Highlight 2** – Victorian and national recycled commodity markets are caught up in a (possibly) structural rather than cyclical shift in the international markets for low quality kerbside recyclables. Overseas markets for low quality kerbside recyclables will continue to tighten further for the foreseeable future.

**Highlight 3** – There are many potential improvements that need to occur to kerbside recycling markets and systems. These are available at all levels, starting with packaging design and community education, through to better collection and sorting infrastructure producing higher quality sorted recyclable materials, and the development of Australian re-manufacturing capacity and end-markets for clean material. High-quality reprocessed materials are usually sought after and have excellent local and international markets. The current market shocks represent a timely opportunity, and motivation, as much as a problem.



### 1.3. About this publication

This is the first of a series of 12 monthly publications that Sustainability Victoria (SV) and the Waste Management and Resource Recovery Association of Australia (WMRR) will release to provide the community, industry and government with an overview of the kerbside recycling markets in Victoria.

The purpose of these publications is to provide a much more up-to-date picture of the health of the markets, what are the ongoing challenges and opportunities, and who is doing what to improve the resilience and recovery performance of our kerbside recycling systems. The publications are a synthesis of many information sources, and the regular updates will be supported by many discussions with industry, government and community stakeholders over the course of the next 12 months.

Here's an overview of the stakeholders involved in this issue, and the roles that they can play:

- Brand-owners and packaging manufacturers – This group needs to put packaging into the market that is made from Australian recycled materials, suitable for recycling and has strong end-markets. Packaging needs to be clearly labelled as to how it is to be recycled so consumers know what to do with it. The Packaging Recycling Label Program ([prep.org.au](http://prep.org.au)) and Australasian Recycling Label (ARL) ([recyclingnearyou.com.au/arl](http://recyclingnearyou.com.au/arl)) are two exciting and complementary developments in improving packaging recyclability at the design stage, and supporting consumers in diverting more packaging to recycling.
- Households – The community needs to be provided with the ability to purchase products that are made from Australian recycled content and are readily identifiable as recyclable, as well as have ready access to recycling services that collect a consistent range of materials. Ideally the community needs clear and consistent labelling on appropriate disposal, such as that provided by the ARL. The ARL does not currently communicate the recycled content of packaging (focus is on the correct disposal). However, its expansion to provide information on the recycled content, and so drive consumer choice at the point of sale, is under development.
- Councils – Councils need clear guidance on optimising collection and processing systems for recovery and consistency across the state. Councils need to provide high-quality education information for kerbside collection services. Government needs to also have ready access to sustainable procurement information and procedures for purchasing of recycled content products.
- Material Recovery Facilities – Need kerbside recycling delivered to them from collectors that is low in contamination, and is not overly compacted so as to enable high recovery of product.
- Resource recovery and remanufacturing industry – Need supply of low-contamination commodity materials that they have certainty of good end-markets in Australia, and assistance with meeting the market needs for each recyclable material.
- State Government – Provides the transitional pathway strategic vision and takes a shared responsibility for addressing the changes needed to meet market requirements and consideration of externalities that markets and industry aren't able to address. Supports Research, Development and Demonstration (RD&D) activities to the benefit of the community. Regulates the resource recovery sector to achieve safety, and human and environmental health outcomes. Increased government purchasing of recycled content products is a potential support mechanism, and is currently being actively investigated.



## Who is this publication for?

The audience for this publication is anyone with an interest in kerbside recycling in Victoria, who is looking for a more holistic overview on the material flows and related markets, through generation, sorting, reprocessing, re-manufacturing and end-product markets.

## Structure of the publication

The publication has six sections, which are:

- **Market snapshot** – A quick overview of kerbside material flows, \$ values, and the key issues, opportunities and activities.
- **Introductory section** – A more detailed and integrated overview of the kerbside material markets, across all material types (paper & paperboard, glass packaging, plastic packaging and metal packaging).
- **Material specific sections** – Specific sections on the each of the four material groups (paper & paperboard, glass packaging, plastic packaging and metal packaging). Each section provides: an overview of the material markets; the latest available information on prices, demand and supply; commentary on the key product end-markets for recovered materials; export and/or interstate market activity; and a summary of market risks, opportunities and developments.

## What is the history and context?

The kerbside recycling system in Victoria has been evolving and developing since the first collections of tied bundles of paper in the 1980s, the introduction of crates in the early 1990s, which was followed by mobile bins across most councils in the early 2000s. The range and quantities of materials collected have also grown massively, to around 600,000 tonnes of kerbside collected recyclables in 2018, of which around 80% is paper, cardboard and glass.

Around half the world's kerbside packaging was received by China up until the end of 2017. While the current recycling market shocks may be the most significant, across even the last decade there have been downturns in the recycled materials market caused by the:

- Global Financial Crisis (GFC) in 2009.
- new Chinese regulations in 2011 aimed at reducing the imports of highly contaminated scrap materials.
- aggressive enforcement in 2013 by the Chinese of the 2011 regulations, through a campaign known as 'Operation Green Fence'.

A key aspect of the latest round of Chinese restrictions is the adoption of a maximum permissible contamination threshold of imported bales of scrap mixed paper/paperboard and mixed plastics of 0.5%. This threshold is very low and Victorian material recovery facilities (MRFs) are not designed to produce bales of material to meet the 0.5% contamination threshold (excepting perhaps with very clean feedstock). It is also possible that this threshold cannot be reached with commingled collections as they are currently configured.

The change in the Chinese import restrictions (National Sword policy) hasn't just hit Australia. Many countries across Europe, North America and Asia are all struggling with the same issues of moving low quality kerbside recycling materials. This also means that other countries that import and process kerbside recyclables are now flooded with this low-quality material, and are responding with their own import restrictions.

Bales of mixed kerbside paper and cardboard and mixed plastic packaging are internationally traded commodities, and the ability to place this material, and prices received, have fallen dramatically since the beginning of 2018. The MRF gate spot price for the two years prior to



2018 for mixed paper was typically around \$125/tonne, and \$200 /tonne for mixed plastics. Currently, mixed paper is perhaps sold for \$20 /tonne and mixed plastic is being traded for \$0. The sale value of one tonne of sorted kerbside recyclables has halved. It's a massive hit to the sorters.

The current challenges with the kerbside recycling markets are a subset of a megatrend of growing environmental problems internationally, which can be framed and managed using a circular economy and materials flow mindset. An underlying objective of the publications is to apply a circular economy lens to kerbside recycling markets.

## 1.4. Overview of kerbside recycling flows

Victorian collection of material from kerbside collection and sorting systems has been fairly steady over the last three years at around 600,000 tonnes. After losses of 100,000 tonnes of contaminant material and unrecovered recyclables, an estimated 500,000 tonnes were sent for reprocessing here in Victoria, interstate or internationally. Paper grades and glass account for 85% or more of this processed material.

Figure 1.1 – Victorian MRF outputs by material category (tonnes)

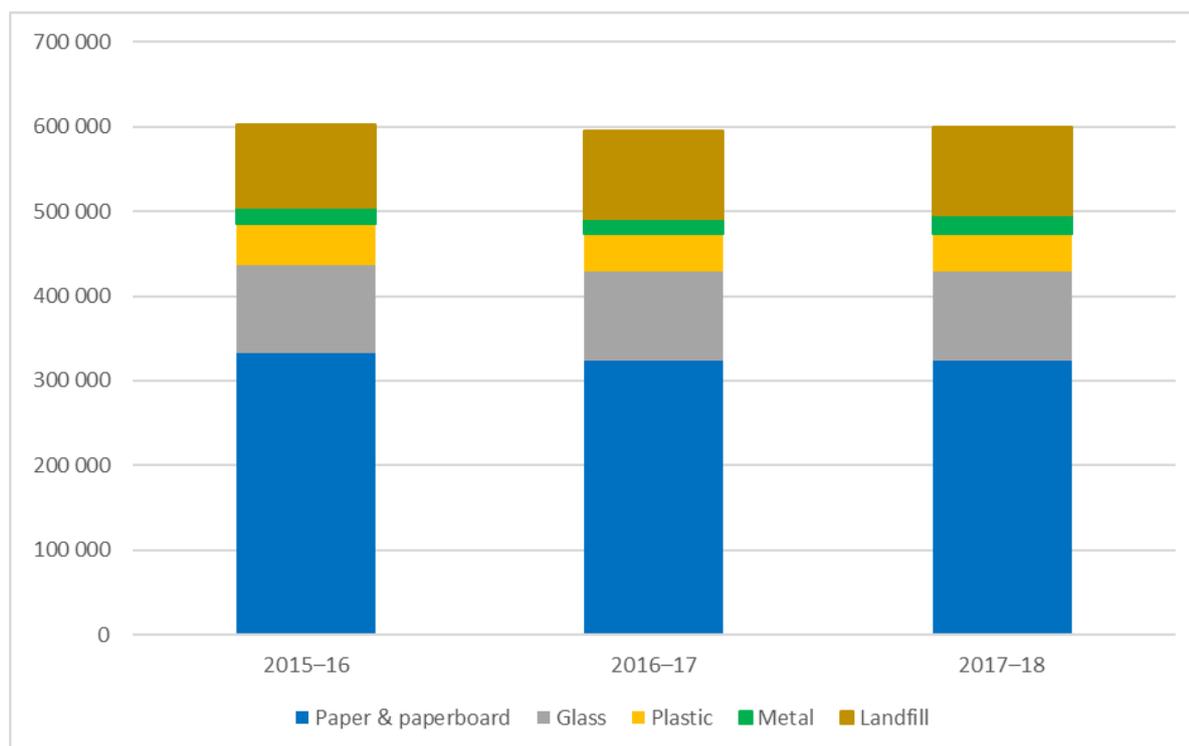
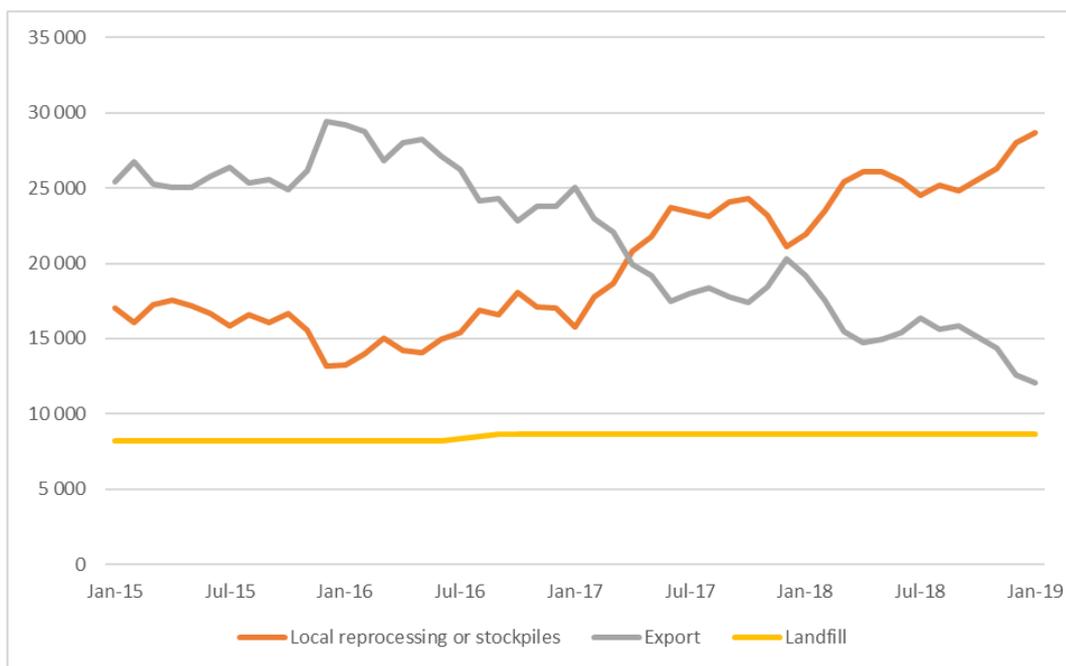


Table 1.2 – Victorian MRF outputs by material category (tonnes)

Material category	2015–16	2016–17	2017–18
	(tonnes)	(tonnes)	(tonnes)
Paper & paperboard	330 000	320 000	320 000
Glass	100 000	110 000	110 000
Plastic	50 000	40 000	40 000
Metal	20 000	20 000	20 000
Landfill	100 000	100 000	100 000
<b>Totals</b>	<b>600 000</b>	<b>590 000</b>	<b>590 000</b>

Source: SV (2017; 2018) and industry consultation

Figure 1.2 – Destination of Victorian MRF outputs (tonnes/month)



Note: Historical total monthly MRF outputs have been approximated in the figure above to enable comparison with monthly ABS customs export data. The 'Local reprocessing or stockpiles' and 'Landfill' estimates should be seen as indicative only. The overall trends are the key aspect of the figure.

Source: ABS (2019) and Envisage Works

## 1.5. Market risks, opportunities and activities

Reduction in export market outlets has not been mirrored by an expansion of domestic remanufacturing activity. This is due to local reprocessors facing the same challenges in using mixed paper and plastics material with contaminants that export markets have faced, and

having far less demand for recycled material input in Australia. There is a growing stakeholder recognition that based on market requirements, our recycling collection and sorting systems may need a substantial modification. Changes in consumer packaging profile is also a subject of broad review. As our purchase and disposal of material changes (less newspaper, more flexible plastics), the kerbside system may need to evolve to address resource capture.

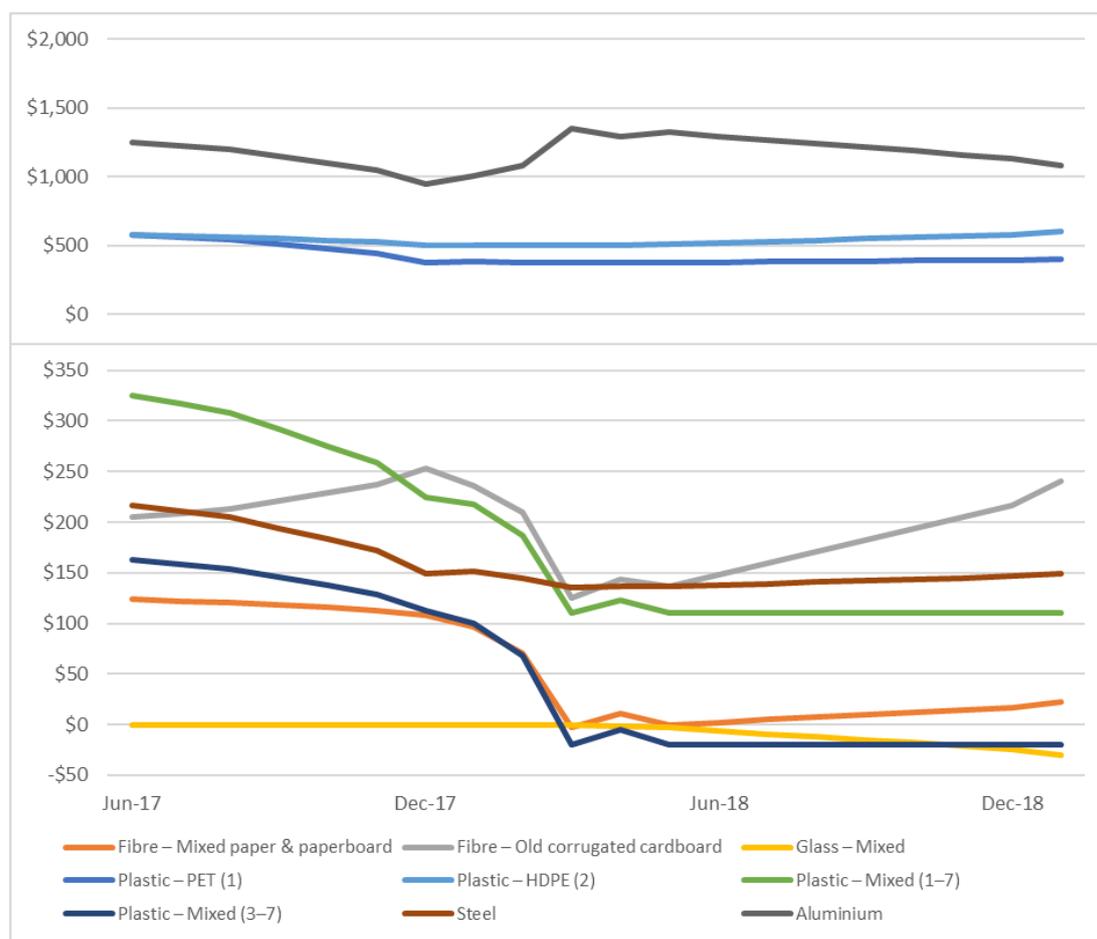
Victorian collection of material from kerbside collection and sorting systems has been fairly steady over the last three years at around 600,000 tonnes. After losses of around 100,000 tonnes of contaminant material and unrecovered recyclables, an estimated 500,000 tonnes were sent for reprocessing here in Victoria, interstate or internationally. Paper grades and glass account for 85% of this processed material.

The challenge of ensuring sorted materials meet the requirements of markets and derive suitable revenue has been greatly increased by export market restrictions, particularly into China, historically our largest destination for exported paper and plastics.

The materials most affected are the mixed paper & paperboard bales produced by (almost) all Victorian MRFs and mixed plastic packaging bales. In both cases, the levels of contaminants have been higher than the permissible Chinese threshold specifications.

In addition to these challenges, stockpile management and the related sorting facility fires have added additional stress to kerbside recycling market stability.

Figure 1.3 – Victorian recovered kerbside materials commodity values (\$/tonne)



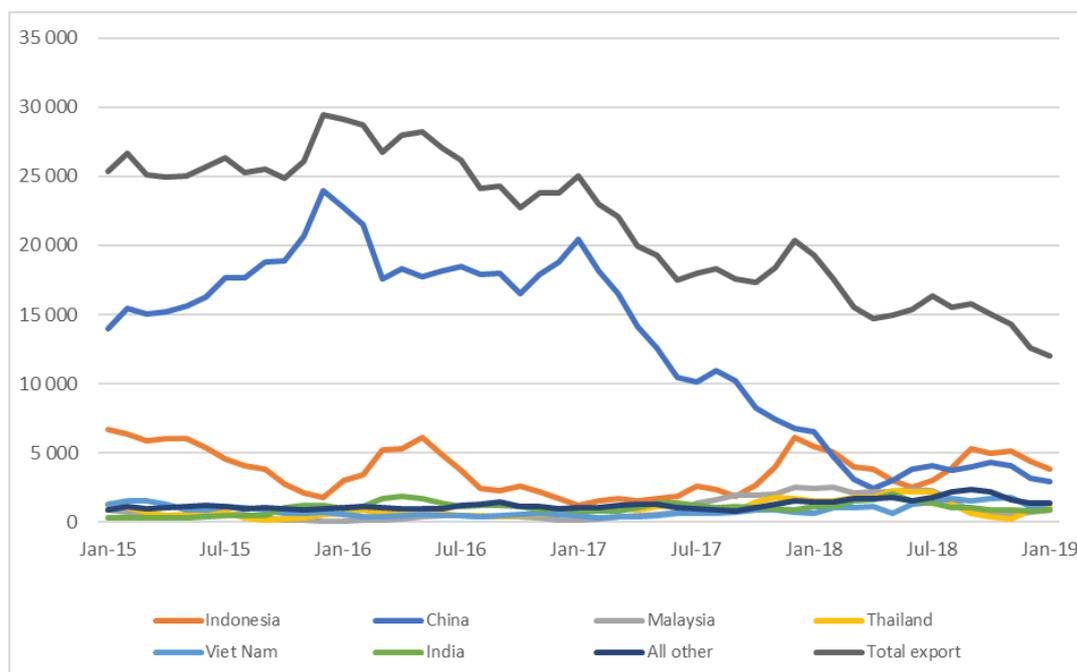
Source: Industry consultation

As markets for high-quality sorted materials remain buoyant, the primary challenge will be to generate less mixed paper and plastics than is currently the case. However, MRF operators can only sort what is delivered to their gates. There is also a significant opportunity to manage more of the re-manufacturing of our recyclable materials in Victoria with economic and employment benefits.

## Export market review

Exports of total kerbside recovered material have dropped by around 50% over the last couple of years. These falls have been driven entirely by lost sales to China, with the fall in export of bales of mixed paper and paperboard the main product contributing to the export reduction.

Figure 1.4 – Victorian recovered kerbside materials, to export country (t/month)



Source: ABS (2019) and Envisage Works

## Overview of current status of countries with scrap import restrictions

- China (restrictions on scrap plastic, paper, metals, and other types of scrap)** – The Chinese import restrictions or outright bans started in March 2018 (but started to impact sales months earlier), became more extensive at the end of 2018, and will extend further at the end of 2019, with completed bans foreshadowed in 2020.
- India (restrictions on scrap plastics)** – India announced bans in March 2019 prohibiting scrap ‘solid plastic’ from being imported into the country, including in special economic zones. The impact on Australian exports is likely to become apparent in April and May 2019.
- Indonesia (new inspection regime)** – As of 1 April 2019 all (100%) scrap paper imports into Indonesia will be inspected at ports (up from around 10% previously). The contamination threshold (impurity limit) is 0.5%, which is the same as China, so can be expected to have a major impact on Australian exports of mixed paper into Indonesia. The 100% inspection rates already applies to scrap plastics and steel imports into

Indonesia. The 100% inspection rates will remain in force until the Indonesian Ministry of Trade completes development of updated specifications on scrap imports.

- **Malaysia (restrictions on scrap plastics)** – Restrictions implemented from July 2018, with a significant impact on scrap plastics imports.
- **Thailand (restrictions on scrap plastics)** – Restrictions implemented from August 2018, to escalate over the next two years, with tighter controls on e-waste imports also foreshadowed.
- **Vietnam (restrictions scrap plastic, paper, metals and other types of scrap)** – Restrictions implemented from around August 2018, with further tightening of scrap imports from late February 2019.

## Supporting information

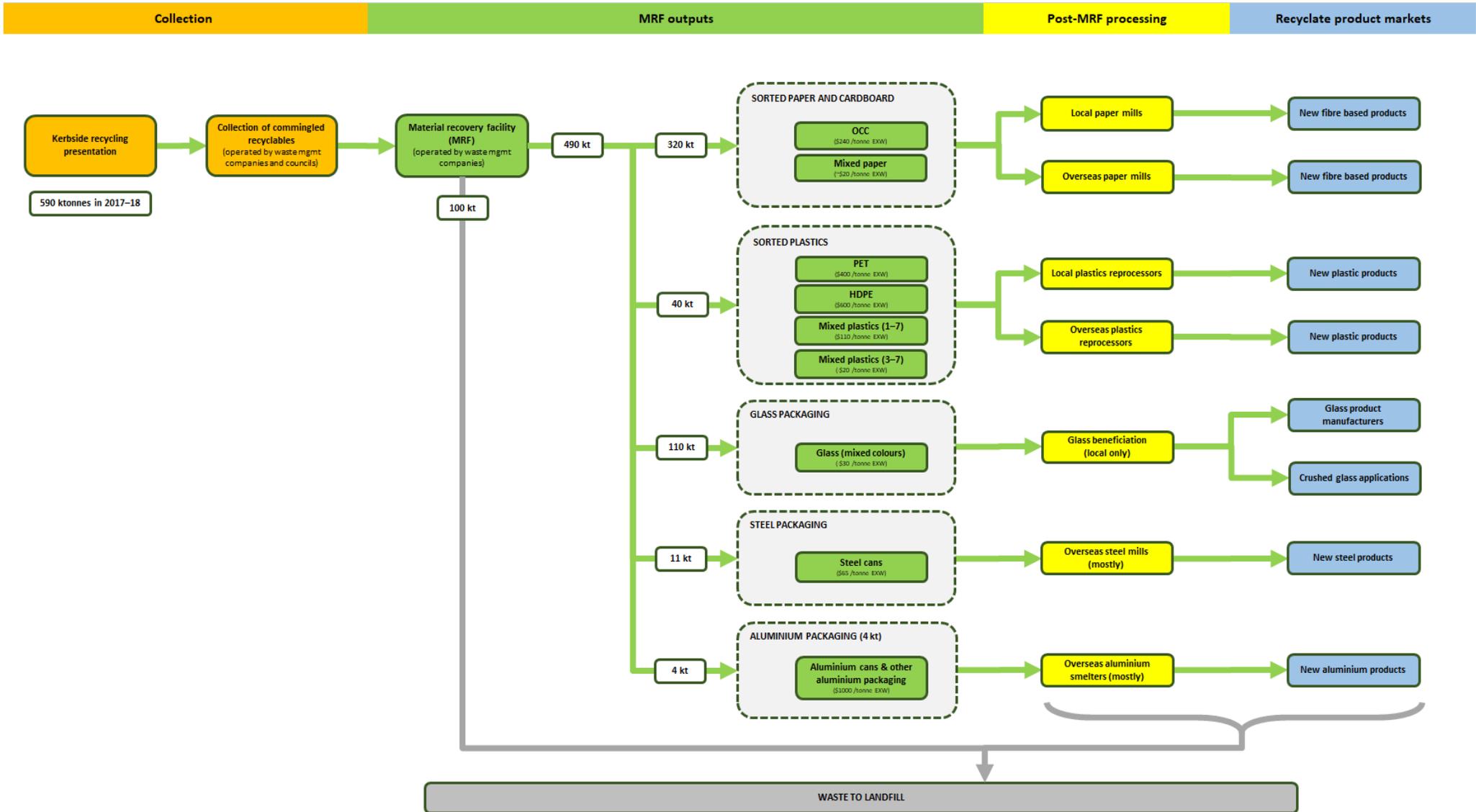
### Definitions

A comprehensive glossary of the terms and definitions used throughout the publication is provided [here](#).

### Information sources

The information and data obtained for the development of the publications has been obtained from a wide range of stakeholders and publications. Sources include many industry and other stakeholder interviews, analysis of ABS Customs export data, and review of national and international publications. A full listing of the information sources is provided [here](#).

Figure 1.5 - Snapshot of kerbside recyclables flows (2017–18) and pricing (end January 2019)



Source: Envisage Works

## 2. Resource markets

### 2.1 Kerbside recovered paper and paperboard

#### Market highlights

**Highlight 1** – Export pricing for all grades except mixed paper and paperboard have increased significantly and stabilised at higher prices, driving domestic prices higher.

**Highlight 2** – Quantities of recovered old newsprint (ONP) in particular, have declined sharply, due to falling newspaper consumption, growing international demand for quality ‘mechanical’ fibres and high pulp prices, for which this material is a substitute in some international markets.

**Highlight 3** – Although they have risen, spot prices for old corrugated cartons (OCC) are probably still insufficient to commercially support the additional sorting of kerbside fibre-based material. Quantities of OCC finding their way into households and small businesses are growing through e-commerce deliveries.

#### Material overview and market summary

Post-consumer paper and paperboard collections are primarily commingled and there is little sorting of recovered paper and paperboard grades by MRFs in Victoria, that is, the MRFs produce a single mixed paper bale product. This material is usually fairly contaminated, in particular by glass fines. These cause significant damage to pulping and paper making equipment, meaning kerbside material is less sought after unless it has been additionally sorted (double-sorted) or cleaned in-process.

Victoria also receives significant quantities of recovered material from South Australia and Tasmania. The interstate flows of packaging will be explored in more detail in future editions of this report.

Markets for recovered paper are increasingly globalised. For much of the last decade, kerbside collected material has been exportable, and at times has commanded higher prices than could be offered by local producers. In turn, this has reduced the viability of local investment in re-processing material.

The major producers in the state are Australian Paper (packaging and industrial, and printing and communication grades), Visy Industries (packaging and industrial grades), and Asaleo Care and Encore Tissue (both manufacturing tissue grades). Production capacity in Victoria totals approximately 1 million tonnes, with an estimated 45% to 50% supplied by recovered paper.

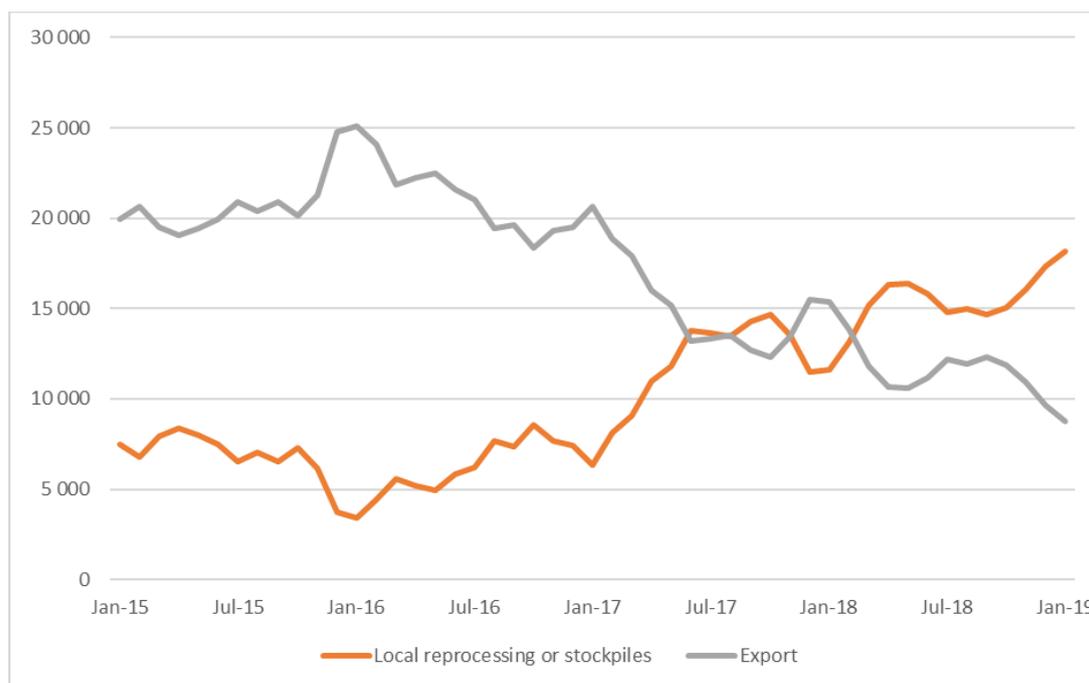
Victoria’s consumption of paper and paperboard is estimated to be between 820,000 and 860,000 tonnes per annum (across all uses, not just household). This consumption includes significant import quantities of printing & communication papers and unrecoverable tissue and tissue products. There are large quantities of industrial grades of paperboard imported as packaging of imported goods.

The declining consumption of newsprint and other grades of printing & communication papers is contributing to a reduction in the quantity of kerbside collected material over the last 5–10 years.

Printing and communication papers and tissue grades are made primarily from virgin fibre pulp, although increasing quantities of recovered paper are being used to manufacture the former, as markets slowly develop for recycled office papers.

Provided in the following figure is data on the change in exports of kerbside recovered paper and paperboard since the beginning of 2015. There was a drop in exports of around 20% across 2017, followed by a further drop of another 30% or more during 2018. Some of this material has been diverted into stockpiles, another issue that will also be explored in more detail in future editions.

Figure 2.1.1 – Destination of Victorian MRF outputs (tonnes/month) – Kerbside paper & paperboard



Note: Historical total monthly MRF outputs have been approximated in the figure above to enable comparison with monthly ABS customs export data. The 'Local reprocessing or stockpiles' and 'Landfill' estimates should be seen as indicative only. The overall trends are the key aspect of the figure.

Source: ABS (2019) and Envisage Works

### Prices, demand and supply

The significant majority of kerbside collected paper and paperboard is governed by supply-side contracts where the value of the fibre had, until recently, been covering costs of most collections.

The economics of this supply-chain have altered dramatically over the last 12 months. While higher prices are being paid for sorted material that meets new quality standards, those are essentially export derived prices. In an environment of largely stable demand for fibre resources, Victorian reprocessors are paying higher prices for the same material than was the case little more than a year ago, or having to accept lower quality material and carry the additional costs of cleaning and processing the raw materials.

Kerbside collected material that has not been sorted by grade (mixed paper and paperboard) is unable to be sold locally or through export in any significant volume and has a current value of close to \$0/tonne. This means that it is often unmovable except to landfill or (temporarily) to stockpiles. Disposal to landfill also then incurs an immediate disposal fee of more than \$100/tonne. It is reported that small quantities were purchased recently for between \$22 and \$50/tonne.

Newsprint and magazine grades have recently been purchased in the Australian market at up to \$340/tonne (at the out-going material recycling facility (MRF) gate, also referred to as ex-works (EXW) in this publication). These grades make up around 30–35% of the mixed paper product that the MRFs are currently baling and cannot sell.

Most quantities of unbleached Kraft or OCC are collected through dedicated commercial collections (e.g. from supermarkets) and are not kerbside collected. This OCC is usually sold domestically on contract and prices cannot be reported here. However, spot prices are known to be around the \$265/tonne mark, and are linked directly to the export price.

In general the demand for the MRF sorted mixed paper and paperboard material remains very low, even though the prices and demand for the sorted grades is so much stronger. However, the required sorting capacity has significant capital funding challenges.

### Key end-markets and related specifications

The major end-markets for recovered paper and paperboard are:

- Newsprint – new newsprint production has long included significant portions of recovered newsprint).
- Packaging papers – especially recycled linerboards and corrugating medium for corrugated box manufacture (at least two-thirds of boxes are manufactured from recycled fibre from OCC). This is the major end market.
- Moulded fibre production, including egg cartons and fruit trays made primarily from recovered newsprint and more recently from lower quality but cheaper recovered magazines and catalogues.
- Pet care products such as 'kitty litter' where the mechanical paper grades such as newsprint are particularly sought after.
- Composting material and growing medium including for roadside and project revegetation made primarily from kerbside collected material.

Provided in the following figure are indicative estimates (by grade) of MRF recovered fibre. Note that most of this material in Victoria is sorted by MRFs into a single mixed paper and paperboard product. As time-series monthly data becomes available the publication will provide data with increased granularity on this important component of MRF output.

Table 2.1.1– Victorian MRF outputs (tonnes in January 2019) – Paper & paperboard, by grade (within the typical mixed bale)

Material type	Quantity
Fibre – Boxboard	3 300
Fibre – Liquid paperboard	200
Fibre – Newsprint & magazine	8 700
Fibre – Office paper	1 400
Fibre – Old corrugated cardboard	13 300
Fibre sorting losses	1 400
<b>Total</b>	<b>28 300</b>

Source: Envisage Works, SV (2018) and industry consultation

## Export and interstate market review

Global markets for higher quality recovered papers and paperboards are significant and robust. Australia remains a major contributor to the global export market, and Victoria is the largest export source in Australia, in part due to its role as recipient of Tasmanian and some South Australian recovered paper, prior to export.

There are four export designations or grades of recovered paper:

- unbleached Kraft (essentially cardboard)
- bleached Kraft (effectively white office papers)
- mechanical (newsprint and old magazines)
- unsorted/mixed (mainly kerbside collected material)

All recovered paper and paperboard is exported under those designations, although within each, there are quality specifications that command different prices.

In 2018, Victoria exported approximately 512,000 tonnes of recovered paper, down 23% on 2017, at an average AUD (FOB) \$190/tonne, (actually 11% higher-priced than the year earlier) demonstrating the extent to which quality fibre commands a price premium in global fibre markets. Only 135,000 tonnes of the 512,000 tonnes was from kerbside sources (down from 180,000 tonnes in 2017).

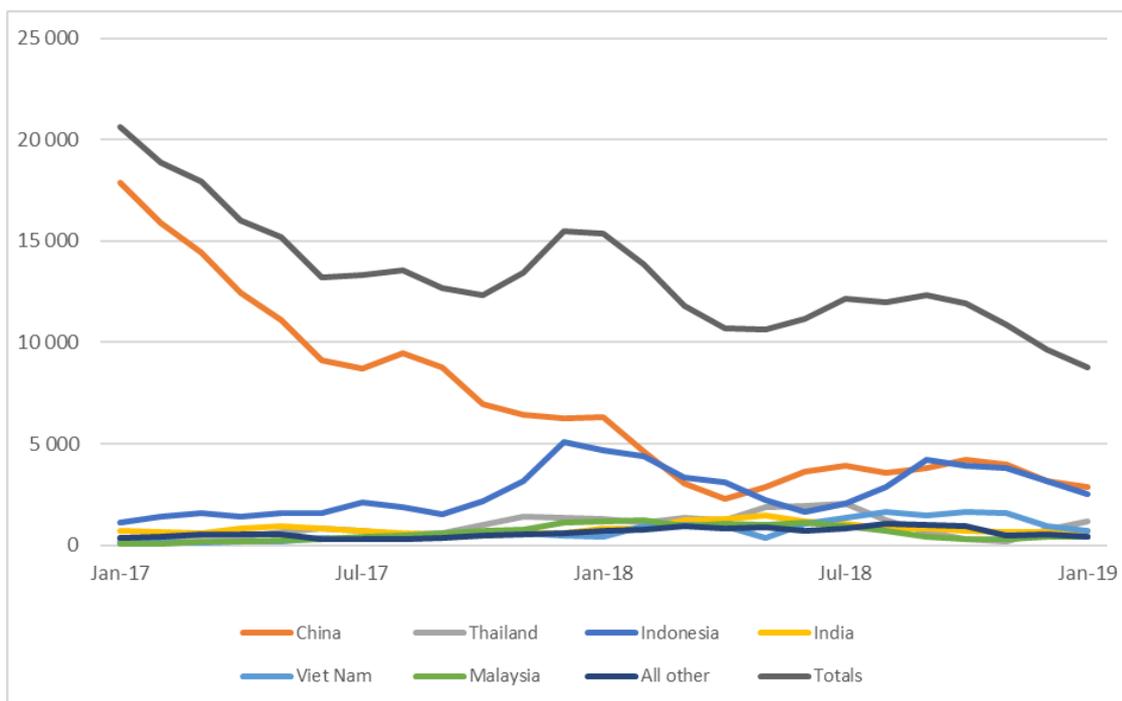
Export quantities of recovered newsprint have fallen dramatically over the last three years, to just over 20,000 tonnes from Victoria in 2018 (down 65% on 2017). In January 2019, exports from Victoria totalled just 1,700 tonnes with an average price of \$440 /tonne (loaded onto the ship).

Currently, interstate transfers of recovered newsprint are particularly strong (as are exports) because the fibre remains in demand and supply low.

Exports of kerbside recovered mixed paper and paperboard have dropped dramatically over the last few years. In 2016 exports were around 250,000 tonnes, down to 180,000 tonnes in 2017 and then 135,000 tonnes in 2018. This fall was driven entirely by lost sales to China, with exports to Indonesia (mostly) increasing somewhat, but flattening through 2018.



Figure 2.1.2 – Victorian recovered kerbside paper & cardboard, to export country (tonnes/month)



Source: ABS (2019) and Envisage Works

### Market risks, opportunities and activities

We are living in a fibre constrained world, and there are good markets and prices available for reasonable quality sorted paper grades both locally and overseas.

The quality of recovered fibre is a major threat. This is heavily influenced by how the material is collected (e.g. commingled recycling) and the resources that have been applied to its handling, sorting, cleaning and preparation for end-users.

Improving the quality of the recovered fibre supplied to market (domestic and international) is a key opportunity for Australia, and specifically for Victoria, which generates (and receives from interstate) the largest volume of recoverable material each year. The local paper mill capacity and fibre demand is not sufficient to absorb all local kerbside paper, so major growth in local use will come with new processing capacity, along with market pull-through due to new product development.

## 2.2 Kerbside recovered glass packaging

### Market highlights

**Highlight 1** – Markets are available for glass back into packaging if the material meets quality specifications. The cullet (recycled) content of packaging can be increased significantly from its current level.

**Highlight 2** – Recovered glass sent from kerbside systems is sometimes incurring a fee per tonne rather than a (very low) payment due to the relatively low price for beneficiated glass.

**Highlight 3** – The increasing amount of CDS sourced glass collected in other states will see more cullet going into glass packaging manufacture, and could lower demand for poor quality Victorian glass.

**Highlight 4** – There is no export market for any grade of recovered glass, it is too low in value.

### Material overview and market summary

Victorian glass packaging consumption is likely to be around 300,000–350,000 tonnes. Over the last 5–10 years or so there has been significant growth in imports of both filled and empty (for local filling) glass packaging. This is displacing domestic production, reducing demand for recovered glass for use in local packaging production.

Some glass packaging is imported into Australia as packaging around goods such as beer, sauces, wine and oils. There is no precise data on the total quantities of glass entering Australia in this form. However, APCO has recently commissioned work to determine this.

The major manufacturer of glass packaging Owens Illinois (O-I), has in recent years closed some furnaces at its glass plant in Melbourne and also in Adelaide, Sydney and Brisbane. Glass packaging is also manufactured in Adelaide by Orora.

Nationally, the recycling rate benefits from container deposit schemes with higher return rates by consumers and businesses, as well as the very high quality (coloured sorted) recovered glass packaging that can be recovered through CD schemes. Container deposit eligible containers (mostly beer) make up an estimated 60% of total consumption.

There is no export of glass cullet from Australia for recycling. Most glass coming through commingled kerbside collections is going to beneficiation (sorting and sizing processes) and cullet feed at O-I glass plants. Some quantities are going into lower grade construction applications and some is being stockpiled. Over 90% of recycled glass cullet comes from MRF sources in Victoria.

Highly mechanised commingled recycling collection and sorting tends to break glass into small pieces that are not easily recoverable. A market analysis on glass packaging published by SV in 2014 estimated that around 34% of glass that is collected for recycling is lost through collection and MRF sorting losses. The unrecovered glass fragments can go to landfill or be sorted with other materials. The larger recycling sorting plants increasingly have technologies to deal with these small fragments.

Sorted glass from MRFs that is to be recycled back into packaging is then required to be sent to one of six beneficiation plants. These plants also receive some loads sent and paid for by O-I from regional locations where freight costs are high. This includes glass into Melbourne from Tasmania. O-I pays these suppliers a rate that recognises the extra cost of freighting. Sometimes small quantities of green glass are transferred to South Australia for wine bottle production.



The impact of glass fragments on other materials, particularly paper grades, is a major problem, and the glass itself is of much lower value when collected through commingled kerbside systems. The City of Yarra is soon to trial separate glass collection.

### Prices, demand and supply

Gate fee rates for MRFs sending material for beneficiation can vary, based on quality and quantities. Gate fees of \$0 /tonne (EXW MRF) to -\$30 /tonne (EXW MRF) are reported. Following beneficiation O-I then receives the glass cullet from beneficiators in each city. The price paid by O-I to these beneficiators has remained largely unchanged in recent years

The price received for cullet is typically locked into multi-year contracts between beneficiators and glass product manufacturers. Currently cullet makes up 40% of the input to O-I glass manufacture. They are targeting 60% input and can accept an even higher ratio, particularly for amber and green production.

### Key end-markets and related specifications

Beyond taking glass packaging waste back into packaging production, there are a range of other secondary markets that can be used but these do not offer a high market price, and are typically down-cycling the glass. These include glass into road base material, abrasives, and filter media. These markets will be explored in more detail in future editions of this report.

Provided in the following figure are indicative estimates (by glass colour) of MRF recovery. Note that in Victoria almost all of this is sorted by MRFs into a single mixed glass product, which may then be colour sorted and beneficiated. As time-series monthly data becomes available the publication will provide data with increased granularity on this important component of MRF output.

Table 2.2.1 – Victorian MRF outputs (tonnes in January 2019) – Glass packaging, by colour

Material type	Quantity
Glass – Amber	2,600
Glass – Flint	4,100
Glass – Green	2,000
Glass sorting losses	3,800
<b>Total</b>	<b>12,500</b>

Source: Envisage Works, SV (2018) and industry consultation

### Export and interstate market review

Glass cullet is not exported and due to its low value relative to shipping costs this is unlikely to change.

There is often a mismatch in demand for different colours in different states, and currently green glass is in oversupply in Sydney and Melbourne so some is transported to Adelaide for wine bottle production.

## Market risks, opportunities and activities

The risks to glass recycling relate to its method of collection and the fact that Australia uses more glass packaging than it ever utilises back into local manufacture due to imported products such as beer, wine and food. This means that there will generally always be more supply than demand.

The commingling of glass with other recyclable materials and contaminants results in low quality glass from kerbside-sourced glass and also impacts on the value and markets for recovered paper and plastics.

The glass packaging returned through container deposit schemes is cleaner and has a higher demand and value compared with glass from MRFs. A separate glass recycling collection is being trialled by City of Yarra to examine the impact of a separate collection on glass and paper grades quality and value.



## 2.3 Kerbside recovered plastic packaging

### Market highlights

**Highlight 1** – The export markets for MRF sorted baled PET (1) and HDPE (2) plastic packaging remain buoyant, with strong local markets also available for good quality material. Even this material cannot enter China as it does not meet the 0.5% permissible contamination threshold. Generally only high-quality pelletised recycled polymer can still get into China.

**Highlight 2** – The export and local markets for baled mixed plastics packaging remains very tight with limited buyers and dramatically reduced value.

**Highlight 3** – Some local and overseas reprocessors are responding to the Chinese import restrictions by investing in new equipment to value-add local scrap and produce high-quality recovered resin for local and overseas markets.

### Material overview and market summary

During 2017–18 it is estimated that around 200,000 tonnes of consumer plastics packaging was used in Victoria. This packaging is both produced here and also imported around imported consumer goods. A large proportion of the resin used in local packaging manufacture is also imported. For example, there is no local production of virgin PET resin at all.

There are a range of plastics packaging formats, primarily bottles, jars, trays and film. Some market applications make up a significant fraction of plastic packaging consumption but are generally not designated to be recycled through kerbside systems (e.g. plastic films). Only a small percentage of households have flexible plastic packaging designated for inclusion in kerbside recycling.

Plastics collected through kerbside collections are generally sent to MRFs and sorted from commingled recycling into either a single mixed plastics grade (1–7 plastic polymer mix), or more commonly three grades, which are PET, HDPE and the residual mixed plastics grade (a 3–7 plastic polymer mix, but with reasonable residual quantities of PET and HDPE still present).

In Victoria the plastic packaging recycling rate is estimated at around 30–35%, with around 60,000 tonnes of recovered packaging (kerbside and all other) and around 140,000 tonnes of unrecovered packaging going to landfill.

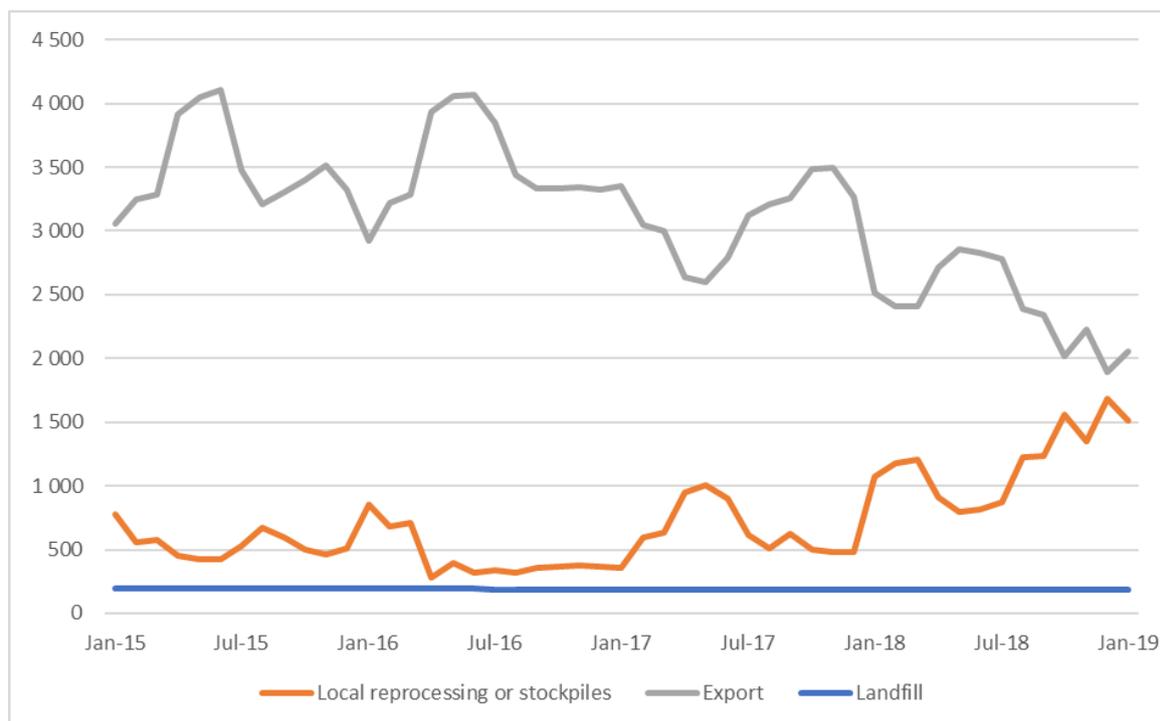
A broader range of plastics packaging has been included in kerbside collections in recent years and this includes other polymers beyond PET and HDPE, and also non-beverage PET and HDPE formats such as punnets and trays.

Baled PET and HDPE packaging is currently exported to a wide range of countries, with the main destinations in 2018 being Malaysia and Indonesia. However, the new Malaysian import restrictions entered into force from July 2018, and have had a major impact on Australian imports into Malaysia since that time.

Plastics from virgin production is fossil hydrocarbon sourced. As a result, the recycling of plastics offers a substantial environmental benefit in terms of reduced greenhouse gas emissions over the production of plastics from virgin resins. The recycled material is now increasingly considered to be of similar quality as virgin product. This means there is a declining level of market resistance to using recycled polymer. However, the use of recycled polymer in food grade applications remains constrained to some PET and HDPE.

Provided in the following figure is data on the change in exports of kerbside recovered plastic packaging since the beginning of 2015. There was a drop in exports of around 40–50% across 2018, most of which would have been mixed plastic bales. Some of this material has been diverted into stockpiles, another issue that will also be explored in more detail in future editions.

Figure 2.3.1 – Destination of Victorian MRF outputs (tonnes/month) – Kerbside plastic packaging



Note: Historical total monthly MRF outputs have been approximated in the figure above to enable comparison with monthly ABS customs export data. The 'Local reprocessing or stockpiles' and 'Landfill' estimates should be seen as indicative only. The overall trends are the key aspect of the figure.

Source: ABS (2019) and Envisage Works

### Prices, demand and supply

There are strong local and export markets for clean PET bales that are collected and sorted to specification, however exporters are reported a decline in the price received from the beginning of 2018. Prices fell by around 30%, from a strong longer-term price of \$500–\$600 /tonne down to \$350–\$400 /tonne (EXW) at the current time.

The price of recycled resin is linked to the price for virgin resin. In the case of PET, the virgin price generally increased across 2018, in part due to China utilising more of this material as it received less imported recyclate, however virgin prices did see some falls starting in October 2018.

There is minimal difficulty in finding a destination for collected and sorted PET packaging. The exception to this is the recovery of PET packaging that has mixed polymer barriers, such as that going into punnet applications. This can hamper recycling and reduce the sale price.

The situation is similar for HDPE, with markets and pricing for clean material remaining strong. There was some export price reduction due to the Chinese restrictions with prices falling to around \$500 /tonne in early to mid-2018. However, prices have recovered somewhat and are now trading at around \$600 /tonne. Building activity has helped to elevate the price paid for HDPE in both virgin and recycled forms.

The market for mixed plastic packaging bales is currently very poor at \$0 /tonne or less (EXW MRF), and significant stockpiling of mixed plastics packaging is occurring by both MRFs and reprocessors.

The nature of the mechanised sorting at MRFs means there is typically some contaminant material and therefore market concerns. This contamination can be in the form of food residue, other polymer plastics or other materials such as paper and glass fragments, and is a particular issue in the mixed plastic packaging product.

### Key end-markets and related specifications

Exported plastics packaging has specifications relating mostly to contamination levels. The positive sorting of PET and HDPE that is undertaken at MRFs allows the baled material to generally meet these specifications without major difficulty or manual sorting input.

Previously plastics packaging has been overwhelmingly exported to China, until the latest round of restrictions. Mixed plastics are currently locked out of the Chinese and Malaysian markets.

A proportion of the mixed plastic packaging is utilised in durable (timber substitute type) plastics applications such as outdoor equipment and building materials.

Provided in the following figure are indicative estimates (by grade) of MRF recovered plastic packaging. Most rigid packaging in Victoria is positively polymer sorted for PET and HDPE, leaving a residual 3–7 polymer stream that is baled, this is also referred to as a 2:2:6 bale (i.e. 20% PET, 20% HDPE and 60% other polymer types). As time-series monthly data becomes available the publication will provide data with increased granularity on this important component of MRF output.

Table 2.3.1 – Victorian MRF outputs (tonnes in January 2019) – Plastic packaging, by polymer

Material type	Quantity
Plastic – PET (1)	1 100
Plastic – HDPE (2)	1 300
Plastic – Mixed (1–7)	0
Plastic – Mixed (3–7)	1 200
Plastic – LDPE film	0
Plastic – Other	0
Plastic sorting losses	200
<b>Total</b>	<b>3 800</b>

Source: Envisage Works, SV (2018) and industry consultation

### Export market review

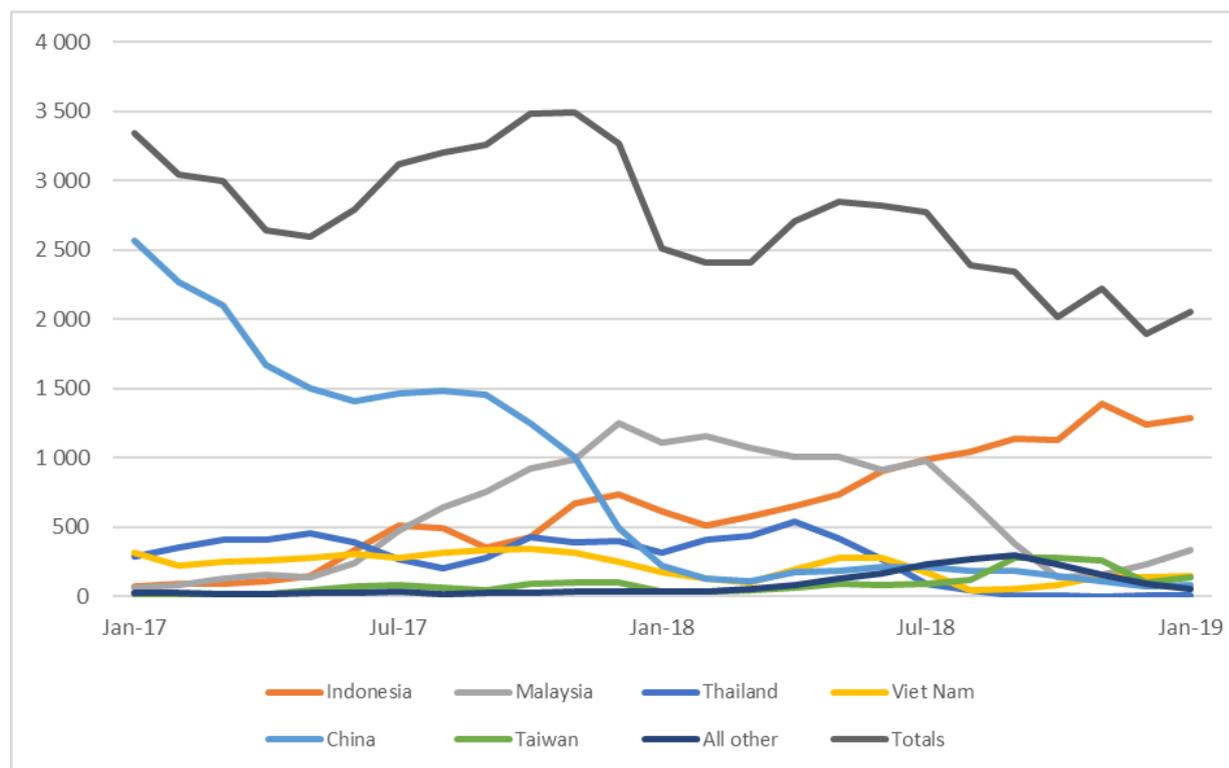
Plastic packaging exports from Australia compete in receiving countries with plastics from the US, Europe and many other countries. It is destined for wherever the demand requires material for production. Generally, demand and pricing will increase or decrease based on worldwide supply and demand conditions.

China, as a traditionally large export market destination has severely curtailed the acceptance of mixed polymer plastics. India, Malaysia, Thailand and Vietnam have also all brought in import restrictions or bans on the imports of scrap plastics. There are now heavily constrained overseas end market for plastic packaging, other than for sorted PET and HDPE.

The worldwide virgin plastics production capacity is also changing and it is reported that much new virgin production capacity is in the pipeline. Once this new capacity enters production it will place downwards pressure on virgin resin prices, and so also on recycled resin prices.

Exports of kerbside recovered mixed plastic packaging have dropped dramatically over the last few years. In 2016 exports were around 42,000 tonnes, down to 37,000 tonnes in 2017 and then 29,000 tonnes in 2018. This fall was driven entirely by lost sales to China, with exports to Malaysia and Indonesia taking up some of this material, however, Malaysian sales then fell sharply after July 2018.

Figure 2.3.2 – Victorian recovered kerbside plastic packaging, export country (t/month)



Source: ABS (2019) and Envisage Works

## Market risks, opportunities and activities

The depressed and constrained market for mixed plastic has put kerbside systems under pressure here, interstate and globally. It is leading to a higher level of sorting of polymers than had previously occurred. It has also triggered some expansion of plastics recycling in Victoria and interstate.

Recognising the challenges of recycling a broad range of polymers, many brand-owners and retailers are selecting PET and HDPE in more formats to the exclusion of other polymer types. The pursuit of nationally adopted targets for the eliminating of problematic plastics packaging is also likely to see a rationalisation of material used in plastic packaging.

Plastic packaging design, disposal practices, collection, sorting and reprocessing will all need to improve if the national target of 70% plastics packaging recycling is to be achieved by 2025 (currently around 25–30%).

## 2.4 Kerbside recovered metal packaging

### Market highlights

**Highlight 1** – Almost all recovered steel and aluminium packaging bales are sold to export, and the export markets for both packaging types have no quantity constraints.

**Highlight 2** – The ease of metal separation during MRF sorting (magnets for steel and eddy currents for aluminium), and the value of the materials, is enough that MRF operators maximise recovery. This is particularly the case for aluminium, which is worth around four times more than steel to MRF operators, even though more than twice as much steel is recovered.

**Highlight 3** – Aluminium and steel packaging remain an important revenue source for MRF operators, even though they are a small proportion of the kerbside recycling stream.

### Material overview and market summary

Steel and aluminium cans, mostly recovered through kerbside recycling collections from households, account for only a small fraction of overall metals recovery from Victoria.

MRFs are well equipped to separate these materials from household collections into marketable grades of recyclate, which although small in volume (around 3–4% of the average household recycling bin) represent a valuable source of revenue for MRFs.

Recovered steel packaging is considered a low-value form of steel scrap, but it is still sought after and overseas markets are reasonably strong. While it contains small quantities of tin, this is often added to steel recycling and therefore there is little market resistance to can material in steel recycling.

Beyond tin-plated steel cans there are other steel packaging formats such as closures and aerosol packaging. These are smaller market applications and account for only a small fraction of the material recycled through kerbside systems.

Aluminium beverage cans have been a key component of kerbside recycling systems since their beginning. The uniform nature of the can, together with the high material value and ease of mechanised sorting, make it a highly sought after material with minimal sorting or market challenges.

Beyond this there are also other aluminium packaging formats such as aerosols, trays and foils. These have much smaller quantities entering the market, and account for only a small fraction of the material recycled through kerbside systems (around 10% of beverage).

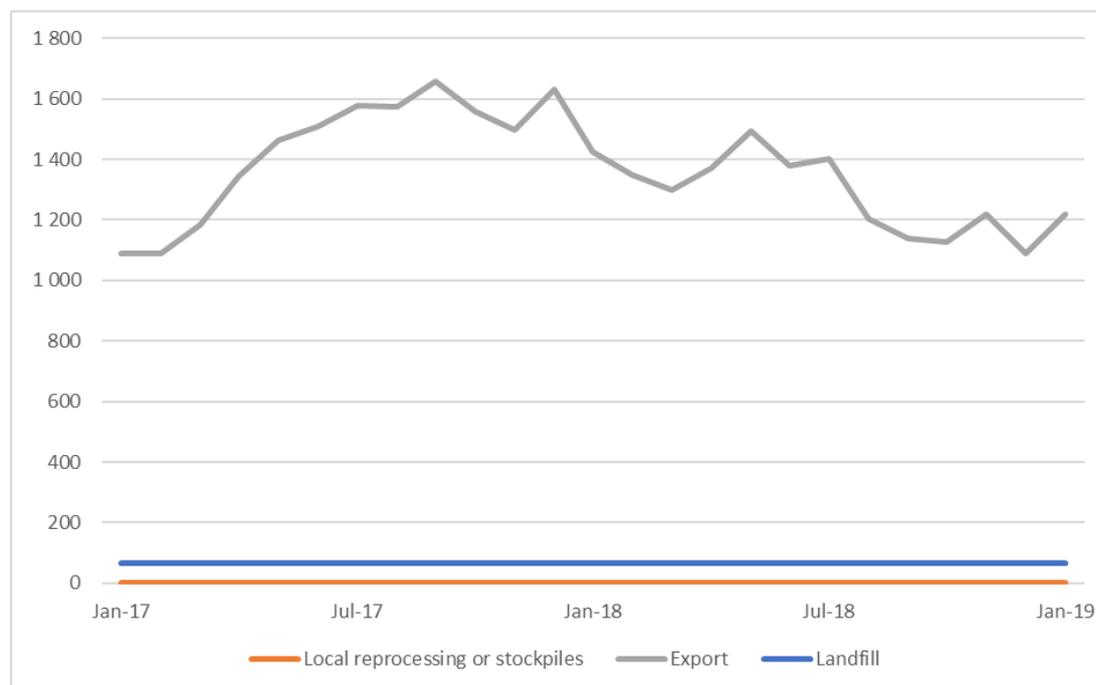
The baled steel and aluminium packaging is sent to a wide range of countries, with the main destinations over the last few years being Taiwan, India, Korea and Malaysia. Almost all recovered metal packaging is sold into export markets, with little of the tin-plated steel or aluminium packaging reprocessed here in Australia.

Australia's scrap metal exports to date are not experiencing difficulties comparable to some other recycling streams in the wake of the Chinese National Sword restrictions. This is due in part to China not being a major destination for these materials prior to the National Sword import restrictions.

Provided in the following figure is data on the change in exports of kerbside recovered metal packaging since the beginning of 2017. Exports have been fairly steady across this period.



Figure 2.4.1 – Destination of Victorian MRF outputs (tonnes/month) – Metal packaging



Note: Historical total monthly MRF outputs have been approximated in the figure above to enable comparison with monthly ABS customs export data. The 'Local reprocessing or stockpiles' and 'Landfill' estimates should be seen as indicative only. The overall trends are the key aspect of the figure.

Source: ABS (2019) and Envisage Works

### Prices, demand and supply

There is now little, if any, steel or aluminium packaging scrap reprocessed in Australia. However, international markets for these commodities remain strong.

There is no significant stockpiling of steel or aluminium packaging.

There are no current limits on quantity of steel or aluminium packaging into any international markets. The nature of the mechanised sorting at MRFs means there is little contaminant material (apart from some product residue) and therefore minimal market concerns.

The price of steel packaging is strongly linked to global steel pricing. The current price received for baled steel packaging is approximately \$130–\$150 /tonne (EXW MRF).

The price of shipped aluminium packaging is linked to virgin aluminium pricing. The current price received for baled aluminium beverage cans is approximately \$1000–\$1100 (EXW MRF).

### Key end-markets and related specifications

Exported steel packaging has specifications relating to contamination levels and bale density. The sorting that is undertaken at MRFs allows the baled material to meet these specifications without major difficulty or manual sorting input. A similar situation exists for aluminium packaging.

Generally steel and aluminium packaging is recycled back into the respective scrap metal pools and go into durable applications such as vehicles, building materials and many other products.

Provided in the following figure are indicative estimates (by metal type) of MRF recovered metal packaging. As time-series monthly data becomes available the publication will provide data with increased granularity on this important component of MRF output.

Table 2.4.1 – Victorian MRF outputs (tonnes in January 2019) – Metal packaging

Material type	Quantity
Steel	900
Aluminium	300
Metal sorting losses	100
<b>Total</b>	<b>1 300</b>

Source: Envisage Works, SV (2018) and industry consultation

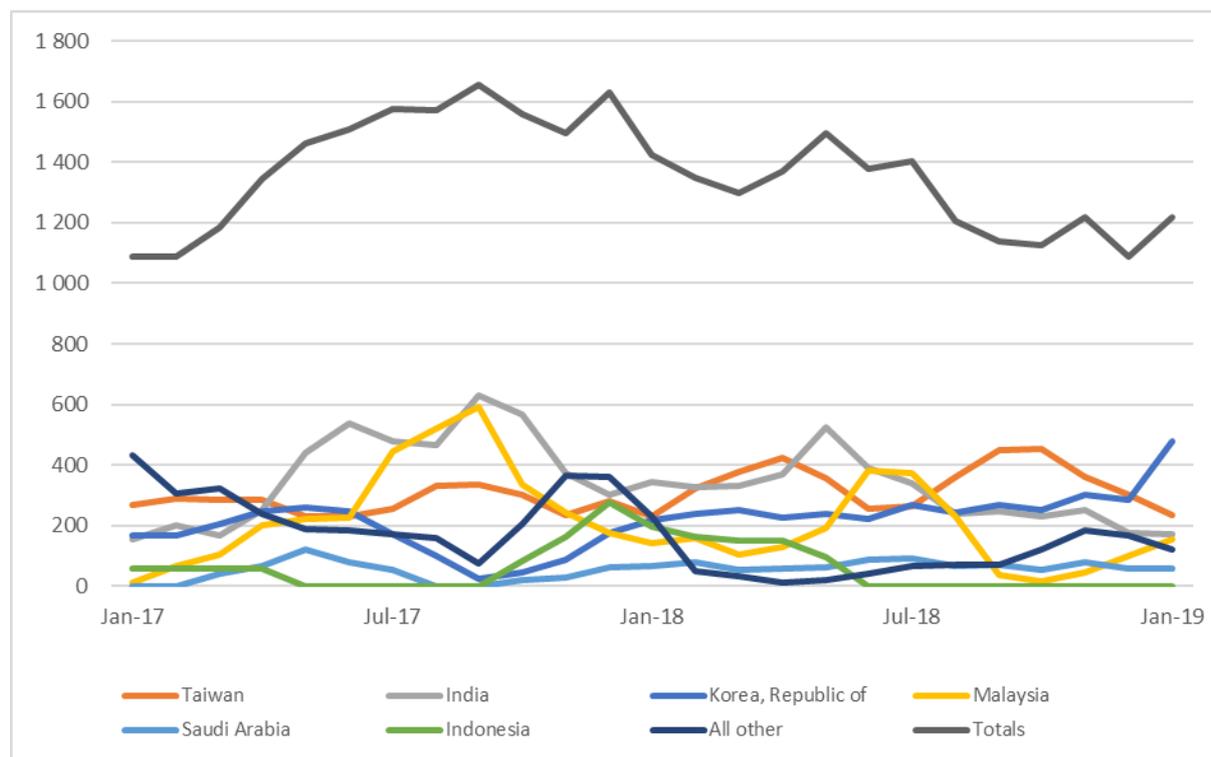
### Export market review

The exported steel and aluminium packaging are sold into large markets with most metal coming from non-packaging sources. The material flows from all countries and is destined for wherever the demand requires material for production. Unlike some other materials, there is no way of knowing the origin of the steel or aluminium in new product. Demand and pricing can increase or decrease based on worldwide supply and demand conditions.

If a large market such as China suffered a contraction in economic activity, this could result in price reductions. The worldwide virgin steel and aluminium production capacities are also changing and a contraction or expansion in capacity will influence pricing.

Exports of kerbside recovered metal packaging have remained fairly steady over the last couple of years, at around 16,000 tonnes in 2016, 17,000 tonnes in 2017, and 15,000 tonnes in 2018.

Figure 2.4.2 – Victorian recovered kerbside metal packaging, to export country (tonnes/month)



Source: ABS (2019) and Envisage Works

### Market risks, opportunities and activities

The global steel and aluminium markets have both been historically able to consistently absorb metal packaging from kerbside systems, better than the local or global markets for any of the other packaging materials. This is primarily due to the lack of barriers in using MRF sourced metal packaging into most steel and aluminium market outlets.

If there was a dramatic negative shift in supply/demand at a global level, this could lead to significant price reductions for baled steel or aluminium packaging. However, there is no specific reason to believe that this is a particular risk at the current time.

## 3. SUPPORTING WEB RESOURCES

### 3.1 Project purpose, scope and approach webpage text

#### Project purpose and scope

The purpose of this project is to provide Sustainability Victoria, its portfolio partners and other key stakeholders, such as industry, with a solid evidence base to support the interventions that can be undertaken to address the current end-market failures for low-value and highly contaminated mixed paper and mixed plastics, as generated by kerbside recycling collections.

The immediate cause of the present situation is the implementation of the latest round of import restrictions or outright bans on these material types by China, followed by other south-east Asian receiving countries such as Thailand, Indonesia and Vietnam.

The problem has been occurring at intervals over the last decade or more. For this reason, an underlying objective of this project is to reduce the exposure of kerbside recycling to the international export market for kerbside recyclables, or alternatively, expand the range of overseas markets seeking the materials, for example through improved local value-adding (e.g. sorting to higher grades and undertaking additional scrap processing activities locally).

This project will underpin Sustainability Victoria's objective to support market recovery and resilience by providing advisory and market information to both internal government and external sector participants. This information will be aimed at identifying current and future opportunities for the recycling of kerbside collected materials, and providing broader information about commodity trends and international market conditions.

The project will support market network development and the identification of new market pull-through opportunities both locally and overseas, leading into the longer-term objective of supporting the development of strong and resilient kerbside recycled material markets.

#### Project approach

The project uses detailed analysis of kerbside recycled material markets and extensive stakeholder consultation to quantify the targeted materials flows and values at specific points in the supply chain (e.g. out-going MRF gate or on-the-ship to export), and provide up-to-date qualitative market commentary on local and export market conditions (e.g. current or future end-market opportunities and status of receiving countries import restrictions) to support decision-making by industry and government, and market development more generally.

The project approach to information collection is to compile monthly data on flows and prices of kerbside recyclables commodity markets through regular rounds of stakeholder consultation, review and synthesis of local and international recycled material related publications, and monthly analysis of ABS Customs data to track changes in Victorian and national exports of kerbside scrap materials.

The information to be provided in the publications is:

- Monthly data on flows and prices of kerbside recyclables commodity markets.
- Monthly information on the condition of the targeted markets.
- Commentary on potential domestic and international markets for the targeted materials.



- Up-to-date information on the status of import bans.
- Flag potential future market shocks where possible.
- Flag any issues around stockpiling activity, particularly with respect to combustible recyclable and waste materials (CRWMs).
- Identification of key blockages in the sector that could be targeted by government and/or other stakeholders.

Kerbside collected scrap paper/cardboard, plastics, glass and metals are the primary focus of the project. Scrap markets beyond kerbside related material are to have a degree of coverage, as there are not always delineated domestic and commercial sourced markets for scrap materials.

## 3.2 Glossary of terms

Term	Description
Beneficiation (of glass)	An optical sorting process used to separate different colours of container glass to produce cullet for reprocessing and mixed fines.
Closed-loop recycling	Material from a product system is recycled in the same product system, and is of the same quality and functionality as the original material. Also see 'Open-loop recycling' and 'Downcycling'.
Commercial and industrial (C&I) waste	Solid inert waste generated from trade, commercial and industrial activities including the government sector. It includes waste from offices, manufacturing, factories, schools, universities, state and government operations and small to medium enterprises e.g. food waste.
Commingled recyclables	Materials combined generally for the purposes of collection, mainly through municipal collection services. Includes plastic bottles, other plastics, paper, glass and metal containers. Commingled recyclable materials require sorting after collection before they can be reprocessed. Can also be called commingled materials.
Composting	The process whereby organic materials are microbiologically transformed under controlled aerobic conditions to create a pasteurised and stabilised organic product for application to land.
Construction and demolition (C&D) waste	Solid inert waste generated from residential and commercial construction and demolition activities e.g. bricks and concrete.
Contaminants – Out throws	A sorted scrap (bale) related term. Recyclable materials that are unsuitable for inclusion in the sorted grade (product) in which they are present, but can be sorted, separated and/ or removed easily during the recycling process. Out throws generally have significantly higher allowable thresholds, compared to prohibited materials, in bale specifications for sorted recycled material commodities. Also see 'Contaminants – Prohibited materials' entry.
Contaminants – Prohibited materials	A sorted scrap (bale) related term. Unrecyclable materials that are unsuitable for inclusion in the sorted grade (product) in which they are present, and cannot be sorted, separated and/or removed during the recycling process. Prohibited materials cause adverse impacts on end-products and may damage the recycling facilities. Prohibited materials generally have significantly lower allowable thresholds, compared to out throws, in bale specifications for sorted recycled material commodities. Also see 'Contaminants – Out throws' entry.
Cullet	Sorted glass feedstock resulting from the beneficiation process of mixed container glass. Generally consists of sorted streams of amber, flint and green glass of particle size greater than 5-10 mm depending on the capacity of the beneficiation plant.
Delamination	The process of splitting a composite material into its component parts e.g. laminated glass.
Downcycling	Recycled material is of lower quality and functionality than the original material. Also see 'Closed-loop recycling' and 'Open-loop recycling'.
Drop off centre/site	A facility where households can drop off selected materials and household items for recycling and reuse. Also called drop off facilities.
EXW / ExWorks	Incoterm (trade term) defining the sale (transfer of ownership) of goods at the gate of the seller. The buyer must carry out all tasks of export & import clearance. Carriage & insurance is to be arranged by the buyer.



End user (of recycled content raw materials)	A user of raw materials that have a recycled content. Examples of end users include plastic product manufacturers that use recycled polymer in their products, or agricultural producers that purchased composted organics as a soil conditioner/fertiliser.
Energy from waste (EfW)	The terms 'energy recovery from waste', 'waste to energy' or 'energy from waste' can be used interchangeably to describe a number of treatment processes and technologies used to generate a usable form of energy from waste materials. Examples of usable forms of energy include electricity, heat and transport fuels.
E-waste	E-waste comprises of electronic equipment with a plug or battery that requires a current to operate and that has reached end of life. It includes televisions, computers, monitors and whitegoods such as fridges and washing machines.
FAS / Free Alongside Ship	Incoterm (trade term) defining the sale (transfer of ownership) of goods once placed alongside the vessel at the named port of shipment by seller. The seller is required to clear the goods for export. This term can be used for sea transport only.
Feedstock	Raw material used to manufacture products. Material varies depending on what is being produced.
Fines (glass)	Unsorted sub 5-10 mm glass material left over from the glass beneficiation process. It can contain contamination including plastics and small pieces of metals. These fines can be further processed to produce a glass sand product which has a number of uses.
FOB / Free On Board	Incoterm (trade term) defining the sale (transfer of ownership) of goods once they pass the ship's rail at the named port of shipment at the cost of the seller. The seller must clear the goods for export. This term can only be used for sea transport.
Food organics	Food waste from households or industry, including food processing waste, out-of-date or off-specification food, meat, fruit and vegetable scraps. Excludes liquid wastes.
Garden organics	Organics derived from garden sources e.g. grass clippings, tree prunings. Also known as green organics.
Generator (of waste materials)	A C&I or C&D generator of waste materials to either landfill or recovery fates.
Green organics	More accurately referred to as garden organics.
Greenhouse gases	Gases, including carbon dioxide and methane, that trap heat in the earth's atmosphere, affecting weather and climate patterns.
Hard waste	The term applied to household garbage that is not usually accepted in kerbside garbage bins by local councils e.g. old fridges and mattresses.
Hazardous waste	See Prescribed waste and prescribed industrial waste (PIW).
Incinerator	For the purpose of this document, a site that facilitates the disposal of waste streams through incineration without producing another useful end product or capturing value from the waste material.
In-vessel composting	Composting technology involving the use of a fully enclosed chamber or vessel in which the composting process is controlled by regulating the rate of mechanical aeration. Aeration assists in heat removal, temperature control and oxygenation of the mass. Aeration is provided to the chamber by a blower fan which can work in a positive (blowing) and/or negative (sucking) mode. Rate of aeration can be controlled with temperature, oxygen or carbon dioxide feedback signals.
Kerbside waste/ collection	Waste collected by local councils from residential properties, including garbage, commingled recyclables and garden organics, but excluding hard waste.

Landfill	Discharge or deposit of solid wastes onto land that cannot be practically removed from the waste stream.
Landfill levy	A levy applied at differential rates to municipal, industrial and prescribed wastes disposed of at licensed landfills in Victoria. Landfill levies are used solely for the purposes of environment protection and fostering environmentally sustainable use of resources and best practice in waste management. They fund the activities of WRRGs, SV and EPA, helping to establish waste management infrastructure, industry waste reduction programs, education programs, regulatory controls and enforcement regimes. Levies also provide an incentive to minimise the generation of waste, sending a signal to industry that the government supports efforts to develop alternatives to disposal to landfill.
Liquid paperboard (LPB)	Liquid paperboard (LPB) is a fibre-based packaging board that is designed to hold a liquid. It is commonly comes in two main types, which are gable-topped LPB (plastic polymer layer / paperboard layer / plastic polymer layer), and aseptic LPB (plastic polymer layer / paperboard layer / aluminium foil layer / plastic polymer layer). Also see Polymer-coated paperboard (PCPB).
Materials recovered	Materials recovered from the region refers to materials diverted from landfill for use or reprocessing irrespective of where the recovery or reprocessing takes place.
Materials recovery facility (MRF)	A centre for the receipt, sorting and transfer of materials recovered from the waste stream prior to transport to another facility for recovery and management. At a MRF materials may undergo mechanical treatment for sorting by characteristics such as weight, size, magnetism and optical density and may include cleaning and compression. Materials may be received as mixed streams such as commingled recyclables from households and businesses or single streams such as metals.
Mixed paper	Post-consumer kerbside mix of fibre based packaging and non-packaging papers. Includes materials such as magazine, newspaper, marketing, some OCC and others fibre based formats. Typically has high levels of contamination, of which broken glass is a particular issue.
Mixed plastics	Post-consumer kerbside mix of plastics based packaging and non-packaging plastic items. Includes materials such as bottles, containers and other packaging formats consisting of all the major polymer groups. Often undergoes a polymer sort at MRFs or post-MRFs to positively recover a limited range of polymer types, typically PET and HDPE. Often has moderate to high levels of contamination.
Municipal solid waste (MSW)	Solid waste generated from municipal and residential activities, and including waste collected by, or on behalf of, a municipal council. In this document, MSW does not refer to waste delivered to municipal disposal sites by commercial operators or waste from municipal demolition projects.
OCC	Old corrugated cardboard.
Open-loop recycling	Material from a product system is recycled into a different product system, and may be of lower quality and functionality than the original material. Also see 'Closed-loop recycling' and 'Downcycling'.
Optical sorting	Technologies used to sort glass by colour type, and plastics by polymer type.
Organic material	Plant or animal matter, e.g. grass clippings, tree prunings and food waste, originating from domestic or industrial sources.
Out the gate	Material leaving a facility following reprocessing; excludes most contamination.
Packaging	Material used for the containment, protection, marketing or handling of product. Includes primary, secondary and tertiary/freight packaging in both consumer and industrial packaging applications.



PE-HD or HDPE	High density polyethylene (PIC 2). Typically referred to as HDPE.
PE-LD/LLD or LDPE/LLDPE	Both low density polyethylene and linear low density polyethylene (PIC 4). Typically referred to as LDPE/LLDPE.
PE-LD or LDPE	Low density polyethylene (PIC 4). Typically referred to as LDPE.
PE-LLD or LLDPE	Linear low density polyethylene (PIC 4). Typically referred to as LLDPE.
PET	Polyethylene terephthalate (PIC 1).
PIC	Plastic identification code.
PS-E or EPS	Expanded polystyrene (PIC 6). Typically referred to as EPS.
Polymer-coated paperboard (PCPB)	PCPB is a type of paperboard that has a primary fibre-based layer, that is laminated on one or both sides with a layer of plastic film. Also see Liquid paperboard (LPB).
PP	Polypropylene (PIC 5).
Prescribed waste and prescribed industrial waste (PIW)	These wastes are defined in the Environment Protection (Industrial Waste Resource) Regulations 2009. EPA closely regulates these wastes because of their potential adverse impacts on human health and the environment. Prescribed wastes carry special handling, storage, transport and often licensing requirements, and attract substantially higher disposal levies than non-prescribed solid wastes. Also known as hazardous waste.
Process derived fuels	Also called process engineered fuel (PEF) or refuse derived fuel (RDF), is a fuel produced after basic processing in a MRF or MBT to increase the calorific value and remove recyclable materials and contaminants of municipal solid waste, commercial and industrial waste and construction and demolition waste.
Processing facilities	Facilities which either receive materials directly from collection systems or from recovery facilities for further sorting and/or processing to provide material for use in the generation of new products.
Product stewardship	A concept of shared responsibility by all sectors involved in the manufacture, distribution, use and disposal of products, which seeks to ensure value is recovered from products at the end of life.
Public place recycling	Recycling facilities found in public areas, such as parks, reserves, transport hubs, shopping centres and sport and entertainment venues, that allow the community to recycle when away from home.
Putrescible waste	Waste that readily decomposes, including food waste and organic waste from gardens.
PVC	Polyvinyl chloride (PIC 3).
Pyrolysis	Thermal breakdown of waste in the absence of air, to produce char, pyrolysis oil and syngas e.g. the conversion of wood into charcoal.
Recover / recovery / resource recovery	The process of recovering resources from waste for reuse or reprocessing. This includes collection, sorting and aggregation of materials. To convert waste into a reusable material.
Recyclate	Scrap material either before or after reprocessing.
Recycle/Recyclables/Recycling	In common practice the term is used to cover a wide range of activities, including collection, sorting, reprocessing and reuse.
Refuse derived fuels	Refer to Process derived fuels.

Reprocess / reprocessing	To put a material that has been used through an industrial process to change it so that it can be used again.
Reprocessor / reprocessing facility / reprocessing infrastructure	Facility that uses an industrial process to change the physical structure and properties of a waste material so it can be used again. This can include facilities that dismantle products, such as tyres, e-waste and mattresses, and energy from waste facilities that use materials to generate energy.
Resale centre / shop	A centre/shop that enables the sale and subsequent reuse of good quality, saleable products and materials that were disposed of by their previous owner.
Residual waste	Residual material that remains after any source separation or reprocessing activities of recyclable materials or garden organics. Waste that is left over after suitable materials have been recovered for reuse and recycling. This generally means the environmental or economic costs of further separating and cleaning the waste are greater than any potential benefit of doing so.
Resource recovery infrastructure	Facility that receives and manages materials to enable them to be reused or reprocessed. This includes drop off points, resale centres, resource recovery centres, transfer stations and materials recovery facilities.
Reuse	Recovering value from a discarded resource without processing or remanufacture e.g. garments sold through opportunity shops are, strictly speaking, a form of reuse, rather than recycling.
Sectors / industry sectors	Groupings of industries used to generalise patterns in waste generation and disposal e.g. construction and demolition, food services including food retail and food manufacturing, small to medium enterprises.
Solid industrial waste (SIW)	Solid waste generated from commercial, industrial or trade activities, including waste from factories, offices, schools, universities, state and federal government operations and commercial construction and demolition work. Excludes MSW, wastes that are prescribed under the <i>Environment Protection Act 1970</i> and quarantine wastes.
Solid inert waste	Solid inert waste is hard waste that has a negligible activity or effect on the environment. The waste may be either a municipal or industrial waste.
Solid waste	Non-hazardous, non-prescribed, solid waste materials, ranging from municipal garbage to industrial waste.
Source separation	The practice of segregating materials into discrete material streams prior to collection by, or delivery to, processing facilities.
Stockpiling	Storage of materials.
Transfer station	Facility which receives materials from the waste stream for possible segregation, consolidation or compaction for bulk transport for resource recovery, treatment or disposal facilities.
Unprocessed material	Material that is unrefined and has not been through any process of recycling.
Waste	Any discarded, rejected, unwanted, surplus or abandoned matter, including where intended for recycling, reprocessing, recovery, purification or sale. Anything that is no longer valued by its owner for use or sale and which is, or will be, discarded. In this document, the term 'solid waste' refers to non-hazardous, non-prescribed, solid waste materials ranging from municipal garbage to industrial waste.
Waste and resource recovery group (WRRG)	Statutory authorities established under the Environment Protection Act 1970 responsible for preparing the regional waste and resource recovery implementation plan for their region.
Waste and Resource Recovery Planning Framework	The planning framework as defined in the 2014 amendments to the Environment Protection Act 1970 and including: <ul style="list-style-type: none"> <li>• The Statewide Waste and Resource Recovery Infrastructure Plan (state infrastructure plan).</li> </ul>

- The seven regional waste and resource recovery implementation plans (regional implementation plans).
- Relevant Ministerial Guidelines made under section 50CA of the EP Act.
- The process for integration of the state infrastructure plan and regional implementation plans.

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Waste management industry	Applies to those involved in managing waste e.g. collectors, sorters, processors and landfill operators.
Waste minimisation	The concept of, and strategies for, waste generation to be kept to a minimum level in order to reduce the requirement for waste collection, handling and disposal to landfill. Also referred to as waste avoidance.
Waste to energy	Refer to Energy from waste.

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### 3.3 References

The information below provides further context, research and data for interested readers.

ABS, 2019. Australian Harmonized Export Commodity Classification (AHECC) data by month, classification and destination country, Canberra: Australian Bureau of Statistics.

ACOR, 2012. Australian Recovered Paper Specifications (AuRPS), Australian Council of Recyclers.

ACOR, 2012. Recycling Guide for Beverage and Food Manufacturers Marketing in Aluminium, Australian Council of Recyclers.

ACOR, 2012. Recycling Guide for Fillers in PET Containers, Australian Council of Recyclers.

ACOR, 2012. Recycling Guide for Fillers Marketing in HDPE, Australian Council of Recyclers.

ACOR, 2012. Recycling Guide for Fillers Marketing in Steel Cans, Australian Council of Recyclers.

ACOR, 2012. Used beverage container specifications (aluminium), Australian Council of Recyclers.

APCO, 2019. Biodegradable & compostable packaging – Working Group 2018, Sydney: Australian Packaging Covenant Organisation (APCO).

APCO, 2019. Expanded polystyrene – Working Group 2018, Sydney: Australian Packaging Covenant Organisation (APCO).

APCO, 2019. Glass – Working Group 2018, Sydney: Australian Packaging Covenant Organisation (APCO).

APCO, 2019. Polymer coated paperboard – Working Group 2018, Sydney: Australian Packaging Covenant Organisation (APCO).

APCO, 2019. Soft plastic packaging – Working Group 2018, Sydney: Australian Packaging Covenant Organisation (APCO).

Blue Environment, 2019. Assessment of waste exports from Australia in December 2018, Melbourne: Report prepared by Blue Environment on behalf of the Department of the Environment and Energy.

DEE, 2018. Analysis of Australia's municipal recycling infrastructure capacity, Canberra: Department of the Environment and Energy.

DELWP, 2018. Managing fire risk at resource recovery facilities: Action Plan, Melbourne: Department of Environment, Land, Water and Planning (DELWP).

DELWP, 2018. Recycling Industry, Melbourne: Department of Environment, Land, Water and Planning (DELWP).

DELWP, 2018. Reducing the impacts of plastic on the Victorian environment, Melbourne: Department of Environment, Land, Water and Planning (DELWP).

DJR, 2017. Review of SKM Coolaroo Recycling Plant Fire, Melbourne: Department of Justice and Regulation.

Envisage, 2018. Chinese import restrictions impact assessment on Victoria, Melbourne: Report prepared by Envisage Works, Helen Lewis Research, Sustainable

Resource Use and Steve Balmforth and Associates on behalf of Sustainability Victoria (unpublished).

EPA Victoria, 2018. Management and storage of combustible recyclable and waste materials – guideline (Publication 1667.2), Melbourne: Environment Protection Authority Victoria.

Hyder, 2013. Association of Regional Waste Management Groups – Data and Reporting Guideline for Waste Management Facilities in Victoria, Melbourne: Report prepared by Hyder Consulting on behalf of the Association of Regional Waste Management Groups.

Inside Waste, 2018. Special Report: National Sword – mapping Australia’s resource recovery future, Sydney: Inside Waste (Mayfam Media).

Inside Waste, 2019. China Sword: The Australian Response, Sydney: Inside Waste (Mayfam Media).

ISF, 2019. Characterising the material flows through the Australian waste packaging system, Sydney: Report prepared by the Institute for Sustainable Futures (University of Technology) on behalf of the Australian Packaging Covenant Organisation.

LME, 2019. London Metal Exchange published metal scrap prices, London: London Metal Exchange.

MRA, 2017. Optimising Kerbside Collection Systems - Supporting Evidence and Analysis, Drummoyne: MRA Consulting Group.

MRA, 2018. China National Sword: The role of Federal Government – A discussion paper prepared for the Australian Council of Recycling (ACOR), Drummoyne: MRA Consulting Group.

MWRRG, 2017. Metropolitan Waste and Resource Recovery Group Bin Standardisation Guide, Melbourne: Metropolitan Waste and Resource Recovery Group (MWRRG).

SV, 2014. Market summary – recycled glass, Melbourne: Sustainability Victoria.

SV, 2016. Victorian Market Development Strategy for Recovered Resources, Melbourne: Sustainability Victoria.

SV, 2017. Victorian Local Government Annual Waste Services Report (VLGAWSR) 2015-16 Workbook, Melbourne: Sustainability Victoria.

SV, 2018. Resource Recovery Technology Guide, Melbourne: Sustainability Victoria.

SV, 2018. Statewide waste and resource recovery infrastructure plan (SWRRIP), Melbourne: Sustainability Victoria.

SV, 2018. Victorian Local Government Annual Waste Services Report (VLGAWSR) 2016-17 Workbook, Melbourne: Sustainability Victoria.