SA recycling options for recovered paper and cardboard

Public Report December 2020

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Executive summary

Recycling provides many social, economic and environmental benefits. The kerbside three bin system in South Australia captures a range of materials for recycling through the yellow-lidded and green-lidded bins. Materials discarded in kerbside yellow-lidded comingled recycling bins (paper, cardboard, plastics, metals, glass) are sent to material recovery facilities, or MRFs. The MRF separates these materials and sells/sends them to recycling facilities. This report is informed by one of the two main material recovery facilities in South Australia, and is referred to as the Project MRF in this report.

Fibre (paper and cardboard) makes up the largest proportion of materials in comingled recycling bins (~50%). SA MRF's separate this material and sell it to pulping facilities and paper mills in Australia and/or overseas. This is a key revenue stream for the MRFs. Selling fibre to be recycled keeps comingled recycling costs down and recycling rates up. As the Australian recycled fibre market is saturated, much of the fibre sold by these MRFs is sent overseas.

In November 2019, the Council of Australian Governments (COAG) decided that a range of waste materials not processed into a value-added material should be subject to an Australian export ban. This included recovered paper/cardboard. 'Value-added material' for paper and cardboard refers to paper pulp. This ban is scheduled for 1 July 2024 and if nothing is done, MRFs that rely on overseas markets for this product will have nowhere to send the material once the ban is in place.

This report explores three fibre re-processing options that may allow the ongoing sale of South Australian recovered fibre once the ban is in place. The three plants explored include:

1. **a polishing plant** (reduces contamination of mixed paper cardboard from ~8% to <2% and old corrugated containers/board to <1% contamination[1]),
2. **a wet lap plant** (removes contaminants and adds water to the fibre, this fibre/water mixture is then pressed to a lap/pulp sheet with ~50% fibre 50% water) and
3. **a dry lap plant** (follows the same process as a wet lap plant but then dries the material to ~10% water 90% fibre).

All facilities would take mixed paper/cardboard, predominately from SA MRFs.

Comparing the three plants

All fibre recovery options require investment in new infrastructure upwards of $12M dollars (Table E1). Each plant would bring jobs to the state (ongoing and for the construction of the new facility) and are likely to enable the ongoing sale of materials after the COAG ban. The cost to build and operate a polishing plant is the lowest of the three options, estimated to be ~$12M (Table E1). It is also likely to cost less to run. However, the sale price for the products is likely to be lower than the lap plants.

[1] Industry discussions indicate sale of mixed paper/cardboard with less than 2% contamination and sale of old corrugated containers/board with less than 1% contamination will be allowed after the COAG ban is in place.

Table E1: Comparison of a polishing plant, wet lap plant and dry lap plant (costs are high-level only and based on several assumptions)

Plant	Assumed throughput	Capex (assuming built adjacent a MRF)	Opex[2]	FTEs	Anticipated revenue from sale of product and gate rates[3]
Polishing plant	50,000 tpa mixed paper card from MRFs	$12M	$2.6M/ year	8-9	$3.4M/year ($10/t cost for incoming material, $62/t sale of mixed paper card <2% contam, $150/t sale of OCC/board <1% contam)
Wet lap plant	50,000 tpa mixed paper card from MRFs	$24M	$6.5M/ year	15	$9M/year ($10/t cost for incoming material, $250/t sale of wet lap product[4])
Dry lap plant	50,000 tpa mixed paper card from MRFs	$29M	$9.6M/ year	19	$18.4M/year ($10/t cost for incoming material, $500/t sale of dry lap product[5])

Each plant brings its own set of risks and limitations. A high level feasibility assessment of each plant indicates the financial viability is highly sensitive to product sale price. The fibre recovery industry anticipates highly volatile sale prices in the coming years, and this must be considered when further investigating each of the options to ensure a drop in sale prices does not lead to facility closure. Ongoing sale and demand for the product is also important. Regarding the polishing plant, industry discussions indicate sale of mixed paper/cardboard with less than 2% contamination and sale of old corrugated containers/board with less than 1% contamination are in demand and will be allowed after the COAG ban is in place. However, this may not eventuate. If these products cannot be exported, the facility would be limited to Australian markets and the sale price would decrease substantially. Lap products on the other hand can be exported after the COAG ban. However, it may be more challenging to find buyers. Wet lap is likely to be sold to Australian plants only given the high volumes of water in the product. With limited Australian markets the price for this product is lower than dry lap. Dry lap is likely to be able to be sold overseas and therefore the anticipated price is higher with more markets available. There are many pulping facilities built or being built in Asia, and the wet lap and dry lap plants would be competing with these.

Despite these risks and required investments of $12M+, the risk of doing nothing is more harmful. If nothing is done, mixed paper/cardboard currently sold overseas may no longer have recycling options. The end use options may be limited to compost (if contamination levels were low enough), energy recovery (more likely) or landfill. If the 50,000 tonnes of fibre had to be used for energy recovery locally instead of sold to make paper/cardboard products, it would cost at least ~$9M per year plus the loss of revenue from sale of the product.

[2] Labour, repair and maintenance, utilities, licences, waste disposal, water supply (lap plants) etc
[3] Sale price is ex works (i.e. considers transport costs)
[4] Fibre component/ dry basis only. Equivalent to $125 per tonne when including water component
[5] Fibre component/ dry basis only. Equivalent to $450 per tonne when including water component

This report presents three options for consideration. The polishing plant and dry lap plants are recommended for further exploration as they are the most viable (considering the risks and based on a high level financial assessment). There are other initiatives that may be worth exploring. For example, funding models such as extended producer responsibility/ product stewardship arrangements for fibre packaging (currently in place in some European countries).

Action is needed to prevent the adverse impact of doing nothing. It is important for local MRFs and the South Australian Government to explore options for fibre recovery so that we have avenues for ongoing paper/cardboard recovery once the COAG ban is in place. Although the options proposed here would cost upwards of $12M to get started, if nothing is done the impact on the recycling industry may be far greater.

Contents

Glossary of terms

Name	Description
ACOR	Australian Council of Recycling
Bleached	Paper that has been whitened by chemicals[6]
Bleached chemical	Almost entirely bleached office and printing papers (SOP), made from chemical pulps[7]
Board	Cardboard that is not OCC (does not have the corrugated cardboard in between the two sheets of cardboard)
C&D	Construction and Demolition
C&I	Commercial and Industrial
COAG	Council of Australian Governments
DAF	Dissolved air flotation
Dry lap	Recycled paper that is cleaned and had water added to it then pressed to make a lap or pulp product. When first pressed it is a wet lap product containing ~50% water and when this is dried to ~10% water it is a dry lap product.
Extended producer responsibility (EPR)	Used to describe laws that mandate responsibilities for manufacturers/brand owners for the end-of-life management of their products
Fibre	'Fibre' is used throughout document to describe all paper and cardboard products
Free into store (FIS)	Total cost/revenue from material once delivered into the buyer's store
Gate rate	In this business case, the gate rate is the revenue/cost received for every tonne of mixed paper/cardboard accepted by the polishing plant from MRFs
ISRI	Institute of Scrap Recycling Industries, Inc
Kraft	Paper made from sulphate pulp (synonyms: brown and strong)[8]
Mechanical	Includes newsprint and most forms of catalogues and some magazines, where they are manufactured from pulp made by mechanical processes
'Mixed' or 'unsorted' recovered paper	Significant majority of recovered paper sourced from comingled kerbside collections that pass through MRFs
MRF	Material recovery facility. A location that separates, bales and sells materials discarded in comingled recycling yellow-lidded bins
MSW	Municipal Solid Waste
OCC	Old corrugated containers. Term used to describe cardboard that has two sheets of brown board with 'corrugated' brown board in between
ONP	Old newsprint
Pulp	Pulp is made from breaking down the fibrous part of plants, primarily trees, and sometimes recovered paper. It is the main ingredient in the papermaking process. During the papermaking process, pulp is made from breaking down either wood chips or paper recovered for recycling
SOP	Sorted office paper

[6] Definition from Scrap Specifications Circular April 2018, Institute of Scrap Recycling Industries, Inc (ISRI))
[7] Definition from Industry Edge, found in Analysis of Australia's municipal recycling infrastructure capacity, Australian Government Dept of the Environment and Energy, October 2018. See https://www.environment.gov.au/system/files/resources/f0196d2e-9040-4547-8cb6-8b433923b53d/files/waste-stocktake-report.pdf
[8] Definition from Scrap Specifications Circular April 2018, Institute of Scrap Recycling Industries, Inc (ISRI))

Name	Description
Unbleached Kraft	Entirely recovered Packaging & Industrial paper grades, where there is no bleached content. This grade is dominated by corrugated boxes and is often known referred to as old corrugated containers (OCC)
Wet lap	Recycled paper that is cleaned and had water added to it then pressed to make a lap or pulp product. When first pressed it is a wet lap product containing ~50% water.

Introduction and background

The world consumes a lot of paper and cardboard (fibre). Globally we are estimated to consume almost 420 million tonnes of fibre a year[9] or ~60 kilograms per person per year. The fibre products we use include cartons, boxes, office paper, newspapers, magazines and envelopes, just to name a few. After consumption, it is commonplace to collect and recycle fibre. Recovering fibre reduces CO_2 emissions and energy and water use[10]. Unlike some other recyclables (e.g. aluminium), fibre is not infinitely recyclable and can be used to make new products only 5-7 times[11]. Many paper mills in Australia and overseas use recycled fibre to make new products as it is cost effective and environmentally beneficial to do so.

In November 2019, the Council of Australian Governments (COAG) decided that waste plastic, paper (including cardboard), glass and tyres that have not been processed into a value-added material should be subject to an Australian export ban[12]. Rawtec understands that by 1 July 2024 any fibre grade that does not meet the scrap export guidelines will be banned from export. For mixed paper/cardboard this means less than 2% contamination while old corrugated containers (OCC)/board require less than 1% contamination. Paper and cardboard processed into a pulp will be allowed to be exported.

Much of the fibre sold overseas is first captured and separated by local material recovery facilities (MRFs). Current contamination levels of recovered fibre sold overseas from the SA MRFs is higher than the scrap guidelines indicate. With demand for recovered fibre in Australia at capacity, export is required to enable recycling of our recovered fibre. When the ban is implemented, significant change is therefore required to systems and processes to lower contamination rates of OCC/board or mixed paper cardboard to acceptable levels, or to change the product to a pulp onshore and then sell this to interstate or international markets.

The South Australian Government (Green Industries South Australia, GISA) and an SA MRF that informed this project (the Project MRF) recognise that action is needed to prepare for the COAG ban. Rawtec was engaged to summarise the high-level costs and logistics behind building a facility for the continued sale of mixed paper/cardboard to domestic (if available) and overseas markets. Three type of facilities were considered:

1. A polishing plant,
2. A wet lap plant and
3. A dry lap plant.

Further details on these facilities is provided later in the report.

A facility that can significantly reduce contamination of the fibre from MRFs, or that can re-process the product to a pulp to enable domestic and international sale is likely to be required unless there are drastic increases in demand for products (tissues, paper towel, toilet paper, packaging made from fibre etc) that have recycled material and that are made in Australia. As Australians buy many products from overseas,

[9] https://www.statista.com/topics/1701/paper-industry/
[10] Recycling Activity Survey 2018-19 (final page), Green Industries SA https://www.greenindustries.sa.gov.au/SArecycling
[11] Recycling and deinking of Recovered Paper by Pratima Bajpai, 2014.
[12] www.environment.gov.au/protection/waste-resource-recovery/coag-waste-export-ban-consultation

we are likely to continue to have an oversupply of recovered fibre and therefore depend on international markets to sell our recovered fibre.

Please note the data provided in this report is based on several assumptions and is high-level only. Further checks and formal quotes are important to confirm assumptions in this report.

Fibre recycling process

According to the Australian Council of Recycling (ACOR), paper/cardboard is recycled in ten steps (Table 1). The fibre is first sorted and graded (see Table 2). It is then generally sent to a separate plant where it is pulped, cleaned, screened and sometimes de-inked. If used for white paper it is then bleached, and in all cases, it is then formed. At this point the product is a 'wet lap' and it may be sold to another facility to be dried, or it could be dried at the current location if the facility has that capability. After pressing and drying the product can then be rolled and sold as 'dry lap' ready to be manufactured into new fibre products.

Table 1: recycling process for paper/cardboard[13]

Step	Process	Description	Type of facility
1	Paper sorting	Paper is sorted and graded by quality in a MRF. Generally, the classifications are based on weight, colour, usage and raw materials.	MRF
2	Pulp preparation	The recovered paper is combined with water in a pulper which separates fibres in paper sheets to produce pulp slurry.	Wet lap (paper pulping facility).
3	Cleaning	The pulp slurry is cleaned to remove contaminants, such as clay, metals and glue.	
4	Screening	The pulp is then filtered through a screen.	
5	De-inking (optional)	Inks are removed from the fibre either by washing or flotation.	
6	Bleaching	If the pulp is used to manufacture white paper, a bleaching process is required.	
7	Forming	A large volume of water is added to the pulp slurry, and the mixture is distributed onto a fast-moving screen for drainage. The fibres begin to form a weak paper sheet ('paper').	
8	Pressing	The 'paper' is pressed between rollers to squeeze out remaining water, approximately 50% of the water content.	
9	Drying	Heat or drying is applied in this process. It furthers reduces the water content to approximately 7-10%.	Dry lap (paper pulping facility)
10	Rolling	The finished paper is processed into large rolls which are ready to be manufactured into new products.	Paper manufacturer

[13] From Australian Paper Recovered Paper Specifications (ACOR), http://www.acor.org.au/uploads/2/1/5/4/21549240/paperspecs_v3.pdf. Final column added by Rawtec.

Types and Grades of Recovered Paper

There are multiple grades of recovered fibre (see Appendix One). Recovered paper/cardboard that has not been subject to processing fall under four broad categories; 1) bleached chemical or sorted office paper, 2) unbleached kraft or OCC and board, 3) mechanical or old magazines and newsprint, and 4) other/unsorted or mixed paper/cardboard (Table 2). The 'Recovered Paper Grades' are the international trade grades. Within each, there are a considerable number of specific grades, for which specifications and prices differ.

Table 2: types and grades of recovered fibre (prior to processing the paper)[14]

Recovered paper grade	Pulp type	Paper & board inputs	Common shorthand name
Bleached chemical (may include some packaging & industrial paper & paperboard)	Chemical	- Office paper - Printing papers - Magazines (some) - Envelopes and stationery	Sorted office paper (SOP)
Unbleached kraft (may include some bleached content material)	Chemical	- Corrugated containers - Industrial sacks - Folding boxes (some)	Old corrugated containers (OCC) and board
Mechanical	Mechanical	- Newsprint - Catalogues - Magazines (some)	Old newsprint (ONP)/ Old magazines (OMG)
Other/Unsorted	Mixed	All	Mixed paper/card

[14] From Industry Edge, found in Analysis of Australia's municipal recycling infrastructure capacity, Australian Government Dept of the Environment and Energy, October 2018. See https://www.environment.gov.au/system/files/resources/f0196d2e-9040-4547-8cb6-8b433923b53d/files/waste-stocktake-report.pdf

Market analysis of recovered fibre in Australia

Australia has an oversupply of recovered fibre and therefore relies on overseas markets. The "rules" for the COAG export bans are still being finalised. The recycling industry understands the COAG ban will require exported recovered fibre to be either in pulp form, or contamination levels in recovered paper/cardboard should be reduced to be suitable for export (below 2% for mixed paper/cardboard or below 1% for OCC/board).

Australia is unlikely to significantly increase its demand for recovered fibre before the COAG ban is in place. An option to enable ongoing export of our recovered fibre with strict contamination requirements is to build new onshore infrastructure to reduce contamination (a polishing plant) or to process the recovered fibre to a pulp (a lap plant).

The fibre recovery process in South Australia

The pathway for recovered fibre in South Australia depends on the location of waste generation and the stream generated. Businesses typically produce OCC as a clean stream and the pathway for this material is often collection directly from businesses, baling the material and exporting to markets (pulping/paper mills) overseas or interstate. For fibre recovered at the household, residents dispose fibre in kerbside comingled recycling bins along with other materials such as bottles and cans (metals, plastics and glass). This is collected and sent to a MRF which separates the fibre from the other materials. The MRF will then separate the fibre into 1-3 of the four main streams highlighted in Table 2; board/OCC, mixed paper/ cardboard, and/or old newsprint, depending on its infrastructure in the MRF and the price of the stream. The fibre stream(s) will be baled for sale to pulping facilities either in Australia or overseas.

The pulping facilities remove the contamination in the paper/carboard product before creating a pulp. The pulp starts at around ~50% moisture, called a wet lap, and then it is either sent elsewhere to be dried or dried on site to ~10% moisture. This product is known as dry lap. The product made at the pulping facility would be 'box grade'. This is then fed into a paper making facility to make paper/cardboard products. See section "comparing a polishing, wet lap and dry lap plant" for more detail.

Recovered fibre supply

Australia is estimated to produce 4.3M tonnes of fibre each year, or around 170 kilograms per person per year[15]. Around 63% of this is recovered, or 2.7M tonnes.

South Australia (SA) recovers around 229K tonnes of fibre per annum[16] (Figure 1) or 9% of the fibre recovered across Australia. This includes fibre from municipal sources, the commercial and industrial (C&I) sector and the construction and demolition (C&D) industry (small volumes only).

If SA built a facility that accepted recovered fibre from MRFs once the ban is implemented, it may be able to capture fibre from other states. This may include fibre from Victoria, Northern Territory, and Western

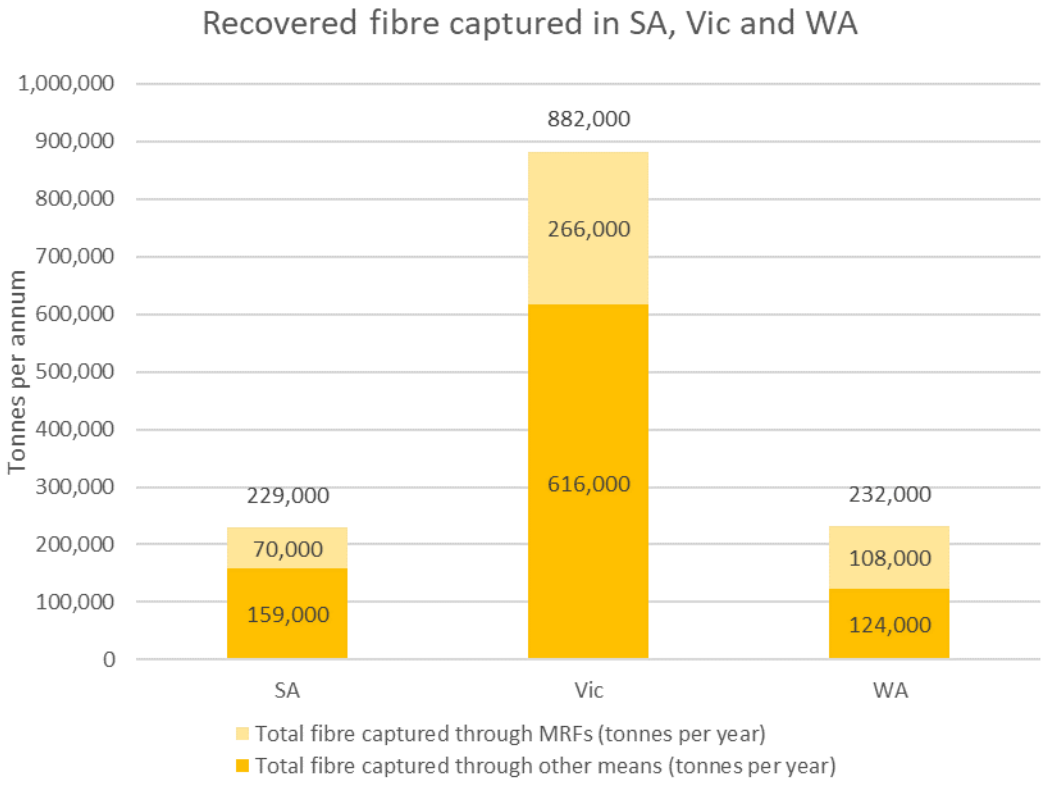
[15] Assessment of Australian paper & paperboard recycling infrastructure and 2018-19 exports, including to China, https://www.environment.gov.au/system/files/resources/8ab67516-76bf-4264-81ed-47098d182483/files/assessment-australian-paper-paperboard-recycling-infrastructure-2018-19-exports.pdf

[16] See Recycling Activity Survey for South Australia 2018-19, https://www.greenindustries.sa.gov.au/SArecycling

Australia (WA) given the proximity. Estimated fibre recovery at WA is like SA at 232K tonnes[17], while Victoria is estimated to recover around 880K tonnes per annum (Figure 1)[18].

Much of these recovered fibre tonnes in WA, SA and Vic are baled and sent directly overseas. However, a proportion first go through MRFs and are then baled and sold to local and overseas markets. Figure 1 shows that around 70,000 tonnes per annum is captured at MRFs in SA each year[19] while Vic MRFs process an estimated 266,000 tonnes per annum[20] and WA 108,000 tonnes per annum through its three MRFs.

Figure 1: Fibre tonnes captured for recovery in SA, WA and Victoria



[17] From Recycling Activity in WA 2017-18, https://www.wasteauthority.wa.gov.au/images/resources/files/2019/10/Recycling_Activity_in_WA_2017-2018.pdf

[18] Victoria recycling data is likely to include tonnes brought into Victoria from interstate. This figure is ~26% of the total recovered fibre in Australia based on Victoria's population as a proportion of the Australian population.

[19] Assumes 53% of kerbside comingled recycling content by weight is paper/cardboard (see City of Burnside kerbside Audit 2014, https://www.burnside.sa.gov.au/Environment-Sustainability/Waste-Recycling-Composting/Waste-Collection/3-Bins-and-a-Basket/Kerbside-Waste-Audit-2014) and a total of 132,400 tonnes of comingled recyclables are collected in SA at kerbside each year (see Recycling Activity Survey for South Australia 2018-19, https://www.greenindustries.sa.gov.au/SArecycling)

[20] Based on the June 2020 SV Recovered Resources Market Bulletin

Market control in South Australia

The 229,000 tonnes of recovered fibre in SA (Figure 1) is controlled by MRFs (around 70,000 tonnes per annum) and waste collection companies that collect mostly OCC and other recovered fibre from the C&I sector (around 159,000 tonnes per annum, Figure 1). If the MRF is vertically integrated (i.e. has a pulping plant/paper mill interstate that can use the product), then it will send most of its recovered fibre to this plant. These MRFs may have some additional recovered fibre which is generally sold overseas. MRFs that are not vertically integrated can either sell to local pulping plants/paper mills, or to overseas markets. Given the surplus recovered fibre available in Australia, these MRFs are often left with no choice but to sell the recovered fibre to overseas markets. OCC and other recovered fibre collected from the SA C&I sector is either sold to interstate pulping plants/paper mills (see Appendix Two) or to overseas pulping plants/paper mills.

Two MRFs capture most of the recovered fibre from SA MSW sources. One is privately owned and vertically integrated and the other is owned by a group of local councils. There are plans to build two new MRFs in SA[21] which will also be owned by groups of local councils.

Additional tonnes from WA and Vic may also be available if these states do not have the infrastructure to lower the contamination rates to acceptable levels for export. We note that sending tonnes from interstate to SA would involve high transport costs (current transport costs from Perth to Adelaide for other streams can be over $100 per tonne).

Recovered fibre demand

Around 1.1M tonnes of recovered fibre in Australia is exported overseas each year[22]. This leaves approximately 1.6M tonnes recovered in Australia[23]. Fibre recovered in SA, Vic and WA is separated into various streams and sent to a range of destinations to be reprocessed into new materials. In SA, 51% of recovered fibre is domestically reprocessed (almost all of this is sent interstate) and 49% is exported overseas[24]. Almost all WA recovered fibre is sent overseas[25], while ~57% of Victorian recovered fibre is recycled in Australia with the remainder exported[26].

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[21] See https://www.charlessturt.sa.gov.au/services/waste-and-recycling/kerbside-recyclables-initiative and https://www.onkaparinganow.com/summer-2020/councils-join-forces-to-build-a-new-recycling-facility-in-adelaides-south/#

[22] Discussion paper on implementing the August 2019 decision of the Council of Australian Governments (November 2019), see https://www.environment.gov.au/system/files/consultations/bf403fda-b6d7-4476-9c6f-5627502d52a4/files/waste-export-ban-discussion-paper-november-2019.pdf

[23] Assessment of Australian paper & paperboard recycling infrastructure and 2018-19 exports, including to China, https://www.environment.gov.au/system/files/resources/8ab67516-76bf-4264-81ed-47098d182483/files/assessment-australian-paper-paperboard-recycling-infrastructure-2018-19-exports.pdf

[24] See Recycling Activity Survey Report by Green Industries SA, https://www.greenindustries.sa.gov.au/SArecycling

[25] Recycling Activity in WA 2017-18

[26] Victorian Recycling Industry Annual Report 2017–18

Australian MRFs, cardboard collection companies and recyclers send recovered fibre overseas as demand in Australia is not sufficient to absorb the fibre waste Australians create[27].

Impact of China's National Sword Policy

On 1 March 2018 China implemented its National Sword Policy. The Policy included the restriction of imports of 24 categories of waste including paper cardboard, requiring contamination to be 0.5% and lower. Prior to National Sword, accepted contamination levels were much higher, varying from 1.5% to 5%+. This significantly reduced the amount of recovered fibre Australia sent to China. To further limit recovered fibre sent to China, the Chinese Ministry of Ecology and Environment has put limits on the amount of recovered fibre that China can import. Import licences have reduced from allowing 26M tonnes of recovered fibre in 2017, to 9-10M tonnes in 2019[28].

Since the introduction of China's National Sword Policy and the limitations imposed on recovered fibre imports, there has been a shift in the destination of Australian recovered fibre sent overseas. Fibre streams previously exported to China that could not meet the contamination requirements moved to other destinations (mainly India, Thailand and Indonesia[29]). This has particularly impacted mixed paper/cardboard and mechanical fibre (old newsprint and magazines). See Figure 2a and 2b. Alternative overseas markets have taken up much of the excess recovered fibre that was previously sold to China, but not all of it. This has also impacted price.

Figures 2a and 2b demonstrate that there is still demand for the product overseas, although this has decreased since 2015-16 and the location of the demand has changed. Prices have also changed.

[27] Recovered Resources Market Bulletin March 2019, Sustainability Victoria
[28] From NAWMA Fibre Industry Updated (https://www.nawma.sa.gov.au/wp-content/uploads/2020/01/Fibre-Industry-Update-Jan-2020.pdf) quoting RISI International Fibre and Containerboard Conference – Echo Xu Analyst Fastmarkets RISI.
[29] Data on exports of Australian wastes 2018-19, Blue Environment

Figure 2a: Exports of scrap paper and cardboard from Australia to China by financial year (tonnes)[30]

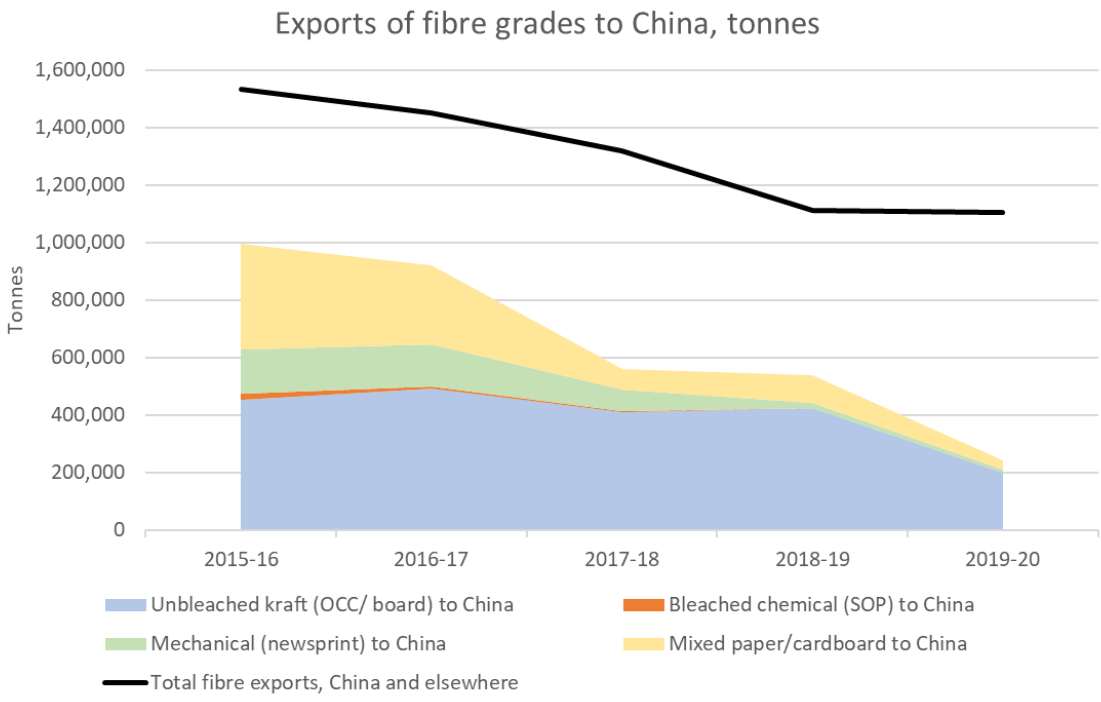
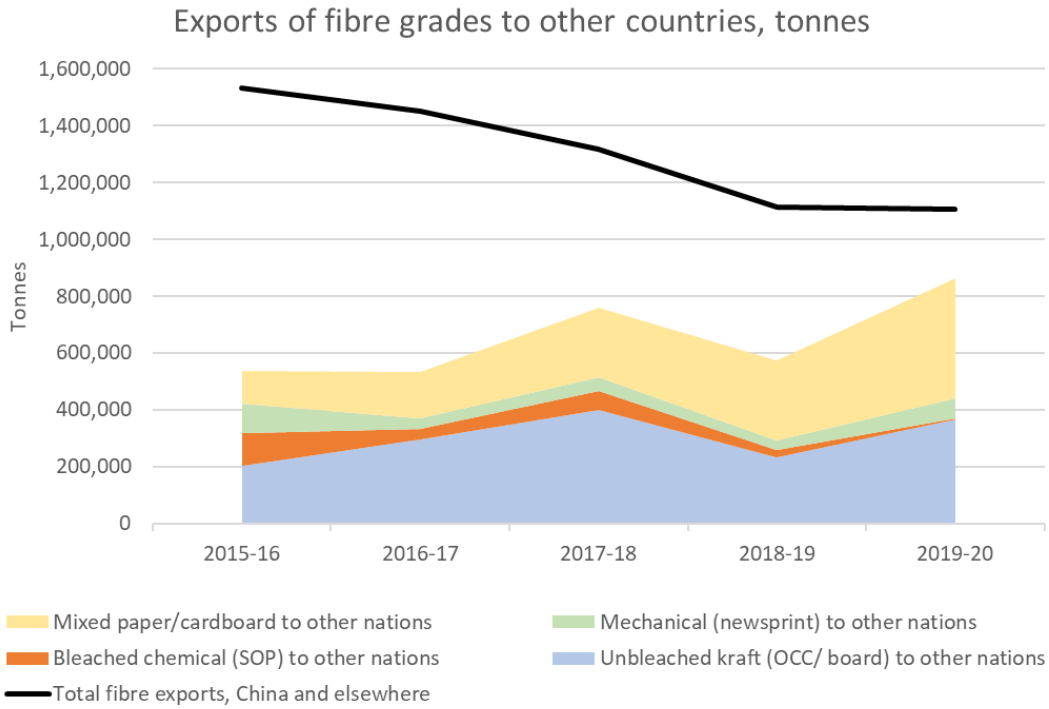


Figure 2b: Exports of recovered fibre from Australia to other destinations by financial year (tonnes)



[30] Data sourced from Australian Bureau of Statistics (ABS) fibre export data https://www.environment.gov.au/protection/waste-resource-recovery/national-waste-policy/waste-exports. Note May 2020 and June 2020 data is based on the average for the remainder of the 2019-20 financial year

Despite these trends, based on industry consultations, capacity to consume recovered fibre is predicted to increase in Southeast (SE) Asia.

Pricing

MRF products

The sale price for OCC/board is higher than mixed paper/cardboard (Figure 3). China's National Sword Policy came into effect early 2018. This lowered the price for OCC/board and mixed paper/cardboard (Figure 3) as these streams were sold to other countries in a flooded market. For companies that could continue to sell OCC/board to China, the price has maintained a relatively high (around $200-$250 per tonne). OCC/board that has been sold to other destinations has decreased and is now around $100 per tonne. Mixed paper cardboard was around $100 per tonne in 2017 and then decreased to below $0 per tonne for a period but has since recovered slightly. These price drops in early 2018 have significantly impacted MRFs that sold into overseas markets.

Figure 3: approximate sale price free into store (FIS)[31] out of Australia to overseas markets[32,33]

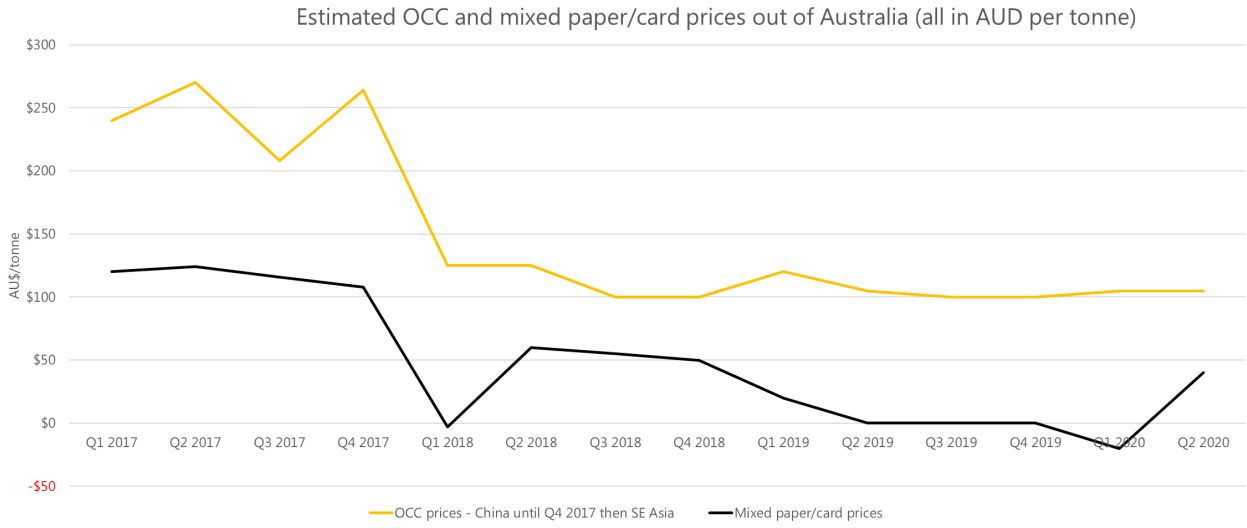


Figure 3 also highlights that the price for recovered fibre is highly volatile. According to recent discussions with industry, price volatility for pulp is very high, and this volatility has increased in recent years.

[31] Price that the seller in Australia would receive per tonne to get the product to the buyer. Considers transport cost.
[32] Prices are based on SV Resource Recovery Market Bulletins, reports from industry and industry indexations.
[33] Note the prices included in Figure 3 are for OCC/board and mixed paper/cardboard from MRFs. These have relatively high contamination rates and industry consultations indicate if international guidelines for sale of fibre can be met (i.e. 1% contamination for OCC/board and 2% contamination for mixed paper/cardboard), prices would be higher than what is indicated here.

Wet lap/ Dry lap products

The wet lap and dry lap products are further processed products than the fibre products sold by a MRF. The price is therefore expected to be higher than the OCC/board or mixed paper/cardboard prices above. The product quality is lower than virgin material (wood chip from trees) and the fibre lengths shorter, therefore the price of recycled pulp tends to be lower than the price of virgin pulp. This is around ~AU$1,000 per tonne[34].

Discussions with industry suggest a facility that takes mixed paper cardboard to make a pulp would be selling 'box grade' product. This is not common in the market as the usual process is for the pulping plant to be adjoined to a paper mill and therefore the box grade pulp is internally transferred rather than purchased externally. Industry discussions indicate the expected price for this product is around ~AU$250 per tonne if selling in Australia and AU$500-$650 per tonne if selling overseas (**dry fibre component** only). Wet lap products have high volumes of water and therefore would rarely be sold overseas. Therefore, selling wet lap, which contains ~50% water, the price for the tonne would be half (~AU$125 per tonne sold) as only half of the tonne of product is fibre. The dry lap product is ~10% water and could be sold overseas. This would equate to ~$450-$585 per tonne when including the water component and selling overseas. The most likely sale location is into Asia given Australia is at recovered fibre capacity. The price to ship into Asia is anticipated to be >$20 per tonne.

Industry discussions indicate although lap products may be higher in value, the demand is low as companies buying the lap may need to re-pulp it to integrate it into their systems. The price they are willing to pay is therefore lower or they may have a preference for mixed paper/cardboard with low contamination. Wet lap may be more challenging to sell the further the destination, given high transport costs as half the product is water.

[34] Based on industry consultation

COAG ban

In November 2019, COAG decided that waste plastic, paper (including cardboard), glass and tyres that have not been processed into a value-added material should be subject to an Australian export ban[35]. Value-added material for paper and cardboard was initially referring to paper pulp[36]. Mixed paper and cardboard and baled paper and cardboard was set to be banned from export by 30 June 2022. This has since changed to 1 July 2024 and includes 'mixed and unsorted paper and cardboard'[37]. Rawtec understands mixed paper/cardboard is likely to be allowed if it meets international export requirements, which is currently 2% contamination (see Appendix One), again noting the "rules" are being finalised.

Current contamination estimates for mixed paper/cardboard sold by MRFs is around 4-8%, depending on the MRF. When the COAG ban is implemented, this material will no longer be able to be sold to overseas markets. Domestic (Australian) paper mills are also advising MRFs that a lower contamination will be required in the future to continue to access their facilities. Australian markets may be able to accept some of the material, although the demand is currently not enough to capture all fibre sold by MRFs. With approximately 1.6M tonnes of fibre recovered in Australia currently, demand would have to increase by around 70% to meet the recovered fibre captured across Australia. This would require significant change at a product manufacturing and purchasing level and is unlikely to be achieved.

[35] www.environment.gov.au/protection/waste-resource-recovery/coag-waste-export-ban-consultation
[36] https://www.environment.gov.au/system/files/consultations/bf403fda-b6d7-4476-9c6f-5627502d52a4/files/waste-export-ban-discussion-paper-november-2019.pdf
[37] https://www.environment.gov.au/protection/waste-resource-recovery/waste-export-ban/paper-cardboard

Options for SA

There are several options for SA to consider in the leadup to the COAG ban. These include:

1. **Build a polishing plant**. A polishing plant would take mixed paper/cardboard from MRFs and reduce the contamination to a level that can be sold to overseas markets (or interstate if capacity is available). It will also separate out OCC/board for sale to interstate or international markets at the required contamination level (<1%). This plant would not 'process' the fibre but use trommels, ballistics, magnets, optical sorters and labour to reduce contamination. To minimise costs, this facility would be aligned with a MRF so the majority of the product can be directly fed to the facility.
2. **Build a plant that creates a 'lap' product**. This facility would take recovered fibre and then pulp it into lap or pulp sheets. One option is to sell the lap as a 'wet lap' product, or to further process the product to a 'dry lap'. This product is then sold to manufacturing companies in Australia or overseas to be turned into a commercial product.
3. **Changing SA kerbside bin models to minimise contamination of recovered fibre**. This could involve having a separate fibre bin/crate at kerbside for recovered fibre. The MRF could accept this material at a different location within the facility, further reduce contamination and sell to the required specifications. The collection costs for this type of initiative would be substantial and the contamination and infrastructure requirements at the MRF at this point are unknown.
4. **Do nothing**. The risk is that after 2024 (or before if markets continue to shrink) there will be no market for up to half of the South Australian household yellow lid kerbside recycling bin. If the 50,000 tonnes of fibre were instead sent to energy recovery or landfill, this is estimated to cost around $9M+ per year (plus the loss of revenue from sale of product).

Comparing a polishing, wet lap and dry lap plant

This report compares the first two options on the previous page: building a polishing plant, or building a lap plant. The lap plant is separated into a wet lap plant and a dry lap plant, as the fibre can be sold as either a wet lap or dry lap product.

Polishing plant

The polishing plant 'model' assumes mixed paper/cardboard inputs from MRFs into the plant with mixed paper/cardboard (contamination <2%) and stripped out OCC/board (contamination <1%) sold to domestic and overseas markets (Figure 4). There is the potential for the polishing plant to accept OCC from the C&I sector. This would not go through the same internal processes in the polishing plant as the mixed paper/cardboard (see 'inground feed conveyor - OCC' in Figure 5).

The process for a polishing plant is as follows (see Figures 4 and 5):

1. Receival and weighing. The plant receives bales of mixed paper cardboard from MRFs. Trucks weigh in on the weighbridge as they arrive (for product not directly fed in by an adjoining MRF).
2. De-baling. The bales of mixed paper/cardboard are 'de-baled'. Ideally this process would be automated, however given the variable size of the waste-paper bales, this is usually a manual task. Wires are cut off the bales at floor level, then loose paper is pushed onto the conveyor system. This conveyor transports the raw material into the trommel.
3. The trommel removes small contaminants such as glass and fines.
4. After the trommel the fibre goes through ballistic separators (product is placed on moving belts/beams that are on an incline. The movement moves two dimensional products (fibre) up the line where the remaining products are bumped to the side or downwards). Large cardboard (OCC) is separated and goes to a sorting bench where sorters take out contamination and the OCC is then baled and sold as OCC with less than 1% contamination.
5. The remaining fibre from the ballistic separator continues past a magnet which picks off steel contaminants while the fibre goes into an optical sorter.
6. The optical sorter identifies contaminants versus fibre (and potentially OCC as well) and air jets push the products to their next respective pathway. OCC may be sent to the OCC sorting bench, contamination to a waste bale press and fibre to another sorting bench.
7. Any last contaminant are removed at the sorting bench and the remaining fibre baled and sold as mixed paper/cardboard with less than 2% contamination.

Figure 4: High-level process flow diagram for the polishing plant

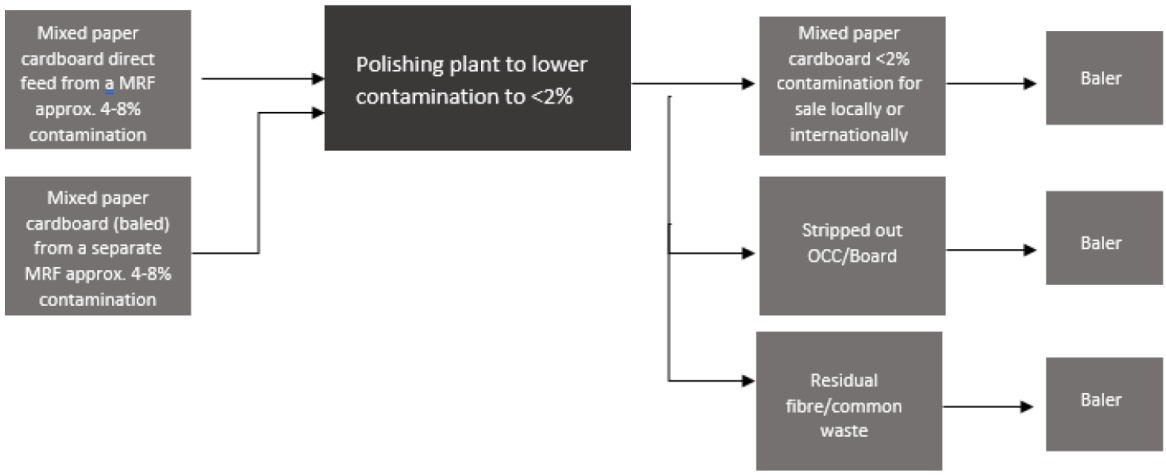
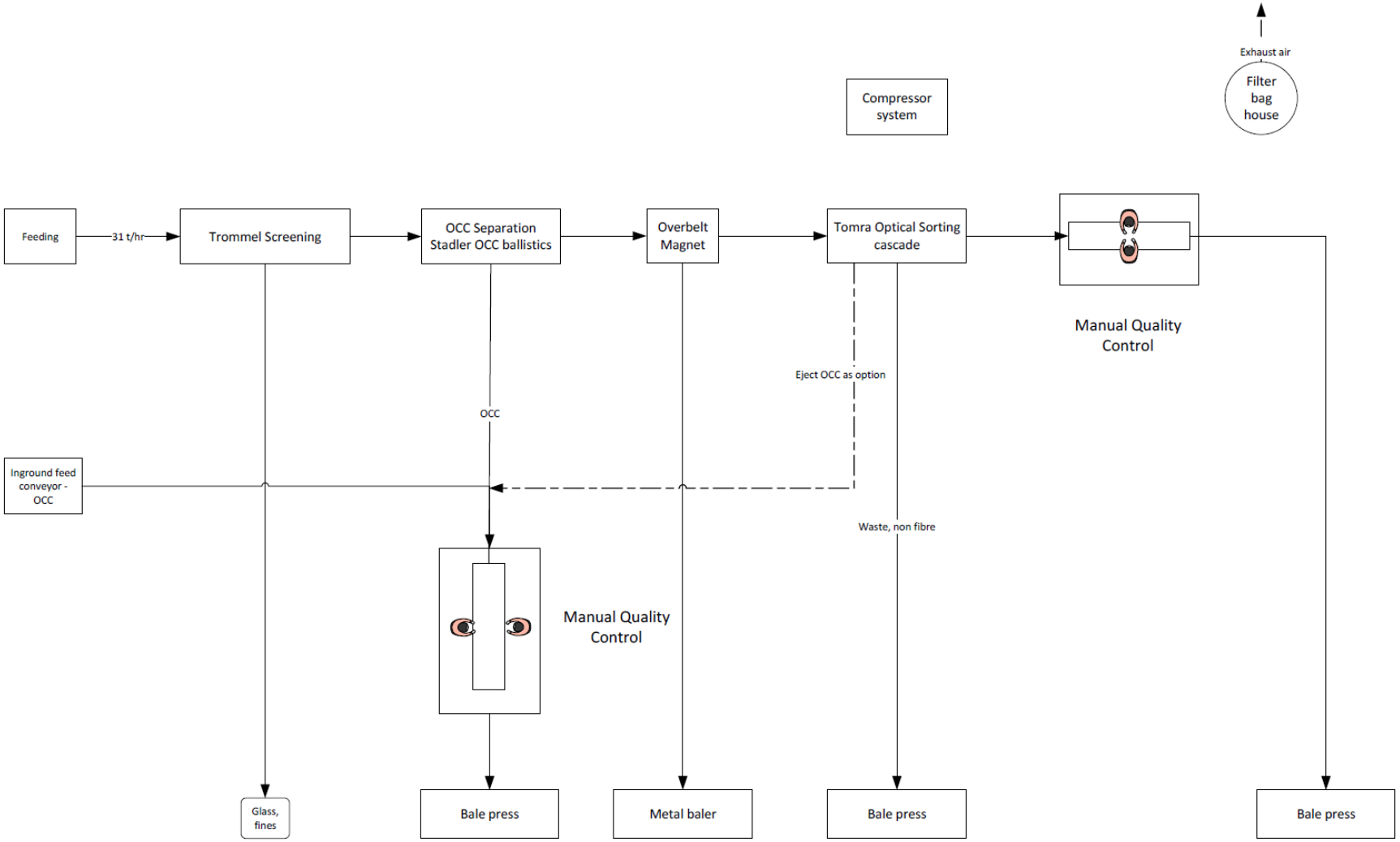


Figure 5: Internal processes of the polishing plant (high-level diagram not showing all equipment and labour)[38]



[38] Figure provided by independent equipment and technology merchant. This is a high-level flow diagram only.

Wet Lap plant/ dry lap plant

A lap facility accepts mixed paper/cardboard from MRFs, removes contaminants and creates a paper pulp. The pulp is made by adding water and then pressing the mixture into sheets. The pressed pulp can be sold as a wet lap product or it can be dried and sold as a dry lap product. Drying the product increases operating costs due to energy use, however the product contains a much lower proportion of water and therefore the price per tonne is higher as it contains more fibre. The bales are also lighter and therefore transport costs lower. See high level financial comparison section below.

Process Description wet lap and dry lap (see Figure 6 for a flow diagram).

1. Receival and weighing. The plant receives bales of mixed paper cardboard from MRFs. Trucks weigh in on the weighbridge as they arrive.
2. De-baling. The bales of mixed paper/cardboard are 'de-baled'. Ideally this process would be automated, however given the variable size of the waste-paper bales, this is usually a manual task. Wires are cut off the bales at floor level, then loose paper/card is pushed onto the conveyor system. This conveyor transports the raw material into the hydra-pulper.
3. Hydra-Pulper/Pulper. This is a batch process. Timing depends on size, however the pulping cycle is typically 30 minutes. Water is added first, followed by the paper/card. An agitator breaks up the paper/card inside the vessel.
4. Ragger. The ragger is a rope hanging inside the pulper. As the pulp moves around large contaminants (plastic, wires, other) get caught on the rope. Once sufficient material has built up on the rope, this is winched out and cut off. This waste is then disposed.
5. Stock Tank. With larger-sized contaminants removed, the paper/card and water mixture (now a pulp mixture) is transferred to a holding tank. Each tank is agitated to keep the pulp fibres dispersed. This is typically a motor and stirrer suspended from the top of the tank.
6. Screen. The pulp mixture is then passed over a screen, this may be in the form of a rotating basket or other screening technology. Further contaminants are removed - the screen achieves a particle removal of around 1mm or above.
7. Cleaning. The pulp mixture is then passed through a cleaning unit. This will typically be banks of "hydra-cyclones". The pulp mixture enters the top of a conically shaped cyclone tangentially. The pulp moves in a circular motion down around the outer edge of the vessel, then up through the centre to exit through a pipe at the top. Clean material exits the top of the cyclone, and heavy contaminants (typically metal and other heavy particles) drop to the bottom and are discharged to waste.
8. Pressing. Once screened and cleaned the pulp can then be thickened through a press. Common technology is to use a twin-wire press. Pulp is pumped through a headbox which directs a stream of pulp between two woven fabrics. These fabrics are made of polymer and have an open weave to allow water to exit as the fibre forms a thick mat of pulp. This pulp sheet is usually around 50% moisture content. At this consistency, the pulp sheet will hold together sufficiently to be able to be cut and stacked into bales.

Next steps – wet lap only (cutting the wet lap pulp and stacking in bales for sale)

9. Cutter. A cutter cuts the pulp sheets from the end to the right dimensions for baling.
10. "Lay-boy". This is a vacuum unit that holds the pulp sheet above the bale and drops it into position.

11. Conveyor. A twin-chain conveyor transports the bale of pulp to the packing area. Here it is sometimes wrapped with another sheet of pulp (this typically wouldn't be carried out for wet lap).
12. Strapping. Wire or straps are wound around the bale to hold it together for transport to the customer.

Next steps – dry lap only

9. Fluffer. After the pressing into sheets of pulp ~50% water 50% fibre, this material would then pass through a fluffing unit. This unit breaks up the pressed sheet to increase surface area of the pulp.
10. Flash Dryer. Pulp sheets are dried to around 10% moisture.
11. Slab Press. Pulp sheets are collected and pressed into a slab of fibres. This slab will be equivalent to a bale of pulp.
12. Wrapping. If desired, this slab of dried fibres is then wrapped with a sheet of another pulpable material to hold it together. Alternatively, the slab could be strapped without an over-cover.
13. Printing. Identification printing would be carried out.
14. Final product is then warehoused prior to transport off site.

Not included in the plant

For the purposes of this report we have assumed a de-inking plant would not be included in the wet lap/dry lap plant. Most of the material would be sold to be made into cardboard boxes and is unlikely to require de-inking. De-inking requires expensive equipment to buy and run.

Other equipment (wet lap dry lap)

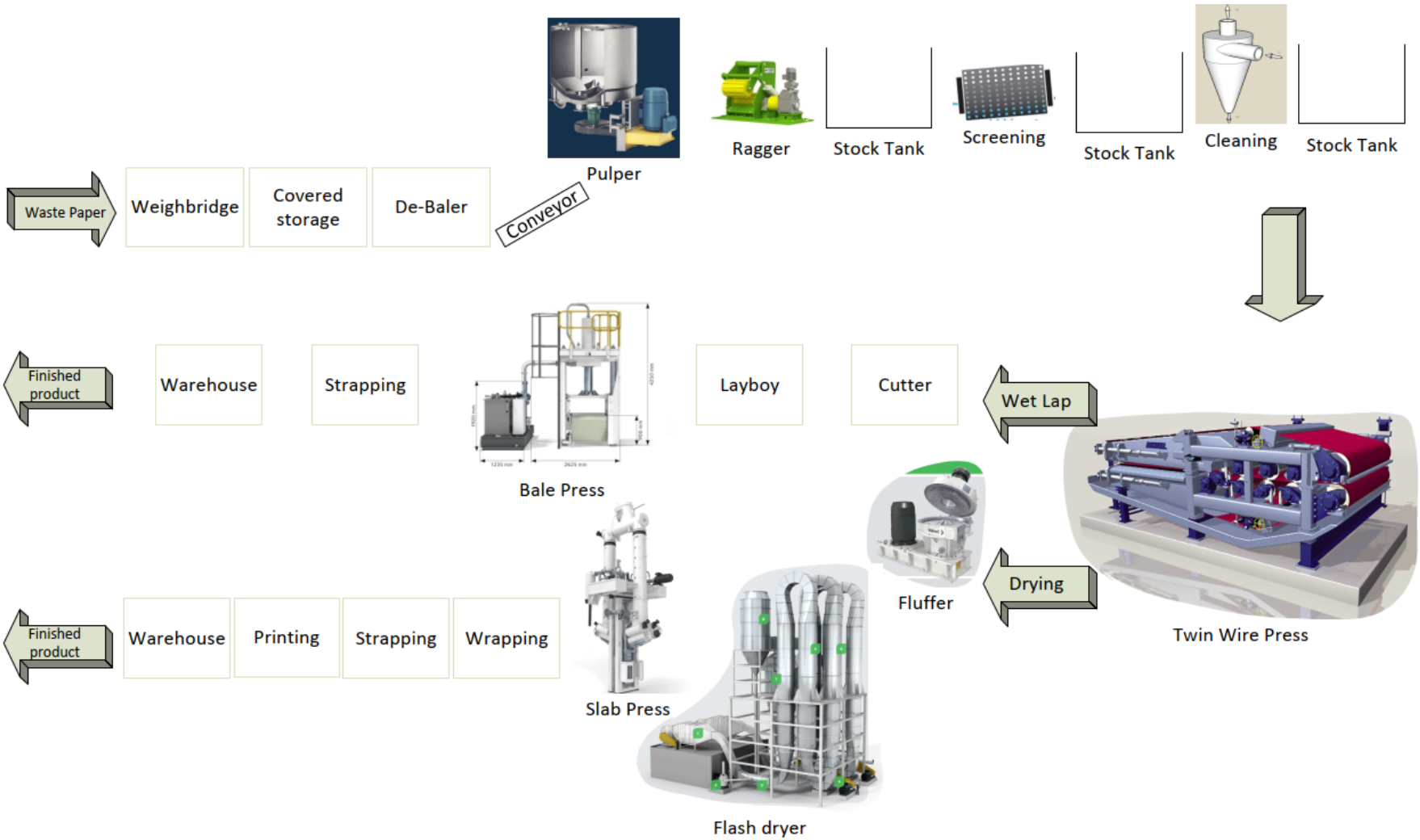
Water Treatment

Ideally the plant would re-use as much water as possible. This would be in some combination of settling, dissolved air flotation (DAF), screw pressing. Solid sludge material will be a by-product of the process. This can be re-used in products such as mulch. It is a fibrous clay-filled product.

Waste handling storage

The plant may require a handling facility for the "Rags" from the pulper. These would be transported to either landfill or a waste to energy plant. Reasonable calorific value.

Figure 6: Wet lap/ dry lap process layout[39]



[39] De-inking may be part of the process but is likely to be cost prohibitive and not critical for making 'box grade' fibre.

High level financial comparison

A comparison of the three plants is included below (Table 3). Note these are high level costs based on a range of assumptions and quotes on plant, equipment and required labour etc need to be confirmed.

Based on the high-level financial assessment, the cost to build a polishing plant is significantly lower than for the wet lap or dry lap plants. It also costs less to operate. The polishing plant has less equipment and overall it is less expensive for this equipment than the wet lap and dry lap plants. The dry lap plant is the most expensive of the three options. It has almost all the plant and equipment that the wet lap plant has, plus a flash drier which is estimated to cost over $4M alone.

The FTEs to run each plant also vary. The wet lap plant and dry lap plant require three shifts to operate whereas the polishing plant has two shifts. This increases staffing numbers.

The revenue is also quite different for the polishing plant when compared to the lap plants. The product sold by the polishing plant is like the fibre sold at a MRF, just with lower contamination. This would lift the price up slightly from what MRFs currently receive for these materials. The product from a lap plant is anticipated to sell for $250 per tonne for wet lap or $468 per tonne for dry lap. These numbers heavily influence the viability of each plant. The revenue per annum is significantly higher than the sale price at the polishing plant, although the costs to set up and run the lap plants is higher.

Table 3: Comparison of a polishing plant, wet lap plant and dry lap plant

Plant	Assumed throughput	Capex (assuming built adjacent a MRF)	Opex[40]	FTEs	Revenue from sale of product and gate rates[41]
Polishing plant	50,000 tpa mixed paper card from MRFs	$12M	$2.6M/ year	8-9	$3.4M/year ($10/t cost for incoming material, $62/t sale of mixed paper card <2% contam, $150/t sale of OCC/board <1% contam)
Wet lap plant	50,000 tpa mixed paper card from MRFs	$24M	$6.5M/ year	15	$9M/year ($10/t cost for incoming material, $250/t sale of wet lap product[42])
Dry lap plant	50,000 tpa mixed paper card from MRFs	$29M	$9.6M/ year	19	$18.4M/year ($10/t cost for incoming material, $500/t sale of dry lap product[43])

[40] Labour, repair and maintenance, utilities, licences, waste disposal, water supply (lap plants) etc
[41] Sale price is ex works (i.e. considers transport costs)
[42] Fibre component/ dry basis only. Equivalent to $125 per tonne when including water component
[43] Fibre component/ dry basis only. Equivalent to $450 per tonne when including water component

Assumptions

Table 4: Assumptions for each plant[44]

Item	Polishing plant value	Wet lap value	Dry lap Value	Unit
Capital costs				
Building and site capital, design, licencing and equipment costs including contingency	$12M	$24M	$29M	$
Assumed contingency (incl in above figure)	20%	20%	20%	% of capital costs
Depreciation period on building and site infrastructure	30	30	30	Years
Depreciation period on plant and equipment	10	10	10	Years
Inputs				
Total input tonnes (all mixed paper cardboard)	50,000	50,000	50,000	t/a
Increase in input tonnes per annum	0%	0%	0%	%
Gate rate from other MRF tonnes (cost for each plant)	-$10	-$10	-$10	$/t
Gate rate from adjoining MRF tonnes (cost for each plant)	-$10	-$10	-$10	$/t
Water supply needed to run facility	NA	443,000	480,000	kL/a
Outputs				
Total product sold (after taking out lost fibre and contamination)	OCC/Board 13,100 Mixed paper/card 30,900	37,800 tonnes dry fibre, 75,700 when including water	37,800 tonnes dry fibre, 42,000 when including water	t/a
Contamination to energy recovery	6,000	4,200	4,200	t/a
Sludge to organics recovery	0	19,400	19,400	t/a
Revenue per tonne for product sold (after transport considered)	OCC/Board $150 Mixed paper/card $62	Wet lap $250 ($125/t when including water)	Dry lap $500 ($450/t when including water)	$/t
Cost for contamination disposal (based on industry estimates)	$180	$180	$180	$/t
Cost for sludge disposal (based on industry estimates)	NA	$50	$50	$/t
Operational requirements				
FTEs	8-9	15	19	#FTEs

[44] t/a = tonnes per annum

Other assumptions:

- The facilities are assumed to be built adjacent a MRF. There are cost savings that would need to be added to the current model if building in isolation.
- Unless otherwise stated, prices are in AUD and ex GST.
- Prices are estimations only. The prices are likely to be +/-50% of actual costs.
- Revenue for the sale of OCC from the C&I sector that goes through each of the plants is not considered.
- Revenue received for metal (aluminium and steel) recovered in the plant is not considered in revenue figures.
- When the COAG ban is implemented it is assumed alternative options for mixed paper/cardboard for these MRFs (when local markets are exhausted) will be landfill, energy recovery or potentially compost. MRFs will therefore lower the rate they will send the mixed paper/cardboard to the polishing plant as the other options are a higher cost and do not lead to recycling of the fibre.
- The price for mixed paper/cardboard, OCC/board, wet lap and dry lap product will remain steady over time. Variations in these prices is considered in the following section.

Limitations and risks

There are several limitations, risks and considerations for each facility:

- Fluctuations in sale price of outgoing materials can significantly impact the commercial viability of these plants.
    - This increases the risk of building a plant given price volatility of fibre has never been higher and this volatility is likely to remain.
    - Given the potential price volatility, the plant may need to enter into rise and fall agreements with MRFs providing the mixed paper/cardboard, to enable a change in gate rate when the sale price of OCC/board and mixed paper/cardboard changes.
- A key risk for the wet lap and dry lap facilities is demand for the product. Although discussions with industry indicate potentially high prices for the product, there is likely to be limited markets in Australia and the product will rely on overseas sale. Wet lap is likely to cost too much to transport overseas so will be limited to Australian markets which are already at capacity. SE Asia currently has and is building additional large pulping facilities that will do the same thing as the proposed lap plant here. This will also lower the demand for this product or lead to a facility accepting the pulp and needing to re-pulp it. The demand for the products from the polishing plant is likely to be higher than the lap plant products.
- The volume of OCC at kerbside is anticipated to grow as online purchases continue to increase while newspapers and print advertising declines. This may impact the commercial viability of each plant and this would need to be considered.
- The polishing plant option will rely on export of mixed paper cardboard at 2% contamination and OCC at 1% contamination. It is assumed these will be allowed to be exported after the COAG ban is implemented. If this is not allowed, the polishing plant will not be required.
- If other MRFs are supplying fibre to the polishing plant, offtake agreements would be required to ensure incoming materials are not highly contaminated. The mixed paper/cardboard from other MRFs would be delivered based on a strict specification. Independent audits are recommended to check contamination and quality of incoming materials.
- The 'risk of doing nothing' needs to be considered. If nothing is done, the paper/cardboard from MRFs (estimated to be ~50% of MRF incoming product) is unlikely to have a recycling market and options will be limited to compost (if sufficiently low contamination can be achieved), energy recovery or landfill. The cost to energy recover all the 50,000 tonnes of paper cardboard is ~$9M per annum plus there is the lost revenue from sale of this material. This would be a significant cost to the state and the industry.
- There are other funding models that may help make this a more commercially viable option. For example, there may be an opportunity to negotiate a higher private sector investment proportion which would lower the government contribution. Another example is extended producer responsibility/product stewardship programs for packaging recycling. This is commonplace in Europe. The company using the packaging must pay a fee to cover recycling costs.

Conclusion

The report compares three options for fibre recovery in SA. These options are important to consider for when the COAG ban is implemented in 2024. The 'do nothing' model is not a good outcome for the state, estimated to cost at least ~$9M per annum plus a significant loss of revenue if the 50,000 tonnes of recovered paper/cardboard is unable to be sold for recycling.

The demand for recovered mixed paper locally and overseas is likely to remain and it is important to continue to recover fibre for recycling. Without significant changes to the Australian manufacturing and consumer buying behaviour, demand for recovered paper is unlikely to increase to the required levels as to not rely on recovered fibre export. With the COAG ban coming in place in 2024, local infrastructure is needed to clean up MRF recovered fibre to meeting international export standards. A polishing plant enables this to be done, but it comes at a high cost (capital cost estimated to be approximately $12M) and ongoing costs of around $2.6M per year. The lap plants are likely to cost a lot more to set up ($24M and $29M for the wet lap and dry lap plants respectively) and operate (ongoing costs ~$6.5M for the wet lap plant and $9.6M for the dry lap plant), although the revenue for the product could be a lot higher than the polishing plant.

The financial viability of each of these plants is dependent on several factors, including the grant funding provided by state and federal governments and revenue received for incoming and outgoing tonnes. Each option has risk associated with it. The polishing plant outgoing materials are currently in high demand and this is likely to increase. However, if the COAG ban does not allow for the export of this product it will find it hard to sell all the products into Australian markets. The COAG ban allows for pulp from a pulping plant and although the anticipated price for wet lap and dry lap products are high, demand may fluctuate and is likely to be lower than the polishing plant products given there are many pulping plants built or planned to be built in SE Asia and the Australian market is at capacity. Price volatility for all products is also likely to be a risk. Wet lap in particular may be limited to Australian markets given the high transportation costs (half the product is water).

Despite these risks, the risk of doing nothing is much worse and would not be a good outcome for the state. Three plants are explored in this paper and further research is required to assess which would be most ideal or if another model (e.g. sending to interstate polishing or lap plants) is more viable. The polishing plant and dry lap plants are recommended as the higher priority options of the three, when considering high level costs and risks. Another option is to explore other funding models such as extended producer responsibility/ product stewardship arrangements currently in place in some European countries. This option is worth exploring regardless of whether the fibre processing plant is built in SA or not, as it may help fund the recovery of fibre. Another initiative is changing SA kerbside bin models to minimise contamination (e.g. separating out fibre into its own bin). This could be considered less practical than building a polishing plant but may be the only option for ongoing recovery of fibre when the COAG ban is implemented if a polishing or lap plant were not built. If nothing is done, high volumes of fibre are likely to have limited recycling markets, leading to composting, energy recovery (likely option) or landfill. This would not be a good outcome for the state.

Appendix One: fibre grades, description and export requirements when COAG ban is in place

Fibre grades, a description and the export guidelines according to Scrap Specifications Circular April 2018, Institute of Scrap Recycling Industries, Inc (ISRI)) is included below.

Table A1: Fibre grades, a description and the export guideline

Fibre name	Definition	% Prohibitive materials allowed[45]	% Outthrows[46] plus prohibitives allowed
(4) Boxboard Cuttings	Consists of new cuttings of paperboard used in the manufacture of folding cartons, set-up boxes and similar boxboard products	0.50%	2%
(5) Mill Wrappers	Consists of paper used as outside wrap for rolls, bundles, or skids of finished paper	0.50%	3%
(9) Over-Issue News (OI or OIN)	Consists of unused, overrun newspapers printed on newsprint, containing not more than the normal percentage of rotogravure and coloured sections	none permitted	none permitted
(10) Magazines (OMG)	Consists of coated magazines, catalogues, and similar printed materials. May contain a small percentage of uncoated news-type paper	1%	3%
(11) Old Corrugated Containers (OCC)	Consists of corrugated containers having liners of either test liner or kraft.	1%	5%
(12) Double-Sorted Old Corrugated (DS OCC)	Consists of double-sorted corrugated containers, generated from supermarkets and/or industrial or commercial facilities, having liners of test liner or kraft. Material has been specially sorted to be free of boxboard, off-shore corrugated, plastic, and wax.	0.50%	2%
(13) New Double-Lined Kraft Corrugated Cuttings (DLK)	Consists of new corrugated cuttings having liners of either test liner or kraft. Treated medium or liners, insoluble adhesives, butt rolls, slabbed or hogged medium, are not acceptable in this grade.	None permitted	2%
(14) Fibre Cores	Consists of paper cores made from either recycled paperboard and/or linerboard, single or multiple plies. Metal or plastic end caps, wood plugs, and textile residues are not acceptable in this grade	1%	5%
(15) Used Brown Kraft	Consists of brown kraft bags free of objectionable liners and original contents.	None permitted	0.50%
(16) Mixed Kraft Cuttings	Consists of new brown kraft cuttings, sheets and bag scrap free of stitched paper	None permitted	0.10%
(17) Carrier Stock	Consists of printed or unprinted, unbleached new beverage carrier sheets and cuttings. May contain wet strength additives.	None permitted	1.00%
(18) New Coloured Kraft	Consists of new coloured kraft cuttings, sheets and bag scrap, free of stitched papers.	None permitted	1.00%
(19) Kraft Grocery Bag (KGB)	Consists of new brown kraft bag cuttings, sheets and misprint bags.	None permitted	1.00%
(20) New Kraft Multi-Wall Bag	Consists of new brown kraft multi-wall bag cuttings, sheets, and misprint bags, free of stitched papers.	None permitted	1.00%
(21) New Brown Kraft Envelope Cuttings	Consists of new unprinted brown kraft envelopes, cuttings or sheets.	None permitted	1.00%
(22) Mixed Flyleaf Shavings	Consists of trim of magazines, catalogues, inserts and similar printed matter, not limited with respect to groundwood, uncoated or coated stock, and may contain the bleed of cover and insert stock as well as beater-dyed paper and solid colour printing.	None permitted	2.00%

[45] Prohibitive Material is defined as a) any materials which by their presence in a packing of paper stock, in excess of the amount allowed, will make the pack unusable as the grade specified, and b) any materials that may be damaging to equipment.

[46] Outthrows defined as all papers that are so manufactured or treated or are in such a form as to be undesirable for consumption as the grade specified

Fibre name	Definition	% Prohibitive materials allowed[45]	% Outthrows[46] plus prohibitives allowed
(23) Telephone Directories	Consists of clean telephone directories printed for or by telephone directory publishers.	None permitted	0.50%
(24) White Blank News (WBN)	Consists of unprinted cuttings and sheets of white newsprint or other uncoated white groundwood paper of similar quality.	None permitted	1.00%
(25) Groundwood Computer Printout (GW CPO)	Consists of groundwood papers which are used in forms manufactured for use in data processing machines. This grade may contain coloured stripes and impact or nonimpact (e.g., laser) computer printing.	None permitted	2.00%
(26) Publication Blanks (CPB)	Consists of unprinted cuttings or sheets of white coated or filled groundwood content paper.	None permitted	1.00%
(27) Coated Flyleaf Shavings	Consists of lightly printed trim from magazines, catalogues and similar printed matter, not limited with respect to groundwood, uncoated or coated stock. The bleed of cover, insert card stock, and beater-dyed paper may not exceed 2%.	None permitted	1.00%
(28) Coated Soft White Shavings (SWS)	Consists of unprinted, coated, and uncoated shavings and sheets of white groundwood-free printing paper. May contain a small percentage of groundwood.	None permitted	1.00%
(29) (Grade not currently in use)			
(30) Hard White Shavings (HWS)	Consists of shavings or sheets of unprinted, untreated white groundwood-free paper.	None permitted	0.50%
(31) Hard White Envelope Cuttings (HWEC)	Consists of groundwood-free cuttings, shavings, or sheets of unprinted, untreated, and uncoated white envelope paper	None permitted	0.50%
(32) (Grade not currently in use)			
(33) New Coloured Envelope Cuttings	Consists of groundwood-free cuttings, shavings, or sheets of untreated, uncoated bleachable coloured envelope paper.	None permitted	2.00%
(34) (Grade not currently in use)			
(35) Semi Bleached Cuttings	Consists of sheets and cuttings of unprinted, untreated, groundwood-free paper such as file folder stock, untreated milk carton stock, or manila tag	None permitted	2.00%
(36) Unsorted Office Paper (UOP)	Consists of printed or unprinted paper typically generated in an office environment that may include a document destruction process. This grade may contain white, coloured, coated and uncoated papers, manila and pastel coloured file folders.	2%	10.00%
(37) Sorted Office Paper (SOP)	Consists of paper, as typically generated by offices, containing primarily white and coloured groundwood-free paper, free of unbleached fibre. May include a small percentage of groundwood computer printout and facsimile paper.	1%	5.00%
(38) (Grade not currently in use)			
(39) Manifold Coloured Ledger (MCL)	Consists of sheets, shavings, and cuttings of industrially generated printed or unprinted coloured or white groundwood-free paper. All stock must be uncoated and free of nonimpact printing. A percentage of carbonless paper is allowable.		
(40) Sorted White Ledger (SWL)	Consists of uncoated, printed or unprinted sheets, shavings, guillotined books, and cuttings of white groundwood-free ledger, bond, writing, and other paper which has similar fibre and filler content.	0.50%	2%
(41) Manifold White Ledger (MWL)	Consists of sheets, shavings, and cuttings of industrially generated printed or unprinted white groundwood-free paper. All stock must be uncoated	0.50%	2%
(42) (Grade no longer in use)			
(43) Coated Book Stock (CBS)	Consists of coated groundwood-free paper, printed or unprinted in sheets, shavings, guillotined books and cuttings. A reasonable percentage of paper containing fine groundwood may be included	None permitted	2%
(44) Coated Groundwood Sections (CGS)	Consists of printed, coated groundwood paper in sheets, sections, shavings or guillotined books. This grade may not include news quality groundwood paper.	None permitted	2%

Fibre name	Definition	% Prohibitive materials allowed[45]	% Outthrows[46] plus prohibitives allowed
(45) Lightly Printed Bleached Board Cuttings	Consists of groundwood-free printed bleached board cuttings, free from misprint sheets, cartons, wax, greaseproof lamination, metallic, and inks, adhesives or coatings that are insoluble.	0.50%	2%
(46) Printed Bleached Board	Consists of groundwood-free misprint sheets, cartons and cuttings of bleached board, free from wax, greaseproof lamination, metallic, and inks, adhesives or coatings that are insoluble.	1%	2%
(47) Unprinted Bleached Board	Consists of groundwood-free unprinted, untreated bleached board cuttings, sheets or rolls, free from wax, greaseproof lamination and adhesives or coatings that are insoluble	None permitted	1%
(48) #1 Bleached Cup Stock (#1 Cup)	Consists of untreated cuttings or sheets of coated or uncoated cup base stock. Cuttings with slight bleed may be included. Must be free of wax, poly, and other coatings that are insoluble.	None permitted	0.5%
(49) #2 Printed Bleached Cup Stock (#2 Cup)	Consists of printed, untreated formed cups, cup die cuts, and misprint sheets of coated or uncoated cup base stock. Glues must be water soluble. Must be free of wax, poly, and other coatings that are insoluble.	None permitted	1%
(50) Unprinted Bleached Plate Stock	Consists of groundwood-free bleached coated or uncoated, untreated and unprinted plate cuttings and sheets.	None permitted	0.5%
(51) Printed Bleached Plate Stock	Consists of groundwood-free bleached coated or uncoated, untreated printed plates and sheets. Must be free of coatings or inks that are insoluble.	None permitted	1%
(52) Aseptic Packaging and Gable-Top Cartons	Consists of liquid packaging board containers including empty, used, polyethylene (PE)-coated, printed one-side aseptic and gable-top cartons containing no less than 70% bleached chemical fibre and may contain up to 6% aluminium foil and 24% PE film.	2%	5.0%
(54) Mixed Paper (MP)	Consists of all paper and paperboard of various qualities not limited to the type of fibre content, sorted and processed at a recycling facility.	2%	3.0%
(56) Sorted Residential Papers & News (SRPN)	Consists of sorted newspapers, mail, magazines, printing and writing papers and other acceptable papers generated from residential programs (such as residential household and apartment collections and drop-off centres) sorted and processed at a recycling facility. Containerboard and brown grades (OCC, kraft bags, boxboard and kraft carrier board) will be considered as "Outthrows." Due to some technical questions, a clarification to the language above was made in August 2019.	2%	3.0%
(58) Sorted Clean News (SCN)	Consists of sorted newspapers from source separated collection programs, converters, drop-off centres and paper drives containing the normal percentages of roto gravure, coloured and coated sections. May contain inserts that would normally be included in the newspaper in the proper proportions. Grade must be free of excessive ink, brown grades and non-paper material. (Some mills may require pack to be free of flexographic inks.)	0.5%	1.0%

Appendix Two: Facilities that accept recovered fibre in Australia

There are many facilities that accept recovered fibre in Australia (Table A2). As mentioned, with current demand for recovered fibre these plants are currently at capacity.

Table A2: Facilities in Australia likely to accept recovered fibre[47]

Facility name	Location	Type of facility	Material accepted/ requirements	What the recovered fibre is used for
ABC Tissue products[48]	NSW & Qld	Toilet tissue, facial tissue, kitchen towel and napkin manufacturer	Recycled office paper (SOP) used for selected products	Used to make a variety of products including Naturale[49] toilet paper and a range of Earthcare products (e.g. hand towels and tissues)
Asaleo Care	Box Hill, Vic	Tissue and toilet paper manufacturing company	Unknown	Unknown
Australian Paper Recovery[50]	Truganina and Fairfield, Vic	Sorting facility and polishing plant	Mixed paper/card	Contamination is lowered and resultant mixed paper/card is sold to local and/or international markets
Detmold	SA	Packaging manufacturer	Unknown, likely OCC	100% recycled mailing packs (cardboard boxes from PaperPak)
Encore Tissue[51]	Melbourne, Vic	Tissue and toilet paper manufacturing company	Some recycled clean office paper (SOP)	Some brands use recycled product such as icare, Merino and Safe toilet paper
Fibrecycle	Lonsdale, SA	Cat litter manufacturer	Magazines and newsprint	Produces kitty litter made from recycled paper
Kimberly Clark[52]	Millicent, SA	Manufacturer of tissue, toilet paper and absorbent hygiene products (e.g. Kleenex tissues, Viva paper towel)	Unknown	If used, would only be for 'lower grade' items such as tissues and paper towel for commercial use (e.g. stored in bathrooms)

[47] Note this does not include all facilities and individuals that purchase recovered fibre. Some facilities may accept recovered fibre for periods of time but not at all times. Some of these facilities are vertically integrated, meaning they accept recovered fibre from its own company (the mill may buy fibre from a MRF which is owned by the same company for example).
[48] http://www.abctissue.com/
[49] See http://naturale.com.au/
[50] http://www.australianpaperrecovery.com/about-apr/
[51] https://www.encoretissue.com.au/
[52] http://www.kimberly-clark.com.au/en/our-company/

Facility name	Location	Type of facility	Material accepted/ requirements	What the recovered fibre is used for
Norske Skog[53]	Albury Mill, NSW	Paper mill now closed but may reopen	Previously ONP	Paper for use in the printing of newspapers, magazines and catalogues
	Boyer Mill, Tas	Paper mill	Unknown	Unknown
Opal Australian Paper[54]	Maryvale, Vic	Multiple paper mills (manufacturer of copy, printing and inkjet papers, and bag, sack, and industrial papers). Includes cardboard recycling arm and wastepaper de-inking plant	OCC for cardboard recycling arm of the mill and SOP for wastepaper de-inking plant	To make new products. Combined with 1.7MT of wood per year. Total 600,000 tonnes of paper made per year sold in Aus and exported to 75 countries. Unsure of proportion that is recovered fibre
	Botany, NSW	Recycling and manufacturing facility	Mostly OCC (approx. 600,000 tonnes accepted per year)	Used to produce 100% recycled corrugated packaging board. 400,000 tonnes produced
Queensland Tissue Products[55]	Carole Park, Qld	Tissue and toilet paper manufacturing company	Unknown	Unknown
Visy[56]	Tumut, NSW plus various other sites (Vic, NSW, Qld)	Pulp and paper mill	Likely OCC but other fibre as well from Visy sources (vertically integrated)	Produces kraft paper such as cardboard boxes

[53] https://www.norskeskog.com/
[54] See https://opalanz.com/divisions/opal-australian-paper/ and https://opalanz.com/divisions/opal-paper-and-recycling/
[55] https://qtp.com.au/about-us/
[56] https://www.visy.com.au/pulp-and-paper/paper-mills

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