

Grain Silo Bag Circular Economy Feasibility Study

April 2024



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Colby Phillips Advisory Pty Ltd

Suite 117 / Level 1, 147 Pirie St

Adelaide, SA 5000

www.colbyphillips.com.au

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Distribution List:

Brad Perry	Grain Producers SA
Serena Yang	Green Industries SA

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Summary

Context behind this Report

Grain Producers SA is a peak industry body representing 4,500 grain farming businesses in South Australia (see: www.grainproducerssa.com.au/). It develops and implements policies and projects that promote economic and environmental sustainability of South Australian grain growing.

This Grain Silo Bag Circular Economy Feasibility Study and Report was commissioned by Grain Producers SA to find a Circular Economy recycling solution to disposal of waste plastic grain silo bags.

- **These silo bags are made from multi-laminate LDPE plastic and used by grain farmers to temporarily 'bulk' store harvested grain** (e.g., Up to 300 tonnes in each bag).
- **These bags can be 3m in width, up to 100m long – see Figure E-1 below – and weigh as much as 180kg** (of plastic material).
- **There are no local manufacturers, and all bags are imported from overseas.**
- **Currently, they are not recycled by grain farmers.**
- **There is growing pressure to find a recycling solution for this plastic waste:**
 - Many countries including Australia are banning and/or restricting plastics because of the pollution and environmental harm they can cause, and
 - Customers and markets are now expecting suppliers to be more sustainable in how they manage their waste.
- Others agricultural waste plastic stewardship schemes exist or are being proposed, e.g., drumMUSTER, bagMUSTER, Dairy Australia Silage Recycling Scheme, National Non-Packaging Waste Plastics Stewardship Scheme.

Funding for the Study was provided by a Circular Economy Market Development Grant (CEMDG) from **Green Industries SA** ([Circular Economy Market Development Grants](https://greenindustriessa.com.au/circular-economy-market-development-grants/)).



Figure E-1 – Examples of silo bags storing grain in a field and the resulting waste bags left afterwards. Image sources: Grain Producers SA (<https://grainproducerssa.com.au/>) and Clean Farms (<https://cleanfarms.ca/materials/grain-bags/>)

Scale & Nature of the Waste Silo Bag problem

South Australia produces 6 million to 11 million tonnes (Mt) of grain each year.

- **This activity could generate between 520 and 1,530 tonnes of bag waste per year.**
- **The majority (up to 60%) of bag waste would be generated on Eyre Peninsula**, with other large contributions happening on the Yorke Peninsula (12 – 13%) and in the Northern grain farming areas (10 – 11%).
- **Bag waste is already crudely rolled up** by existing bag extractor / unloading machines, but **newer machines can bale this waste material** in a form more suited for easier transport – see Figure E-2 below.



Figure E-2 – Examples of plastic silo bag being unloaded (or extracted), and of waste material then baled and secured with twine. Image sources: Silo Bag Grain (<https://www.silobaggrain.com.au/>) and Loftness (<https://www.loftness.com/>)

Potential Recycling Pathways Identified

Following extensive stakeholder consultation, three different potential pathways for grain farmers in SA to recycle their waste plastic silo bags were identified. These pathways were as follows, are overviewed in more detail by Table E-1 overleaf, pictorialized in Figure E-3 (two pages over), with Table E-2 (three pages) summarising their expected performance, cost, greenhouse gas emission impact / savings, set-up cost, and other attributes.

- **Pathway 1 – Industry-wide drop-off & collection scheme**
 - Grain farmers would join an existing product stewardship scheme, e.g., like bagMUSTER or proposed National Agricultural Plastics Stewardship Scheme.
 - Farmers would pay a disposal fee to drop off waste bags at existing collection depots across the State.
- **Pathway 2 – Producer led on-farm pick-up and recycler delivery scheme**
 - Grain farmers would work with bag suppliers to establish their own stewardship scheme for bag waste with an annual or biannual pick-up service direct to farms (or supply depots) to maximise participation and diversion outcomes.
 - Costs would be covered by a levy on new bags at point-of-sale (POS).
- **Pathway 3 – Bag supplier led used silo bag return scheme**
 - Bag suppliers would launch their own individual bag return schemes as an opt-in service. *{Cont. four pages overleaf on Page 6}*

Table E-1 – Overview of three identified recycling pathways for grain silo bags

Pathway 1 – Industry-wide drop-off & collection scheme

- Grain farmers join an existing industry-wide voluntary product stewardship scheme, e.g., like bagMUSTER or currently proposed National Agricultural Plastics Stewardship Scheme.
- Farmers drop waste bags at existing collection depots and pay disposal fee (e.g., up to \$250 per bag for farmers in remote regions) at the depot gate.
- It has a low hurdle entry and (set-up) cost for grain farmers but may only deliver moderate farmer participation (e.g., 30 to 60%), have low visibility on performance outcomes, and could have the highest disposal cost to farmers.
- For more information, see Section 4.2 and a detailed pictorialisation in Figure 4-2 (on Page 36).

Pathway 2 – Producer led on-farm pick-up and recycler delivery scheme

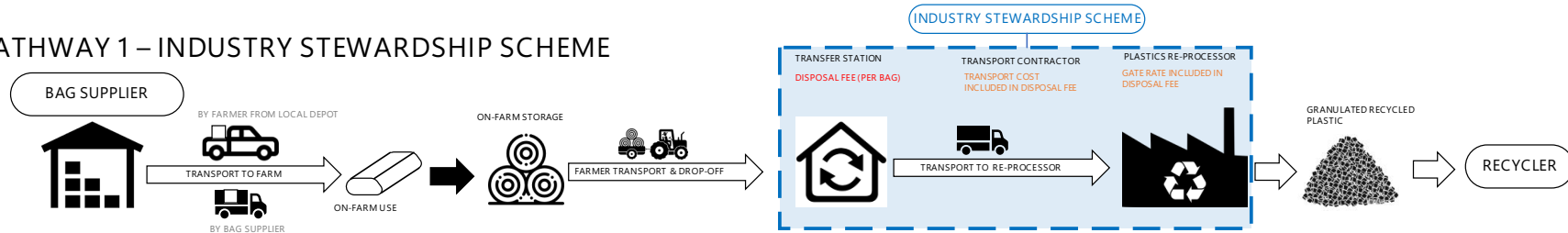
- Grain farmers establish and manage their own voluntary stewardship scheme for bag waste with opportunity for an annual or biannual pick-up service direct to farms (or supply depots) to maximise participation and diversion outcomes.
- The scheme could be paid for by levy (see Footnote 4 later on Page 6) collected by participating bag suppliers at point of sale, so farmers would not need to pay a disposal fee later.
- It could register for Australian Government Product Stewardship Accreditation and could be established at State (e.g., by Grain Producers SA) or National Level (e.g., by Grain Producers Australia).
- It could require substantial investment to set-up (e.g., \$300-\$600k) (which could be offset by a grant funding of available from the South Australian and/or Australian Government¹) and would have an on-going management responsibility (which could be outsourced to existing stewardship scheme operator) and cost.
- As a sector endorsed and accredited scheme with all major bag suppliers participating it should have the higher farmer commitment (e.g., >60-75%), delivering better diversion and product stewardship outcomes.
- But it would still come at a cost, albeit slightly less than other Pathways, adding up to \$200 per bag in remote regions (exc. set-up cost).
- See Section 4.2.9 and a detailed pictorialisation in Figure 4-4 (on Page 46) for more information.

Pathway 3 – Bag supplier led used silo bag return scheme

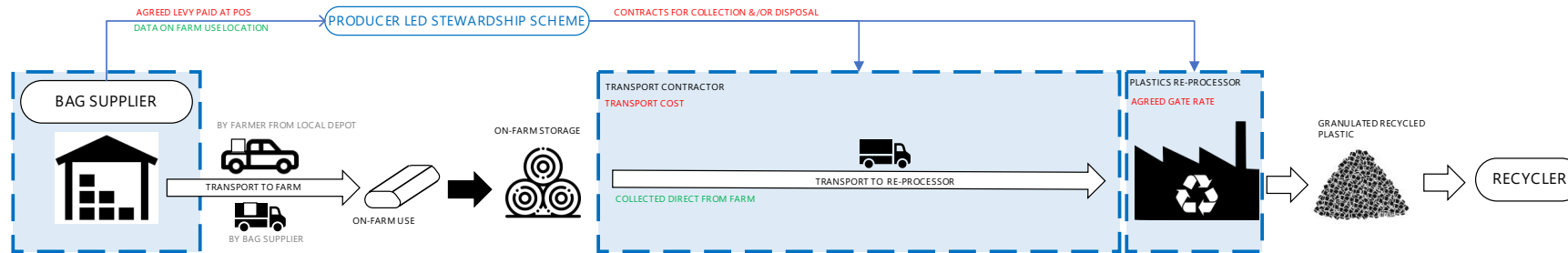
- Bag suppliers fund their own bag return schemes as an option for grain farmers when they buy bags.
- They (ideally) manage collection and pick-up of bags from farms or supply depots at same time as new bags are delivered, adding a fee to sale price to cover costs if this option is elected.
- Grain farmers do not have to get involved but Grain Producers SA could register and promote participating bag suppliers in return for data on bag sales and returns received for recycling to track performance.
- It has lowest set up cost but would likely have lowest farmer participation (e.g., < 50%) as not all bag suppliers may participate, and farmers may be more liable to opt out of electing the recycling option when they buy bags.
- Due to expected lower collection volumes and fragmentation between different bag suppliers it could have the highest cost to farmers (unless subsidized by the bag suppliers, which would be unlikely).
- See Section 4.2.9 and a detailed pictorialisation in Figure 4-4 (on Page 46) for more information.

¹ As an example, this funding could be from the National Product Stewardship Investment Fund ([National Product Stewardship Investment Fund - DCCCEEW](#)). Note: At time of this report, this program was closed.

PATHWAY 1 – INDUSTRY STEWARDSHIP SCHEME



PATHWAY 2 – PRODUCER LED SCHEME



PATHWAY 3 – BAG SUPPLIER LED SCHEME

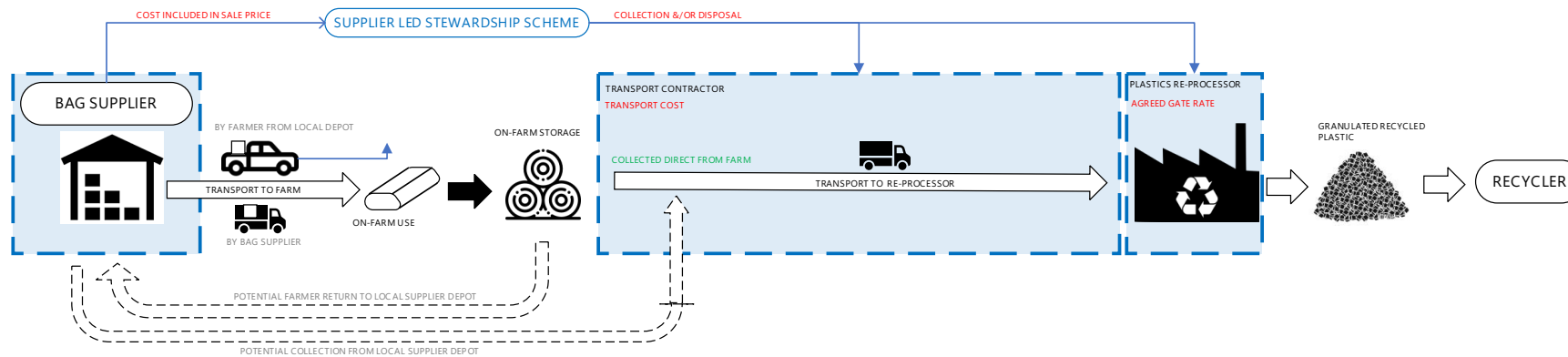


Figure E-3 – Pictorial Overview of the three proposed Recycling Pathways for waste grain silo bags

Table E-2 – Overview of proposed Recycling Pathways: Operation, possible performance, cost, greenhouse gas emission reduction, set-up cost, and other attributes. Key scheme attributes are ranked, and colour coded (with Green = Better) to reflect perceived preference.

Recycling Option & Outcome	Pathway 1	Pathway 2	Pathway 3
Description	Industry-wide drop-off & collection scheme	Producer led on-farm pick-up and recycler delivery scheme	Bag supplier led used silo bag return scheme
Scheme Owner	Existing Scheme, e.g., CropLife, RCMG, AgSafe	Grain Producers SA or Australia	Individual Bag Suppliers
Scheme Operator		Outsource to third party, e.g., AgSafe	
Likely Re-processor	Recycling Plastics Australia (Adelaide) <ul style="list-style-type: none"> • Subject to planned investment by re-processor in new "washing & compaction" plant • Gate Fee may start at +\$250 / tonne charge (cost) then may rise to -\$250 / tonne rebate (payment)** 		
Participation & Diversion Potential*	Moderate, e.g., 30-60%	Higher, e.g., >60-70%	Lowest, e.g., < 50%
Possible Cost to Farmer - \$ per Bag[^]	Highest, e.g., \$60 to \$250 / Bag	Maybe (Slightly) Less, e.g., \$50 to \$200 / Bag	Hard to know, e.g., \$50 up to \$300 / Bag
Farmer Payment Point	Depot	Point-of-Sale / Member Payment	Point-of-Sale
Greenhouse Gas Emission Impact	3 to 4 t-CO ₂ -eq / t saving (Scope 1, 2 & 3), similar between options, dictated by volume recycled,		
Grain Producer SA Management Burden	Lowest	Highest	Low to Medium
Grain Producer SA Investment to set-up (estimated)	Lowest, e.g., \$0-150k	Highest, e.g., \$300 - \$600k	Lowest, e.g., \$0-100k
	Negotiate Entry to existing scheme.	More expensive to set up own scheme.	Support Set-up & Promote
Grant Opportunity to offset set-up cost?	Possible, e.g., GISA, National Product Stewardship Investment Fund		Unlikely
Grain Farmer Ownership / Commitment (Perceived)	Lowest	Higher	Moderate
Performance Data Visibility Opportunity	Lowest	Highest	Moderate

* These are high-level estimates informed by expected scheme sector coverage and/or feedback from grain farmers on likely participation if cost was perceived as affordable. What is a perceived affordable price in the future cannot be discerned at current time and may depend on future actions by Australian and State Governments to regulate plastic waste disposal. But if was, these might the practical participation rates expected across the State.

[^] Based on estimated costs for collection, transport, and assumed re-processor gate rate (to accept and recycle the waste bags).

** The transition from a gate fee to rebate is not guaranteed and may take several years to happen (e.g., between 3 and 8 years) and cannot necessarily be relied on to reduce future scheme cost to farmer.

Best Recycling Scheme for Grain Producers?

The identified pathway with expected lowest future operating cost and best potential participation and diversion performance was **Pathway 2 – Producer led on-farm pick-up and recycler delivery scheme**.

- **It could be an Australian Government registered voluntary product stewardship scheme² for waste bags that could operate nationally³.**
- **All bag suppliers can be asked to participate and collect a levy⁴ to generate necessary monies to cover the costs of running the scheme.**
- **It could provide collection direct from farms** (or nearby supplier or regional waste depots), so farmers did not have to cart the bulky and heavy waste long distances regional collection depots.
- **It would maximise scheme scale and volume and the quality of waste material supplied to re-processors** to minimise gate fee and improve recycle utility and value.

However, **Pathways 1 and 3 operated by third parties would have lowest up-front cost and on-going management burden for the grains industry and farmers (and may be preferred).**

Stakeholder Feedback on Recycling Pathways

Grain farmers, bag suppliers, and existing product stewardship operators were re-engaged to listen to their views. Their feedback is summarised in Table E-3 overleaf.

In summary, each party had a different view on would work best.

- **Farmers preferred a scheme that delivered lowest cost with on-farm collection.**
- **Even then, potential costs at >\$100-\$200+/bag were not seen as affordable.**
 - **It may be necessary to undertake more engagement with grain farmers to:**
 - **Better understand expectations and/or sensitivity about recycling costs.**
 - **Re-frame the business case to grain farmers for paying to recycle their waste**, so they are presented relative to farm operating costs or other disposal solutions if current practices can no longer be used.
- **Any future recycling scheme could require commitment by grain farmers to participate at scale** to minimise recycling cost, maximise diversion, and ensure material is delivered and can be recycled at highest “technical utility” in line with Circular Economy principles.

² The Recycling and Waste Reduction Act 2020 provides for voluntary, co-regulatory and mandatory product stewardship schemes. Voluntary schemes can operate independently of Government or apply for accreditation.

³ Assuming participation of all State Grain producer associations and support from Grain Producers Australia ([Grain Producers Australia](#)).

⁴ A levy may require authorisation from the Australian Competition & Consumer Commission (ACCC) (For more information, see [Authorisation | ACCC](#)).

Table E-3 – Overview of Stakeholder Feedback on Recycling Pathway options

Existing product stewardship scheme operators	<ul style="list-style-type: none"> Keen to sign up producers to participate. Some (but not all) have proven collection and recycling of grain silo bags in “pilots”, but costs were ‘subsidised’. Fee for service > \$100-\$200 / bag is likely as collection and transport costs (to some regions) likely outweigh any material rebate from reprocessors (if there is any at all).
Bag suppliers	<ul style="list-style-type: none"> Many may prefer to launch own voluntary bag return schemes, with cost potentially passed on at point-of-sale, based on farmer election. Some could look to ‘close-the-loop’ and send material for re-processing to manufacture bags overseas
Grain Producers	<ul style="list-style-type: none"> Many may be (but not all) interested in recycling their bags. Potential costs at >\$100-\$200+/bag (10%-20+% bag cost) above what was seen as affordable (which was suggested as more like 5 to 10% of bag retail cost, or \$50 to \$100 / bag) Existing schemes with drop-off arrangements were generally not preferred by grain farmers (they would favour on-farm pick-up due to size and weight of bags)
Re-processors (recycled plastics)	<ul style="list-style-type: none"> Can accept material but it is not high quality (due to multi-laminate construction and colours and other additives present) likely only suitable for low-value recycled material end use (e.g., builders’ film). Consequently, future gate rates paid for the material may not be high (or even nothing to start with until a market is built for recycle). Prefer a scheme that supplies only grain silo bags, not mixed with other plastic waste. Require long-term commitments for feedstock supply to justify large capital investments to upgrade existing plant to accept and process at scale.

Recommended Steps towards Implementation of a Recycling Scheme

In conclusion, there was no clear and immediate pathway for recycling grain silo bags that was agreed on by all stakeholders or presently seen as affordable by grain farmers.

- **Recommended steps for Grain Producers SA to progress the sector towards developing a feasible Recycling Scheme and successfully implementing it are summarised in Figure E-4 overleaf.**
- **Table E-4 (overleaf too) suggested potential actions that Grain Producers SA could consider in each recommended step.**
- **These potential actions in Step 1 include:**
 - Consider a pilot with bag supplier(s), farmers, local re-processor(s), and existing scheme operators to demonstrate proof-of-concept for recycling waste plastic grain silo bags and raising awareness about Circular Economy disposal options.
 - Keep a watching brief on how existing or new scheme(s) develop and/or future funding opportunities for a State-wide scheme.
 - Use the outcomes of the pilot to look at opportunities for a larger waste grain silo bag scheme, including design, partners, and funding model.

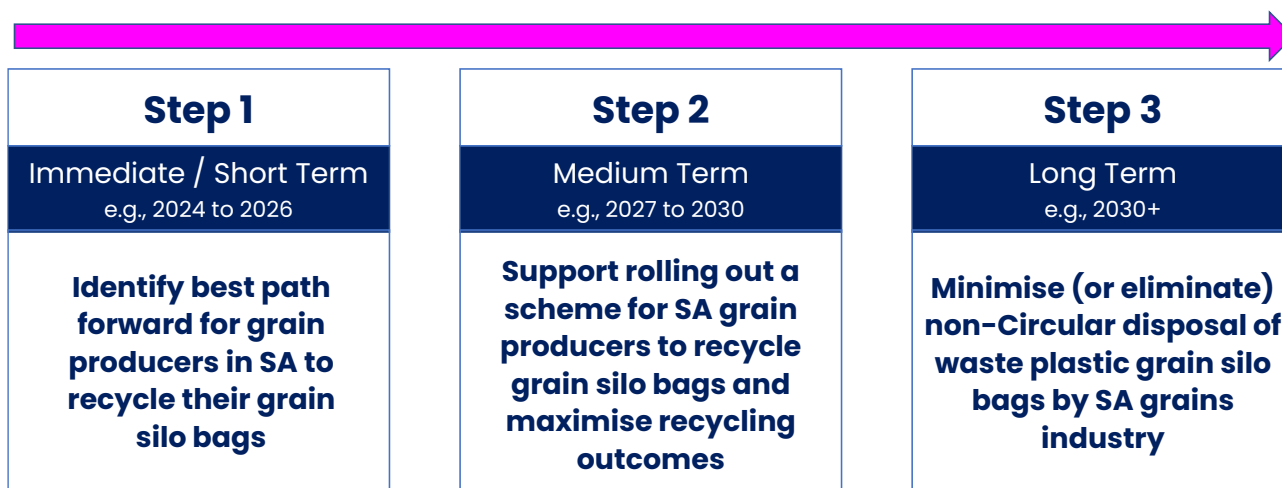


Figure E-4 – Pictorial overview of recommended steps to develop a feasible Circular Economy solution for recycling waste plastic silo bags.

Table E-4 – Proposed steps and potential actions that Grain Producers SA could undertake to implement each.

Step (& Timeframe)	Goal	Potential Actions
1. Immediate / Short Term , e.g., 2024 to 2026	Identify best path forward for grain producers in SA to recycle their grain silo bags.	<ol style="list-style-type: none"> 1. Develop and support a pilot scheme with bag supplier(s), farmers, local re-processor(s), existing scheme operators to demonstrate proof-of-concept for recycling waste plastic grain silo bags and raise producer awareness about Circular Economy disposal options. 2. Keep a watching brief on how existing or new scheme(s) develop and/or future funding opportunities for a State-wide scheme. 3. Use outcomes of the pilot project to look at opportunities for a larger waste grain silo bag scheme, including design, partners, and funding model. 4. Investigate opportunities (including grant funding if available) to expand farmer access to on-farm equipment to bale extracted bags, so they are 'recycle-ready' to participate in a future waste grain silo bag scheme.
2. Medium Term e.g., 2027 to 2030	Support a scheme (or schemes) for grain producers across SA to recycle grain silo bags and look to maximise recycling outcomes (or fate).	<ol style="list-style-type: none"> 1. Support launch of a State-wide recycling scheme for product stewardship of waste plastic grain silo bags available to all Grain Producers SA members. 2. Work with bag suppliers, grain producers, R&D agencies, and government to research new silo bag designs that can reduce members' grain silo bag storage cost and/or product stewardship costs and/or that improve recycling outcomes.
3. Long-term , e.g., 2030+	Minimise (or even eliminate) non-Circular disposal of waste plastic grain silo bags by the grains industry in SA.	<ol style="list-style-type: none"> 1. Work with grain producers, bag suppliers, and government to minimise non-Circular disposal of waste plastic grain silo bags by the grains industry in SA. 2. If not happening already, support expansion of State scheme(s) nationally. 3. Support the launch of any new silo bag designs that can reduce members' grain silo bag storage cost and/or product stewardship costs and/or that improve recycling outcomes.

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1 Introduction

1.1 Context

1.1.1 Grain Producers SA

Grain Producers SA is a peak industry body representing 4,500 grain farming businesses in South Australia (see: <https://grainproducerssa.com.au/>).

Each year these grain farming businesses:

- Plant more than 4 million hectares of cereals, pulses, and oilseeds
- Produce on average 7.9 million tonnes of grain,
- Contribute more than \$4 billion to Australia's gross food revenue.

To support members, **Grain Producers SA develops and implements policies and projects that promote the economic and environmental sustainability** of South Australian grain growing. This important role includes (among other things):

- Advocacy to industry and government stakeholders on members' interests,
- Knowledge building, policy development and information sharing with members, and
- Industry development projects that achieve this goal.

Recent examples of Grain Producers SA initiatives are:

- 'Take the Spray' pledge – to encourage grain producers to take up best practice when spraying agrochemicals.
- South Australia's 'Worst Grain Road' report – identifying roads that farmers rely on for transport in desperate need of repair.
- 'Don't be a Bright Spark' this harvest campaign – reminding and helping farmers to have a farm fire prevention strategy in place.



Figure 1-1 – Grain being harvested in a field and Grain Producers SA members committing to the 'Take the Spray' pledge. Image sources: Grain Producers SA (<https://grainproducerssa.com.au/>)

1.1.2 This Study

This Grain Silo Bag Circular Economy Feasibility Study was funded by a Circular Economy Market Development Grant (CEMDG) from **Green Industries SA** ([Circular Economy Market Development Grants](https://greenindustriessa.com.au/circular-economy-market-development-grants)). **It addresses a growing problem** for South Australian grain farmers **arising from a lack of recycling options for used plastic silo bags**. These silo bags are used on their farms for temporary storage of harvested grain – see Figure 1-2 below. **Once used, they become an on-farm waste problem** (see Figure 1-2).

The key aims of the Study were to:

- **Overcome the** lack of information around the **size of the plastic silo waste bag problem**.
- **Assess the status of existing disposal pathways** (if any) for these waste bags.
- **Identify future circular economy/recycling opportunities** and assess their feasibility.
- **Recommend actions and/or practices** that Grain Producers SA and its members could take **to implement these opportunities** and achieve more sustainable management of waste plastic silo bag.



Figure 1-2 – Examples of silo bags storing grain in a field and the resulting waste bags left afterwards. Image sources: Grain Producers SA (<https://grainproducerssa.com.au/>) and Clean Farms (<https://cleanfarms.ca/materials/grain-bags/>)

1.1.3 Stakeholder Engagement

To inform the Study and this report, engagement was undertaken with a range of key stakeholders – see Figure 1-3 overleaf – including (but not limited to):

- **Grain Producers SA Members** or South Australian grain farmers
- **Local Suppliers** of grain silo bags (to these farmers)
- **Re-processors** of waste plastics
- **Operators of Product Stewardship schemes** for agricultural waste plastics
- **Regulatory authorities and policy makers**, including South Australian Environment Protection Authority (SA-EPA) and Green Industries SA



Figure 1-3 – Stakeholder Engagement Snapshot. Note: Names of grain farmers were provided by Grain Producers SA and not included in this report to protect their privacy.

1.2 Report Presentation

This report is presented as follows.

Section 2 – Grain Silo Bag Waste in SA	<i>More information about grain silo bags, how they are used by grain farmers, what waste volumes could be produced and where.</i>
Section 3 – Why Recycle	<i>Why grain farmers want or may need to find a recycling solution for waste grain silo bags and what is already available or happening in this area.</i>
Section 4 – Identified Recycling Scheme Pathways	<i>Potential ways waste grain silo bags could be collected and recycled in South Australia.</i>
Section 5 – Alternative Disposal Pathways	<i>Summary of alternative disposal pathways for grain farmers to contrast them against proposed recycling options.</i>
Section 6 – What Key Stakeholders think?	<i>Feedback on these pathways from grain farmers, silo bag suppliers, recyclers, regulators, and policy makers, and existing / proposed (agricultural plastic) stewardship scheme operators.</i>
Section 7 – Pathway Selection and Implementation	<i>How to proceed from here to identify the best pathway and implement it to meet grain producer future silo bag recycling needs</i>

2 Grain Silo Bag Waste in SA

2.1 More About Grain Silo Bag Use

2.1.1 Why are Plastic Silo Bags Used?

Advances in grain harvesting have increased the speed and capacity of combine harvesters. As a result, **grain is harvested at a rate faster than it can be trucked off farm or sold to markets.**

To bridge this gap, farmers temporarily store harvested grain on their farms.

- **Historically, metal silos have been used.**
- **In recent years, however, farmers** (in Australian and internationally) **have turned to** more affordable, mobile, and convenient **plastic silo bags** – see Figure 1-2 earlier.

2.1.2 What are They and How are They Used?

Grain silo bags vary in size but **can be several meters in width, up to a hundred metres in length, and hold several hundred tonnes** (e.g., 200 to 300 t) **of grain** (see Figure 1-2 earlier).

- **Bag walls are made from multi-laminate** (or layer) polyethylene (**PE**) plastics **up to several hundred microns thick** (e.g., 0.2 to 0.3mm).
 - **There can be between 3 or 5 different (PE) layers in bag walls**, each designed to render different properties (e.g., colour, UV resistance, strength, etc.).
- **A bag's weight is usually greater than 120kg** (and can be up to 180kg for larger bags).
- **New bags are delivered in cardboard boxes** – see Figure 2-1 overleaf.
 - **The boxes cannot easily be lifted by hand** and mechanical assistance is needed.
 - **Farmers use specialised equipment to roll out and fill the bags** (at same time) with grain **and then empty them afterwards** (Figure 2-1).
 - **Some machines that empty** (or extract) the **bags** can **roll** and 'strap' **them** (with twine) into a **cylindrical bale** (Figure 2-1).

2.1.3 Where are They Made and Who Supplies them

There are multiple local suppliers (up to 10) of silo bags to grain farmers. Major ones operating in South Australia include (but are not limited to):

- Seed & Forage Bags Australia (<https://www.seedforagebags.com.au/>)
- Tama Australia (<https://www.tama-australia.com.au/grain-bags/ipesasilos/>)
- Silo Ag Bag (<https://www.silobagag.com/>)

One of the above suppliers could have up to 50% of the market in South Australia (but sales data was unavailable to confirm this).

Suppliers deliver bags direct to farm and/or via a network of local distributors (at townships in major grain growing regions across the State – see later).

There appears no local or Australian manufacturer of grain silo bags. All bags supplied to South Australian farmers are imported from overseas, mainly from China, Brazil, and Argentina.



Figure 2-1 – Examples of plastic silo bag waste supplied in box, being filled at a farm, being unloaded, and of waste plastic silo bag that has then been baled and secured with twine. Image sources: Tama Australia (<https://www.tama-australia.com.au/>), Grain Producers SA (<https://grainproducerssa.com.au/>), Silo Bag Grain (<https://www.silobaggrain.com.au/>) and Clean Farms (<https://cleanfarms.ca/materials/grain-bags/>).

2.1.4 Current Challenges for Farmer Disposal After Use

Waste grain silo bags are challenging for grain farmers to dispose of **because:**

- **They are a bulky and heavy waste** that is difficult to move or transport easily.
- **They contain contamination from grain and soil residue**, which requires cleaning before recycling or reuse.
- **They have likely been damaged during use**, including holes from farm vermin (e.g., rats), which make them unsuited for reuse.
- **They were designed for single use**, so not robust enough for reuse (unless re-designed).
- **The waste is generated on farms in regional areas**, where it is challenging and costly to transport to a recycling depot (which can be more than 100km away in some cases).
- **They cannot access existing industry plastic recycling supply chains** focussed on small item or consumer packaging waste, (e.g., container deposit, chemical drums).
- **Their multi-laminate design reduces their future recycling use and value.**
- **There are no local bag manufacturers in Australia that can ‘close-the-loop’**, so any local recycling of the waste material would need to be diverted to another and potentially lower value use.

2.2 Scale & Nature of Grain Silo Waste problem

2.2.1 Grain Production in SA

Grain silo bag usage (and thus waste) in South Australia depends on grain production (and its location).

- **Grain production varies from year to year** (PIRSA, March 2023) – see **Figure 2-2** below.
 - **Production has averaged 7.9 million tonnes (Mt)** the last decade (2013 to 2022).
 - During this period, **it has been as low as 5.8 Mt and as high as 11.2 Mt.**
- **Major production areas in the State** (as classified by Primary Industries and Resources SA or PIRSA) – see Figure 2-2 and Figure 2-3 overleaf – **are** (PIRSA, March 2023):
 - **Eyre Peninsula** (which can contribute 30 to 40% of the State’s production)
 - **Northern Regions** (20 to 40%)
 - **Yorke Peninsula** (15 to 25%)
 - **Murray Mallee** (7 to 14%)
 - **South-East** (4 to 12%)
 - **Central (or Adelaide) Hills, Fleurieu Peninsula and Kangaroo Island** (<2%)

South Australian Grain Production by Region from 2013 - 2022

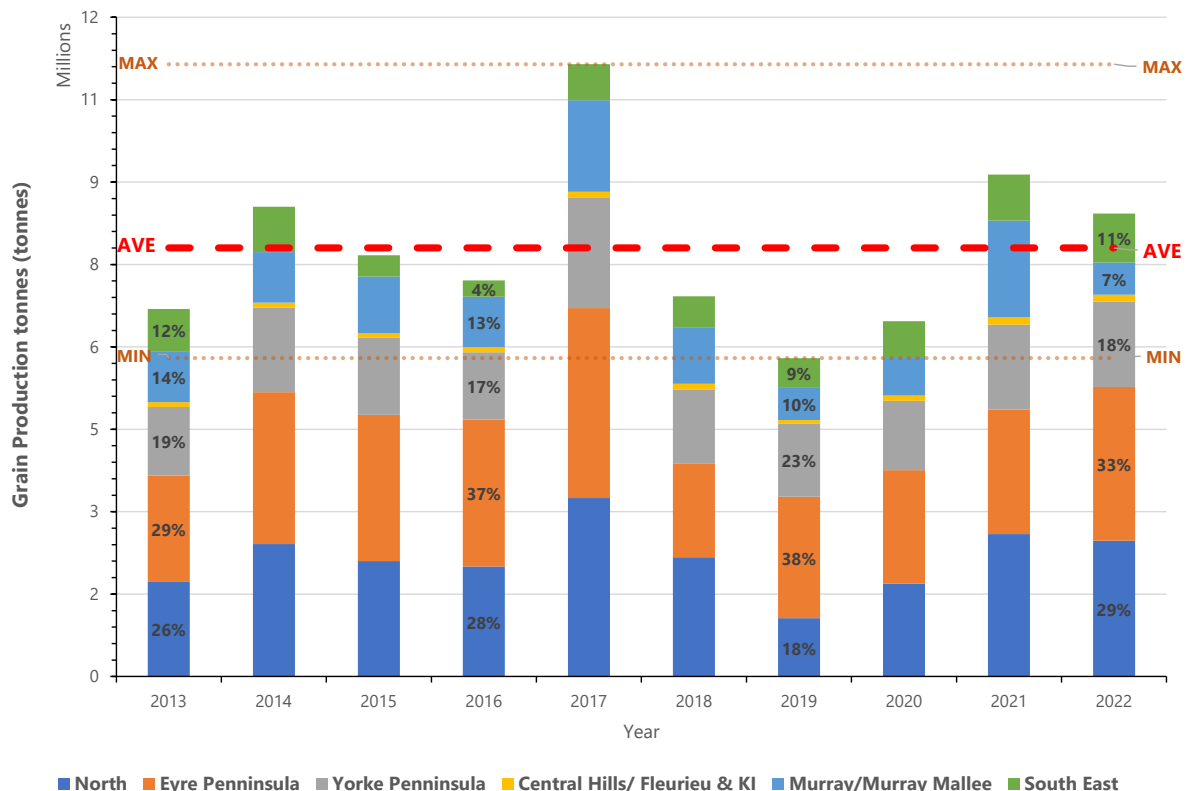


Figure 2-2 – South Australian Grain Production by Region from 2013 to 2022. Data Source: Primary Industries and Regions (PIRSA) (<https://www.pir.sa.gov.au/>)

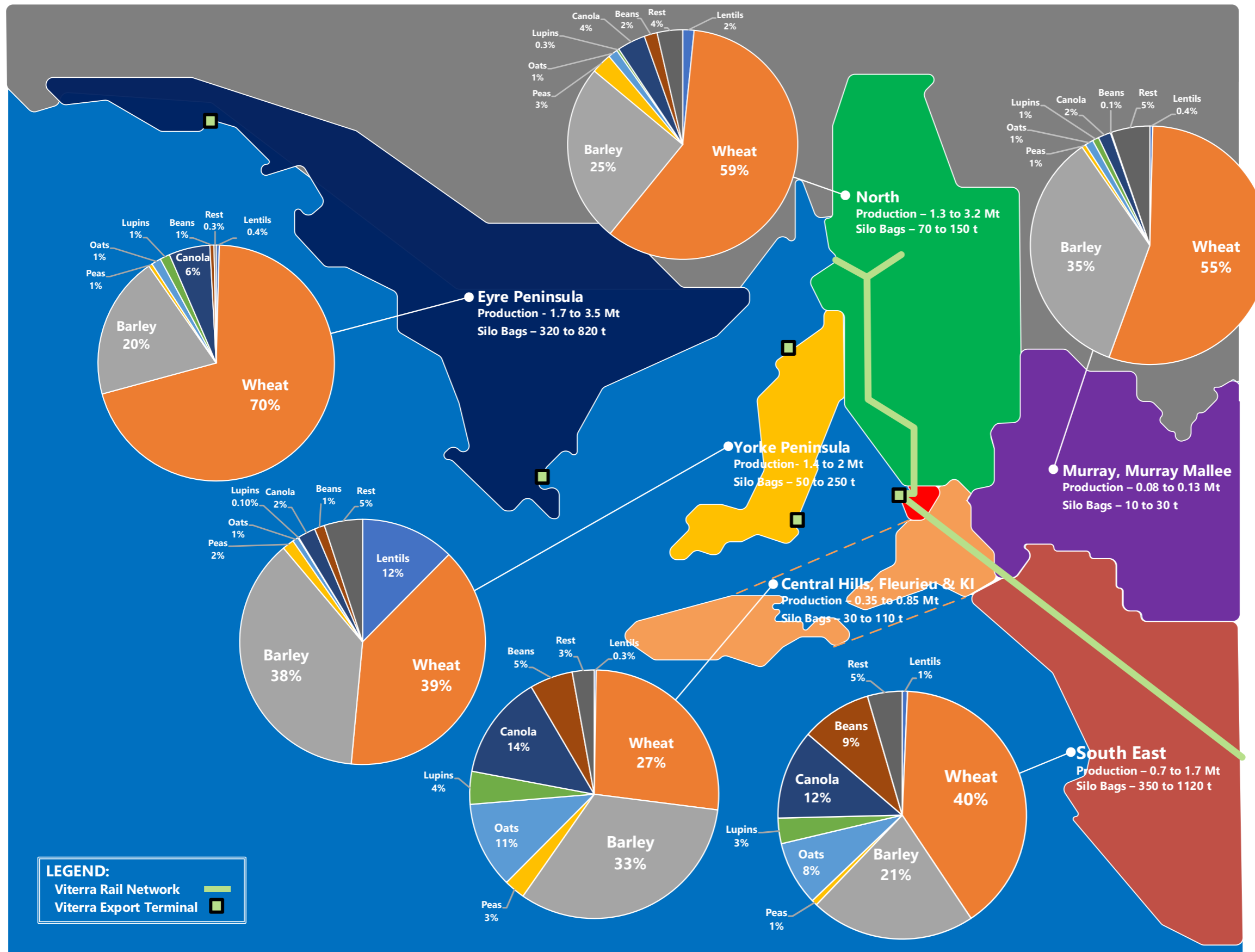


Figure 2-3 – South Australian Grain Production Regions, Grain Tonnage Range, Typical Grain Crops, Viterra Storage & Handling Network and Projected Silo Bag Usage Range (in tonnes) from 2013 to 2022. Data Sources: Primary Industries and Regions (PIRSA) (<https://www.pir.sa.gov.au/>), Viterra (<https://www.viterra.com.au/>), feedback from grain farmers and silo bag suppliers, and analysis by Colby Phillips Advisory.

2.2.2 Silo Bag Usage & Waste Generation

Figure 2-4 estimates silo bag usage as percentage (%) of grain production for the State’s different production regions between Low, Average and High Production Years⁵.

- **It can vary substantially between regions.**
 - For example, it could be higher on the Eyre Peninsula (up to 40 to 45% of harvested grain may be stored on-farm in plastic silo bags) and in Murray-Mallee (from 25 to 40%) than in Northern Regions (<10%) or on Yorke Peninsula, Fleurieu Peninsular and Kangaroo Island regions (<20%).
- **Differing levels of silo bag usage may arise from a grain farmer’s:**
 - **Proximity to grain handling transport and storage facilities**, which can vary between regions, e.g., see Viterra Storage & Handling Network illustrated in Figure 2-3, and
 - **Level and availability of own on-farm grain silo storage.**

{Cont. overleaf}

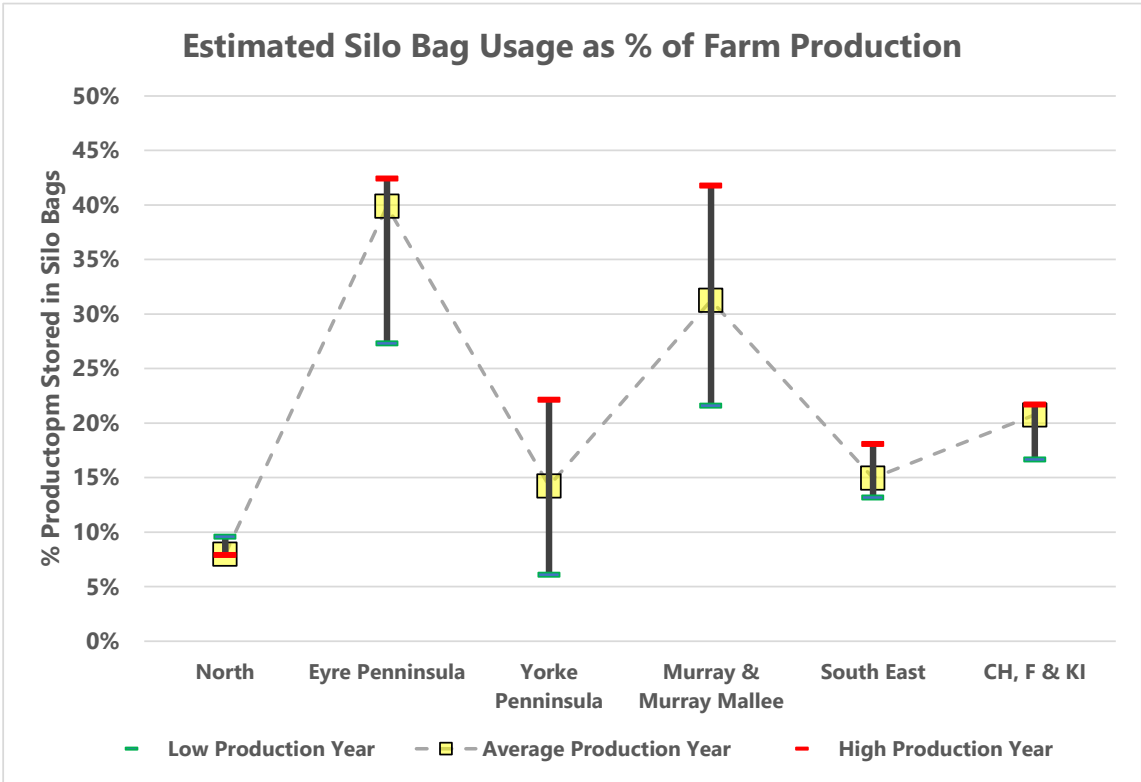


Figure 2-4 – Estimated Silo Bag Usage as percentage (%) Farm Production in Low, Average and High Production Year. Data Source: Feedback from grain farmers in different grain growing regions.

⁵ Based on feedback and data collected from grain farmers during stakeholder engagement.

Table 2-1 below projects silo bag usage in tonnes (of plastic bag material) for South Australia⁶.

- **Silo bag usage (and thus waste) could vary between 520 and 1,530 tonnes** (of plastic) per year.
 - This tonnage equates to about 3,500 to 10,200 silo bags (by number) per year.
- **The majority (>50%) of grain silo bag usage** (and waste) **is predicted to occur on the Eyre Peninsula.**

Table 2-1 – Estimated tonnage (plastic material) of Grain Silo Bag usage and (thus) Waste in South Australia by region. Data Source: Analysis by Colby Phillips Advisory based on silo bag usage from farmer engagement and grain production data from PIRSA.

Region	Silo Bag Usage (tonnes)		
	Low Production Year	Average Production Year	High Production Year
North	70	100 (10.3%)	140
Eyre Peninsula	310	560 (57.7%)	820
Yorke Peninsula	50	120 (12.4%)	250
Murray & Murray Mallee	10	20 (2.1%)	30
South-East	50	90 (9.3%)	180
Central Hills, Fleurieu Peninsula & KI	30	80 (8.2%)	110
TOTAL (State)	520	970 (100%)	1,530

2.2.3 How does this compare with other agricultural waste plastic data?

A recent assessment⁷ of agricultural non packaging plastic waste in Australia estimated volumes at up to 110,000 tonnes (RCMG, January 2022).

- This assessment also found that broadacre cropping – a category which includes production of grain crops (but also other crop) – may account for 14% of this waste plastic – or 15,000 tonnes.
- Land area for broadacre cropping in Australia is about 22 million hectares (DAFF, March 2023), which is 5.5× the land area of Grain Producer SA members.
- At face value, if the relationship between plastic use and area was linear, the waste plastic generation for Grain Producer SA members would be 2,700 tonnes.

⁶ By combining estimated bag usage data in Figure 2-4 with grain production data (from Section 2.2.1).

⁷ Reported by RCMG as part of a January 2022 update on the Australian Government’s National Agricultural Plastics Stewardship Scheme – see:

<https://www.rmcmg.com.au/app/uploads/2022/03/DAWE-NPSIF-ag-plastic-waste-update-Jan22-V4-Ir2.pdf>

- This value is more than 2.5× that estimated in Table 2-1 at around 1,000 tonnes for waste plastic silo bags alone.
- Potential explanations for the difference between these two values may be:
 - Other broadacre crops use and produce more plastic waste per crop area than grain production, which may be true, i.e.
 - Silage waste in Australia could be 8,000 tonnes⁸ alone, according to Dairy Australia (ABC, 27 December 2021), which is developing its own Plastic Recycling Scheme to collect and recycles 100% of silage wrap in the dairy industry by 2030⁹ (Dairy Australia, May 2023).
 - The area planted for these silage crops may be as low as 2 million hectares.
 - The uptake of grain silo bags in South Australia is greater than assumed in this Study.
 - There are other types of waste plastics from the industry supply chain included in the National Agricultural Plastics Stewardship Scheme estimate for broadacre cropping outside of waste plastic silo bags.

Considering all the above, we believe that the estimate of between 500 and 1,500 tonnes per year for waste plastic grain silo bags is a reasonable starting assumption.

- **However, further research and investigation may be needed** to obtain better numbers to confirm feasibility of potential Circular Economy pathways for this waste presented later in this report.

2.2.4 Silo Bag Waste Composition & Potential Recyclability

The plastic in silo bags is multi-laminate low density polyethylene (LDPE)¹⁰.

- **It is therefore single polymer, but each layer may have differing polymer PE density and additives** to provide desired bag properties, e.g.,
 - Light reflectivity,
 - Minimise light transmission,
 - Render UV resistance,
 - Low water vapour permeability,
 - Optimal properties (e.g., strength, elasticity, softness, puncture resistance), etc.
- Design and manufacturing data for silo bags is proprietary so detailed information was not available.
- **Some local recyclers have recycled LDPE grain silo bags in the past, and** there was confidence from them that they **could do so in the future and find markets for its recycle¹¹.**

⁸ See: [Albury plastic recycling company turns silage waste into farm products - ABC News](#)

⁹ See: <https://www.dairyaustralia.com.au/land-water-and-climate/environmental-programs/silage-plastic-recycling-scheme#.ZG7zBX1BwuV>

¹⁰ Confirmed by all local suppliers contacted.

¹¹ Based on feedback from local recyclers during stakeholder engagement.

- But **variable and mixed polymer density in different layers and additives too**, especially black colour, in the recovered PE recyclate (which was referred to as 'Panda'-type plastic'), **limits** product applications for **recycling**.
- **With no local manufacturers in Australia, there could be low prospect to 'close-the-loop'** by recycling it back into silo bags, **although** achieving **this is being considered by some** local bag suppliers owned by overseas companies that manufacture these bags.
- **It may therefore only suit locally available lower value recycling applications**, e.g., see Figure 2-5 below: black rubbish bags, building construction film, dark coloured hardware and garden products, dark coloured building products, etc.



(a)



(b)



(c)



(d)

Figure 2-5 – Examples of recycled plastic products (builders' film, garbage bags, garden root barrier, wood composite access ramp and stairs) that contain recycled PE in them.

Note: Some of these products have a percentage of recycled PE in them and may be mixed with other plastic polymers. Image Sources: Safari (<https://www.safarigroup.com.au/>), Glad (<https://www.glad.com.au/>), Bunnings (<https://www.bunnings.com.au/>) and APR Composites (<https://aprcomposites.com.au/>).

2.2.5 On-farm Presentation & Storage

Presentation of waste bags on farms can depend on type of bag emptying equipment or machine.

- **Some machines discard the empty bag in a crudely rolled format** which farmers cart around and stockpile, e.g., see Figure 2-6 below.
- **Newer machines are being introduced (but not yet widely used) can roll the bag as it is emptied and tie it as a cylindrical bale**, which keeps it compact and easier to cart, e.g., Figure 2-6.

The bags will often be aggregated or piled up together to be stored on the farm in a suitable location until disposal can happen.



(a)



(b)

Figure 2-6 – Photo examples of a pile of loosely rolled up waste silo bags vs. a machine rolled and baled waste bag.

2.2.6 Current Disposal Practices

No grain farmers in South Australia spoken to during stakeholder engagement were recycling their grain silo bags and local recyclers in South Australia said they were not receiving them at current time (although they had done in the past years, e.g., 10-15 years ago).

In general, the following practices were reported by farmers.

- **Waste bags were rolled up and being stockpiled on farms.**
 - Some farmers had access to new bag emptying machines to bale the bags.
- **Some were carting them to a local waste depot or landfill for disposal as rubbish.**
 - But some were holding on to them in event that a future recycling option became available, which was of genuine interest to them.
- While none of the farmers spoken too were doing so, there were some reports that other farmers may be burying the waste or even burning it on farm to dispose of it.

3 Why Recycle

3.1 Why are plastics a problem?

In recent years, plastics, and the waste they can cause, have received great public attention and the problems they cause are now well known.

- **Plastics don't breakdown in the environment – plastic litter** that ends up in the environment **can hurt** delicate **ecosystems and animals** and find its way into food supply chains as microplastics where it can **release potentially harmful chemicals**.
 - **Around 22 million tonnes of plastic waste could 'leak' into the environment every year**¹² (OECD, April 2023).
 - **An accumulation of these plastics in the Pacific** (see Figure 3-1 overleaf) could already cover an area of 1.6 million km² (The Ocean Cleanup, June 2023)¹³, **bigger than South Australia**.
 - **Plastic ingestion could kill an estimated 1 million marine birds and 100,000 marine animals** each year¹⁴.
 - **90% of birds and fish may already have plastic particles in their guts**¹⁴ (see Figure 3-1 overleaf).
 - **People could be eating 70,000 bits of microplastic each year**¹⁴.
- **Plastics are manufactured from fossil fuels – which can be environmentally damaging** and polluting **to obtain, require a lot of energy** to make, **and release** large amounts of CO₂ and other **greenhouse warming gasses**.
 - **About 8 to 10% of our total oil supply goes into making plastic**¹⁵, or **1.9L per kg of plastic**¹⁶.
 - **Plastics could generate nearly 2 billion tonnes CO₂-eq of greenhouse gas (GHG) emissions – 3.4% of global emissions – with 90% of these emissions coming from their production and conversion from fossil fuels**.

Many countries and governments around the world (including South Australia – see Section 3.2 later) are responding to these public concerns through plastic bans. But it may not be feasible to eliminate plastic in all uses. In these situations, correctly disposing of plastics and recycling them can help address these problems by substantially reducing environmental impacts, improving sustainability, and reducing emissions.

¹² See: <https://www.oecd.org/environment/plastics/increased-plastic-leakage-and-greenhouse-gas-emissions.htm>

¹³ See: <https://theoceancleanup.com/great-pacific-garbage-patch/>

¹⁴ See: <https://www.globalcitizen.org/en/content/effects-of-plastic-pollution-facts-you-should-know/>

¹⁵ See: <https://www.theguardian.com/sustainable-business/2016/jan/20/from-oil-use-to-ocean-pollution-five-facts-about-the-plastics-industry>

¹⁶ See: <https://globalrecycle.net/how-much-oil-does-it-take-to-make-1-kg-of-plastic/>



(a)



(b)

Figure 3-1 – Plastic waste in the ocean and plastic particles found in a fish. Image Sources: WWF Australia (<https://wwf.org.au/blogs/plastic-waste-and-climate-change-whats-the-connection/>) and National Geographic (<https://education.nationalgeographic.org/resource/great-pacific-garbage-patch/>)

3.2 Waste Plastics Policy and Regulation

3.2.1 Context

Australia and South Australia, like many countries or jurisdictions elsewhere, **have introduced a regulation and policy to reduce and manage plastic use and disposal.**

- These plastic waste relevant laws and policies at national and state level are summarised in Table 3-1 overleaf with their practical implications for grain farmers described below.
- Those most relevant to management of waste plastic silo bags are as follows.

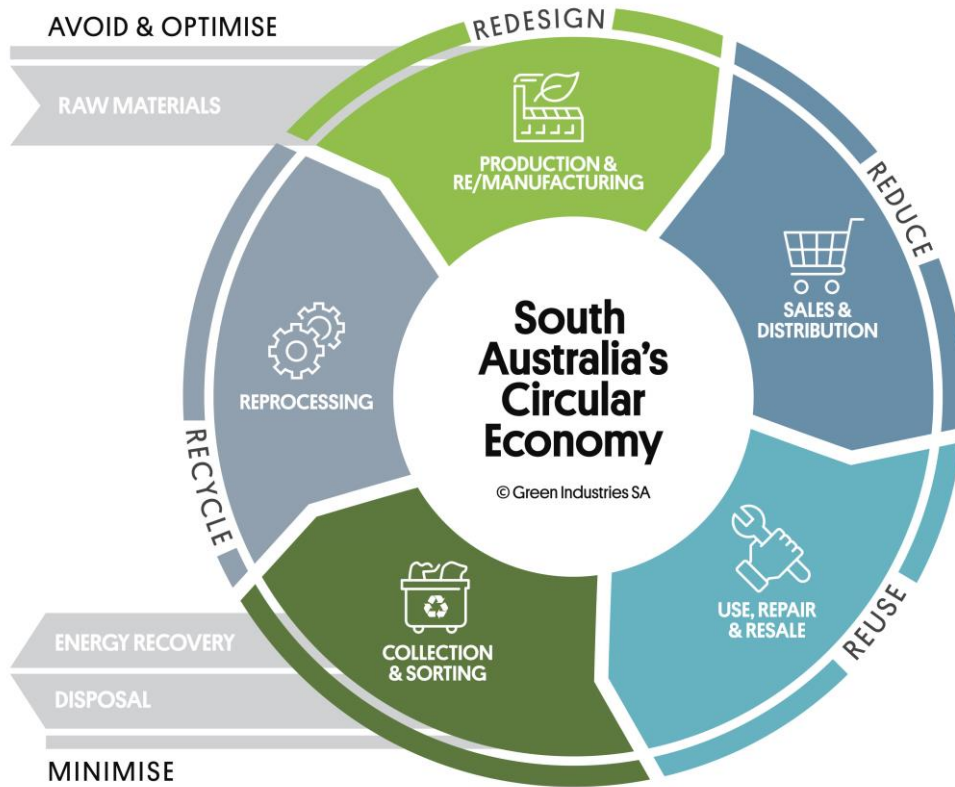
3.2.2 South Australia

South Australia has been a national and international leader in this area and has a range of waste plastic related laws and policies, which include:

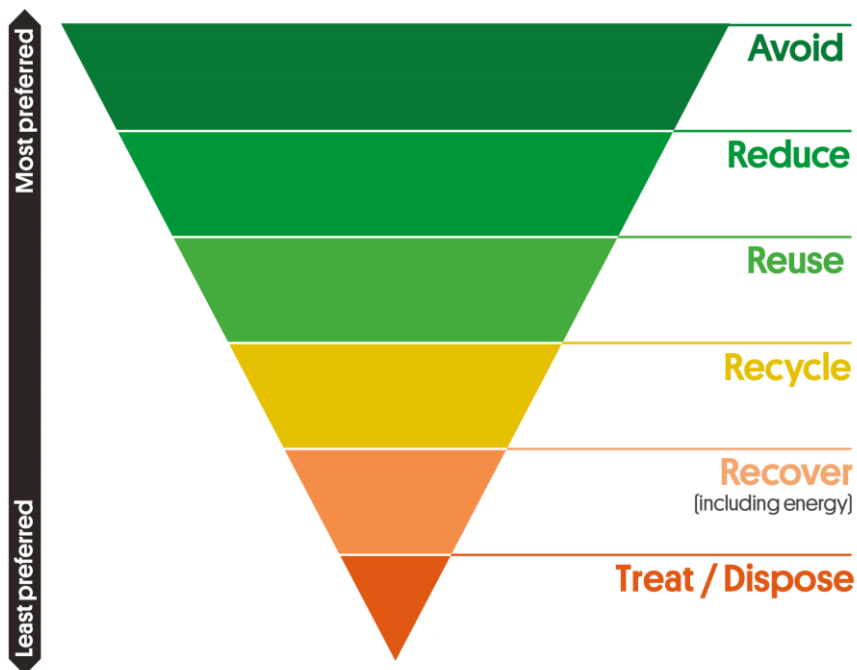
- **State Waste Strategy 2020-2025** (Green Industries SA, 2020) – that **adopts Circular Economy and Waste Hierarchy principles** (see Figure 3-2 two pages over) in Government policy and decision-making, **advocates restrictions and/or bans single use plastics, and encourages product stewardship** by industry and businesses.
- **Single-use and Other Plastic Products (Waste Avoidance) Act 2020** – already **bans a range of single use plastics items and might be extended to plastic waste silo bags** in the future if it deemed a waste problem by the Government.
- **Environment Protection Act 1993** – which **makes it a responsibility for grain farmers to manage their silo bag waste, so it does not cause environmental harm.**
- **Environment Protection (Waste to Resources) Policy 2010** – which **makes it illegal to dispose to unlicensed waste depots, dispose already aggregated and source separated plastic waste to landfill without resource recovery, incinerate waste** if not authorised, **or dispose waste to land if it causes an environmental nuisance or fire hazard.**

Table 3-1 – Snapshot of plastic related law or policy in Australia and South Australia.

Plastic Related Law or Policy	If and how it might affect grain farmers using and disposing of waste plastic silo bags.
SOUTH AUSTRALIA	
Single-use and Other Plastic Products (Waste Avoidance) Act 2020	Restricts and prohibits the manufacture, production, distribution, sale and supply of certain single-use and other plastic products. While silo bags are not covered presently, it could be expanded to ban their future use if they are not being managed responsibly by farmers.
Environment Protection (EP) Act 1993	Even though plastic silo bags are not mentioned, it includes a 'General Environmental Duty' that requires farmers to not do anything that can cause 'environmental harm'. It effectively creates a legal obligation to safely dispose of waste plastic silo bags and gives the Government powers to regulate to achieve this outcome if needed in future.
Environment Protection (Waste to Resources) Policy 2010	<p>This policy, enacted under the above EP Act, makes it illegal to:</p> <ul style="list-style-type: none"> • Dispose of waste to an unlicensed depot, • Incinerate waste if not authorised, or • Dispose waste to land if it causes an environmental nuisance or fire hazard. <p>It additionally creates the potential obligation to resource recover waste materials before landfill disposal where recycling options are available and feasible.</p>
Environment Protection (Used Packaging Materials) Policy 2012	This Policy implements the National Environment Protection (Used Packaging Materials) Measure 2011. It covers consumer packaging and retailers and brand owners' obligations for product stewardship of these materials. It is not relevant to non-packaging agricultural plastics.
Plastic Shopping Bags (Waste Avoidance) Act 2008	This Act only covers supply of single use shopping bags.
Green Industries SA Act 2004	This Act established Green Industries SA as an agency to advise the Government on waste management practices that eliminate waste disposal to landfill and promote resource recovery and adoption ecologically sustainable development by businesses and the South Australian community.
South Australia's Waste Strategy 2020-2025	This Strategy developed by Green Industries SA sets out the policy framework the South Australian Government follows. This framework includes adoption of Circular Economy Principles, the Waste Hierarchy, phasing out single use plastic products, and advocating extended producer responsibility across industry sectors for managing waste. It sets the agenda for new laws and policies that may directly impact how grain farmers manage waste plastic silo bags.
AUSTRALIA / NATIONAL	
Recycling and Waste Reduction Act 2020	Bans future export of unsorted and unprocessed waste plastics to help support local plastics resource recovery and processing for recycling. It will see more investment in local capacity which may make it easier for grain farmers to find a local recycler able to take this material. Provides for voluntary, co-regulatory and mandatory product stewardship schemes and has been used to develop a National Plastics plan, establish a National Product Stewardship Investment Fund, and set up a National Non-Packaging Agricultural Plastics Stewardship Scheme project and pilot.
Product Stewardship Act 2011	Now repealed by the Recycling and Waste Reduction Act 2020, previously used to set up product stewardship schemes, such for recycled oil, TVs and computers, tyres, (consumer) plastics and packaging, etc.
National Plastics Plan 2021	Has been developed as part of the National Waste Policy Action Plan and has set out actions to reduce plastics waste including through export bans, recycling investment, existing and new product stewardship schemes, national packaging targets, and selective government procurement practices
National Non-packaging Agricultural Plastics Stewardship scheme	The Australian Government is supporting RM Consulting Group Pty Ltd (RMCG) to develop a national non-packaging agricultural plastics stewardship scheme.
National Environment Protection Council Act 1994	Has seen the introduction of Product Stewardship Schemes by State and Territory Governments across Australia, including for used (plastic consumer) packaging as achieved through the National Environment Protection (Used Packaging Materials) Measure 2011



(a)



(b)

Figure 3-2 – The Circular Economy (a) and Waste Hierarchy (b) concepts for managing waste and avoiding waste generation and encouraging waste recovery at a resource’s highest utility (or value). Image Source(s): Green Industries SA (<https://www.greenindustries.sa.gov.au/>)

3.2.3 Australia / Nationally

Nationally, the Australian Government has progressed substantially in the five years towards developing policy and laws around managing plastic waste. The most relevant to grain farmers management of waste plastic silo bags are:

- **Australian Government’s Recycling and Waste Reduction Act 2020 – which bans exports of mixed and unsorted plastics** and will require investment in local plastics resource recovery, **which may make it easier for farmers to find a local recycler** able to take this material.
- **National Plastics Plan 2021** (DAWE, 2021) – **setting out actions to reduce plastics waste** including export bans, recycling investment, existing and new product stewardship schemes, national packaging targets, and selective government procurement practices.
- **National Non-Packaging Agricultural Plastics Stewardship Scheme project and pilot**¹⁷ – **which** was launched in 2021 and **could provide a pathway for disposal and recycling of SA grain farmer waste plastic silo bags.**



3.3 Existing or Future Product Stewardship schemes

The National **Non-Packaging Agricultural Plastics Stewardship Scheme** mentioned above is **one of several product stewardship schemes already being proposed to deal with agricultural plastic waste material.**

- Figure 3-2 overleaf lists and summarises these schemes.
- **The National Agricultural Plastics Stewardship Scheme is the only one presently accepting grain silo bags.**
 - **It has already been in contact with Grain Producers SA.**
 - **While there have been pilots, it is still being developed and yet to launch as a national scheme.**
 - **There could be a disposal cost to farmers of \$50 to \$200 / bag (based on reported collection cost range of \$300 to \$1,500 / tonne).**
- **But two other schemes (bagMUSTER, Dairy Australia) could be able to accept grain silo bags in the future.**
 - **Both have been in contract with Grain Producers SA too.**
 - **Both may be alternative partners.**

¹⁷ See: <https://www.dcceew.gov.au/sites/default/files/documents/recycling-non-packaging-agri-plastics.pdf>

Table 3-2 – Examples of existing Proposed Product Stewardship schemes for agricultural plastic waste

<p>NATIONAL AGRICULTURAL PLASTICS STEWARDSHIP SCHEME</p>	<ul style="list-style-type: none"> • Set up with - \$900k funding support from the Australian Government National Product Stewardship Investment Fund and being led by agricultural consultancy RMCg (http://www.rmccg.com.au/agplasticpilotvic/). • Two pilots undertaken: one in Queensland, the other in the Sunraysia / Loddon region of Victoria between May and October 2022, which accepted grape covers, irrigation tube and grain bags dropped off at depot. • Looking to develop nation-wide scheme involving plastics re-processors and industry groups. <ul style="list-style-type: none"> ○ Focused on PE-based plastics but silage wrap may not be included. ○ Volume of plastics to be captured could be tens-of-thousands of tonnes. ○ Have already spoken to Grain Producer SA about their participation. ○ Estimated cost at drop-off depot would be \$300 to \$1,500 / tonne. • For more information see: <ul style="list-style-type: none"> ○ https://www.dcceew.gov.au/sites/default/files/documents/recycling-non-packaging-agri-plastics.pdf ○ https://www.rmccg.com.au/agplasticpilotvic/
<p> Silage Plastic Recycling Scheme</p>	<ul style="list-style-type: none"> • Supported by Australian Government National Product Stewardship Investment Fund. • A trial was undertaken in Western Victoria with 90 farmers between April 2022 and March 2023. • Aims to develop a national product stewardship scheme with suppliers, plastics re-processors and farmers to dispose of silage plastic responsibly so it doesn't end up in landfill or being burned or buried. <ul style="list-style-type: none"> ○ The trial enabled farmers to drop off pre-packaged plastic waste to local collection centres for free. ○ The future scheme would target 8,000 tonnes per year of silage wrap waste produced nationally with on-farm collection fee based on NZ Plasback model. ○ Potential costs of scheme appear to be unclear or not known yet (but Plasback model collection fee was at least several hundred dollars per tonne cost to farmers). • For more information, see: https://www.dairyaustralia.com.au/westvic-dairy/land-water-and-climate/environmental-programs/silage-plastic-recycling-scheme
<p></p>	<ul style="list-style-type: none"> • Set-up by CropLife Australia with Australian Seed Federation and operated by AgSafe – which also administer and operate the drumMUSTER scheme. • Would target woven polypropylene (PP) bags and leverage existing drumMUSTER drop-off depots across Australia, collection agencies and plastics re-processors. • The scheme is scheduled to launch with a pilot in 2023. • Being designed as fee-for-service model for bag manufacturers and suppliers, so a minimal disposal fee to farmers (like drumMUSTER operates). • For more information, see: https://www.bagmuster.org.au/

3.4 Why act now?

Growing public awareness of problems with waste plastics and national and state laws and policies to control this problem have implications for how South Australian grain farmers manage their plastic silo bag waste.

- **There are potential legal risks, public perception issues and growing community and supply chain pressures** for grain farmers to properly manage disposal of this waste resource.
- **Especially now** that:
 - **The National Plastics Plan 2021** (DAWE, 2021) **has highlighted the issue** of non-packaging agricultural plastics.
 - **A National Non-Packaging Agricultural Plastics Stewardship scheme has been canvassed and is being developed.**
 - **State waste policy:**
 - **Aims to reduce or eliminate single-use plastics use items** in society, including restrictions on use and/or bans.
 - **Expects waste resources not to be disposed of to land fill and recovered in line with Circular Economy principles.**
 - **Encourage industry sectors to take product stewardship responsibility** for managing the waste they produce in their supply chains.
- **From a legal perspective:**
 - **Future stockpiling on land, burying it, or burning it (unless authorised) may be problematic depending on** South Australian Environment Protection Authority's **interpretation and enforcement** view of:
 - **Grain farmers' 'General Environmental Duty'** for managing this waste under the Environment Protection Act 1993, and
 - **Legality of existing disposal practices** under the Environment Protection (Waste to Resources) Policy 2010.
 - **Disposing without resource recovery may become illegal**, especially if stockpiling is seen as aggregating for resource recovery, under the Environment Protection (Waste to Resources) Policy 2010.
 - **Waste plastic silo bags are single use plastic items and** (as unlikely as it might be to happen), especially if seen as causing litter issues and not being recycled by grain farmers, **could be theoretically targeted for potential future bans** under the Single-use and Other Plastic Products (Waste Avoidance) Act 2020.

It could take time (e.g., several years) for grain farmers **to resolve, develop and implement a strategy** to better manage this waste issue. **It would therefore be important to start planning and laying the groundwork for a solution now**, so it is available on their timetable and does not become a costly knee-jerk reaction later (in response to a regulatory action and/or market pressures to ban use of waste plastic silo bags or non-recycling disposal practices by farmers).

4 Identified Recycling Scheme Pathways

4.1 Overview

Three different potential pathways for grain farmers in SA to recycle their waste plastic silo bags were identified. These are listed below, pictorialized in Figure 4-1 two pages over, further summarised in Table 4-1 (three pages over), and explained in succeeding sections.

Pathway 1 – Industry-wide drop-off & collection scheme

- This pathway proposes that South Australian grain farmers join a sector or industry-wide product stewardship scheme with same drop-off and collection approach as similar existing schemes, e.g., like bagMUSTER or currently proposed National Agricultural Plastics Stewardship Scheme.
- Farmers would drop waste bags at existing collection depots across South Australia and pay a disposal fee (up to \$250 per bag for farmers in remote regions) themselves at the depot gate.
- It has a low hurdle entry and (set-up) cost for South Australian grain farmers but may only achieve moderate farmer participation (e.g., 30 to 60%), have low visibility on Circular Economy / Product Stewardship performance outcomes, and could have the highest disposal cost to farmers.
- For more information, see Section 4.2 and a detailed pictorialisation in Figure 4-2 (on Page 36).

Pathway 2 – Producer led on-farm pick-up and recycler delivery scheme

- Grain farmers establish and manage their own stewardship scheme for bag waste with an annual or biannual pick-up service direct to farms (or supply depots) to maximise participation and diversion outcomes.
- The scheme could be paid for by levy collected by bag suppliers at point of sale, to avoid a disposal fee for farmers.
- To work successfully it would likely need to register for Australian Government Product Stewardship Accreditation with cooperation of bag suppliers and could be established at State (by Grain Producers SA) or National Level (by Grain Producers Australia) and obtain authorisation for the levy from the Australian Competition & Consumer Commission (ACCC).
- It could partner with an existing stewardship scheme operator to manage and operate the scheme.
- It could require substantial investment to set-up (e.g., \$300-\$600k) (which could be offset if grant funding was available) and an on-going management responsibility (which could be outsourced to existing stewardship scheme operator) and cost.
- As a sector endorsed and accredited scheme with bag supplier participation and levy included at point-of-sale it should have a higher farmer commitment (e.g., >60-75%), delivering better diversion and product stewardship outcomes.
- But it would come a cost, albeit slightly less than other Pathways, adding up to \$200 per bag.
- See Section 4.2.9 and a detailed pictorialisation in Figure 4-4 (on Page 46) for more information.

Pathway 3 – Bag supplier led used silo bag return scheme

- Bag suppliers fund their own bag return scheme as an option for grain farmers when they buy bags.
- They (ideally) manage collection and pick-up of bags from farm or supply depots at same time new bags are delivered, adding a fee to sale price to cover costs if this option is elected.
- Grain farmers do not have to get involved but Grain Producers SA could register and promote participating bag suppliers in return for data on bag sales and returns received for recycling to track performance.
- It has lowest set up cost to grain farmers but would likely have lowest farmer participation (e.g., < 50%) and not all bag suppliers may participate, and farmers may be more liable to opt out of electing the recycling option when they buy bags.
- Due to low collection volumes and fragmentation between different bag suppliers it could have the highest cost to farmers (unless subsidized by the bag suppliers, which would be unlikely).
- See Section 4.2.9 and a detailed pictorialisation in Figure 4-4 (on Page 46) for more information.

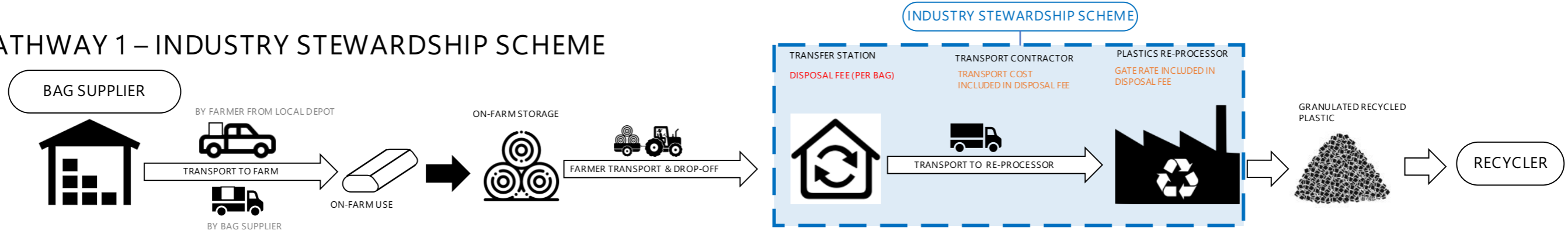
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Important Notes:

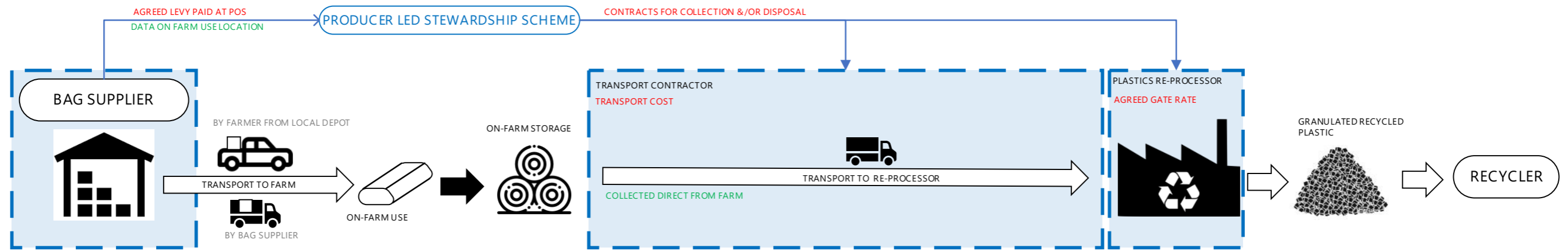
- *These pathways in Figure 4-1 represent differing approaches (or scheme perspectives) developed from stakeholder feedback, desktop research, and informed by observation and practical experience on how other such schemes operate elsewhere including in different industry sectors and/or other jurisdictions.*
- *They are designed to provide a reference frame for comparative discussion about how these differing approaches could work to achieve Grain Producer SA's member desired outcome for a recycling solution to waste grain silo bags.*
- *They are not the only approaches possible, however, and there could be hybrid options too where elements of each could be combined to achieve the best outcome for grain farmers.*
- *There are shared elements between the pathways, in how they might operate and how they were assessed.*
 - *These shared elements are introduced when describing Pathway 1 and (where appropriate) then annotated in presentation and discussion of Pathways 2 and 3.*
 - *The following section describing Pathway 1 is therefore necessarily longer than the succeeding sections for Pathways 2 and 3.*
- *Figure 4-1 and Table 4-1 includes estimates of:*
 - **Potential participation and diversion outcome** – *which were informed by expected scheme sector coverage and/or feedback from grain farmers on likely participation if the scheme cost was affordable.*
 - *Gaining more confidence on future participation and diversion outcome would require more extensive member-based survey work by Grain Producer SA.*
 - **Likely Scheme Cost** – *Based on assessment of expected costs for collection, transport, and re-processor gate rate.*
 - *Per request by Green Industries SA, Appendix 1 includes a summary of how the transport component of these scheme costs was estimated.*
 - **Greenhouse Gas Emission Savings** – *From assessment of emissions from collection and transport of bags for recycling and avoided emissions from replacing fossil fuel derived plastic material by recycling the waste grain silo bags (see Section 4.2.9.2 for more details on the methods used).*

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PATHWAY 1 – INDUSTRY STEWARDSHIP SCHEME



PATHWAY 2 – PRODUCER LED SCHEME



PATHWAY 3 – BAG SUPPLIER LED SCHEME

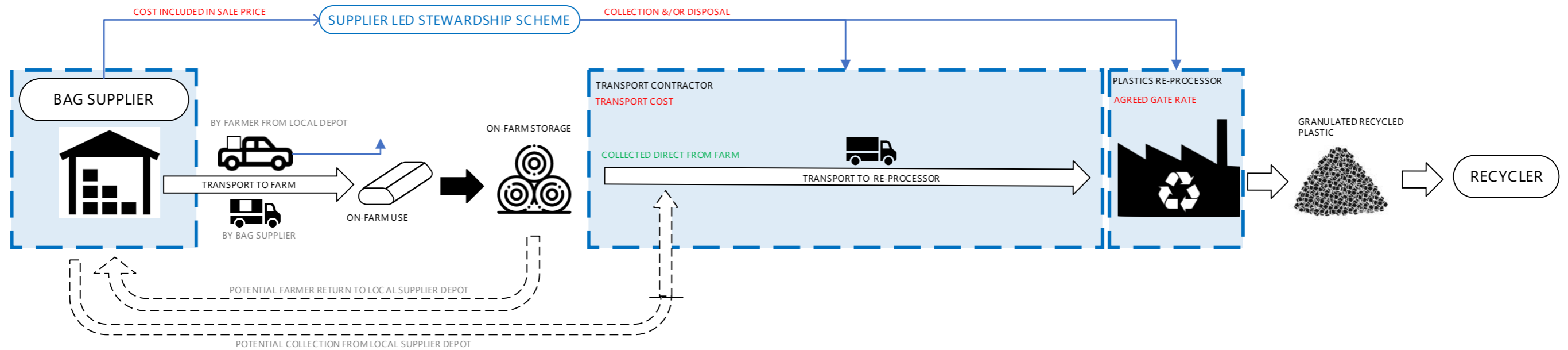


Figure 4-1 – Pictorial Overview of the three proposed Recycling Pathways for waste grain silo bags

Table 4-1 – Overview of three proposed Recycling Pathways: Operation, performance, cost, greenhouse gas emission impact / savings, set-up cost, and other attributes. Key scheme attributes are ranked, and colour coded (with Green = Better) to reflect perceived preference.

Recycling Option & Outcome	Pathway 1	Pathway 2	Pathway 3
Description	Industry-wide drop-off & collection scheme	Producer led on-farm pick-up and recycler delivery scheme	Bag supplier led used silo bag return scheme
Scheme Owner	Existing Scheme Owners, e.g., CropLife, RCMG, or Grain Producers SA or Grain Producers Australia	Grain Producers SA or Grain Producers Australia	Individual Bag Suppliers
Scheme Operator	Existing Scheme Operator (most likely), e.g., CropLife, RCMG, AgSafe	Can be outsourced to third party, e.g., AgSafe	
Likely Re-processor	Recycling Plastics Australia (Adelaide) Material received subject to planned investment by re-processor in new "washing & compaction" plant Gate Fee may start at +250 / tonne charge (cost) then transition towards a \$250 / tonne rebate (payment) once plant paid for and markets developed**		
Participation & Diversion Outcome Potential*	Moderate e.g., 30-60%	Higher e.g., 60-75+%	Lower e.g., < 50%
Scheme Cost - \$ / t plastic^	Dictated by Expected Participation		
	Highest e.g., \$390 to \$1,290	Lowest (not by much) e.g., \$220 to \$1,110	Higher e.g., \$460 to \$1,430
	Region/ Distance Dependent: More expensive further from Adelaide. Re-processor Gate Fee Dependent: Lower if rebate paid for material. Can be affected by bag use intensity in that Region: more bags per depot or farm for collection = cheaper.		
Cost to Farmer - \$ per Bag	Highest	Lowest (not by much)	Higher
• At Point of Sale (Levy applied or included in Sale Price)		e.g., \$50 to \$200	e.g., \$50 to \$300
• At Disposal Point (when dropped off at a collection depot)	e.g., \$60 to \$250		
Greenhouse Gas Emission Impact - t CO2-eq / year	Medium 1,000-1,900	Highest 1,900-2,500+	Lowest < 1,600
	Dictated by diversion level (or volume recycled), no substantial different in carbon saving intensity between options		
Grain Producer SA Management / Operating Burden	Lowest	Highest	Medium
Grain Producer SA Investment to set-up (estimated)	Medium \$100-200k Negotiate Entry to existing scheme.	Highest \$400 - \$600k More expensive to set up own scheme.	Lowest \$75 - \$150k Support Set-up & Promote Bag Suppliers.
Grant Opportunity to offset set-up cost?	Possible, e.g., GISA, National Product Stewardship Investment Fund		Unlikely
Grain Farmer Scheme Ownership / Commitment (Perceived)	Lowest	Highest	Medium
Performance Data Visibility Opportunity (Potential)	Lowest	Highest	Moderate

* These are high-level estimates informed by expected scheme sector coverage and/or feedback from grain farmers on likely participation if cost was perceived as affordable. What is a perceived affordable price in the future cannot be discerned at current time and may depend on future actions by Australian and State Governments to regulate plastic waste disposal. But if was, these might be the practical participation rates expected across the State.

^ Based on estimated costs for collection, transport, and assumed re-processor gate rate (to accept and recycle the waste bags).

** The transition from a gate fee to rebate is not guaranteed and may take several years to happen (e.g., between 3 and 8 years) and cannot necessarily be relied on to reduce possible cost to farmer.

4.2 Pathway 1 – Industry-wide drop-off & collection

4.2.1 Scheme Design & Operation

4.2.1.1 Scheme Operator (& Waste Scope)

There are two likely scope and management strategies for this type of industry-wide scheme.

(1) Waste Plastic Grain Silo Bags only & Managed by Third Party appointed by Grains Industry	<ul style="list-style-type: none"> Ideally established at national level by the grains industry, e.g., through Grain Producers Australia (like the Dairy Australia Silage Recycling Scheme), with third party operator appointed, like AgSafe was by CropLife for drumMUSTER.
(2) Agricultural Plastic Waste & Third Party Managed	<ul style="list-style-type: none"> Where grain farmers would participate in a third-party managed scheme with broader industry-wide mandate, like the National Non-Packaging Agricultural Plastics Stewardship scheme or bagMUSTER.

4.2.1.2 Scheme Operation

Key steps in scheme operation would be as follows (see pictorialisations in Figure 4-1 (earlier) and Figure 4-2 overleaf).

❖ Scheme Levy (if applicable)	<ul style="list-style-type: none"> If part of the Scheme, collected by Scheme Operator from participating bag suppliers under authorisation by the Australian Competition & Consumer Commission (ACCC) (For more information, see Authorisation ACCC).
❖ On-farm Baling & Storage – Farmers would bale their bag material	<ul style="list-style-type: none"> Farmers would bale their bag material after extraction / unloading and store it on-farm (ideally in a dry area). Not all existing silo bag unloading / extraction machines have in-built baling capability. but equipment can be retrofitted or operate next to them to provide this function, e.g., see Figure 4-3 two pages overleaf. <i>Note: There may be grant funding to support purchase of these machines by grain farmers.</i>
❖ Farmer Disposal – Farmers would take bags to regional drop off locations	<ul style="list-style-type: none"> These locations would be designated and contracted by the scheme operator for where bags could be accepted and stockpiled. The depot would charge a disposal fee paid to the scheme operator to cover the costs of the scheme (up and above any levy collected or bag supplier subsidy). Ideally, the scheme would leverage off existing collection depots across regional South Australia that perform similar function for other stewardship schemes or local councils, like already happens with drumMUSTER, e.g., see Figure 4-3 overleaf. However, not all collection depots may have the equipment to handle the bags. which could limit number of depots available.
❖ Collection & Transport – Transport contractors collect material and transport to plastics re-processor	<ul style="list-style-type: none"> These transport contractors would be paid by the scheme operator. There are transport operators operating across South Australia's regional area already that could be contracted to pick up and transport the baled silo bags.
❖ Plastics Re-processor(s) – Contracted by scheme operator to accept and re-process the material into recycle to sell the markets	<ul style="list-style-type: none"> This re-processor would charge a gate rate to accept the material or pay for it if recycle value justified. Adelaide already has plastics re-processor that has taken waste grain soil bags in the past and is looking to set up to take them again: Recycling Plastics Australia at Kilburn (see: https://www.rpau.com.au/). <ul style="list-style-type: none"> Its future capacity to take the material, however, is subject to planned capital investment in new high capacity washing unit and compactor. There are other plastics re-processors located interstate are setting up and might be able to accept the material (e.g., Sustainable Plastic Solutions, Pro-Pac Packaging) which could take the material too, but there could be substantial extra transport cost to send the waste material there.

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PATHWAY 1 - Industry-wide drop-off & collection scheme

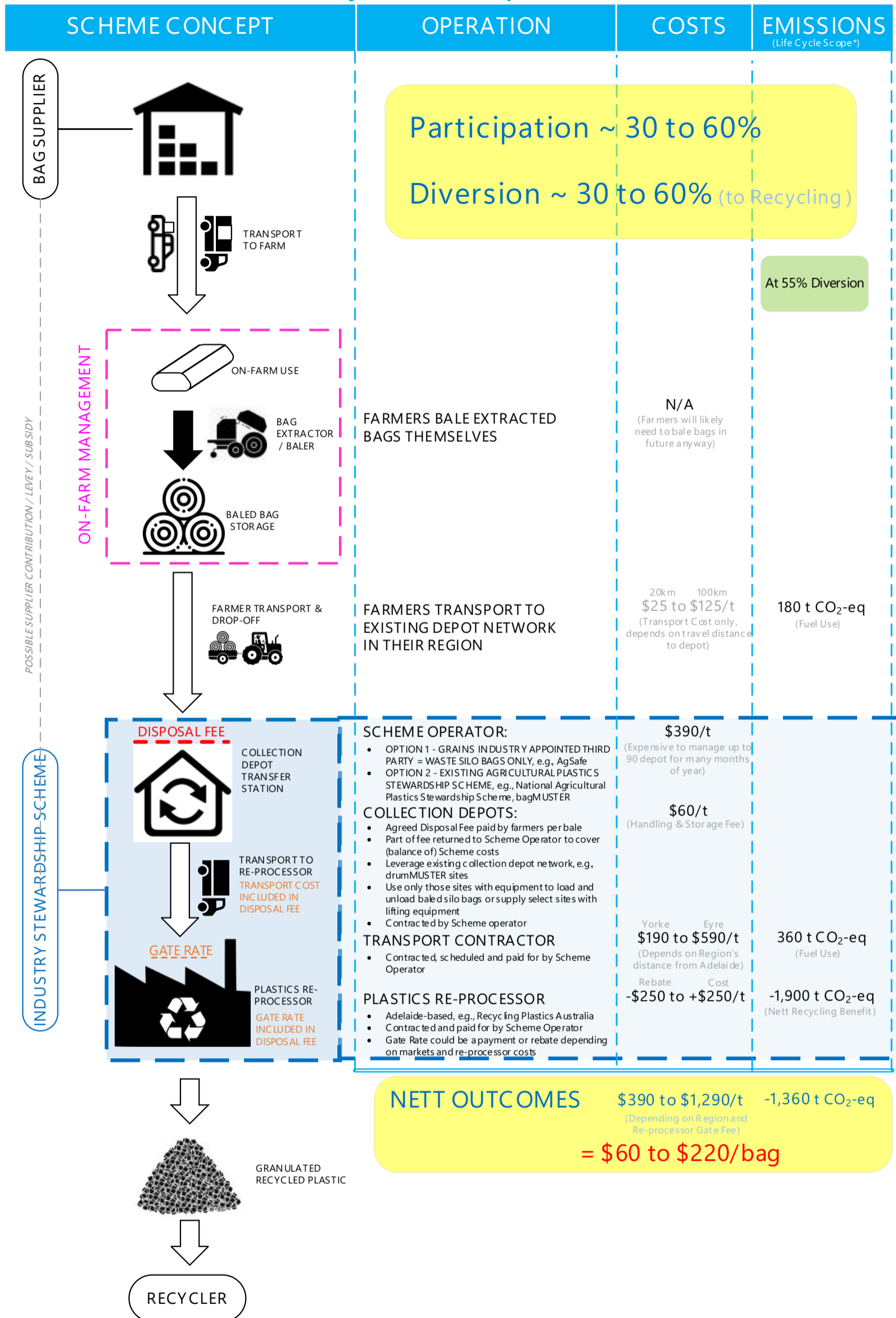


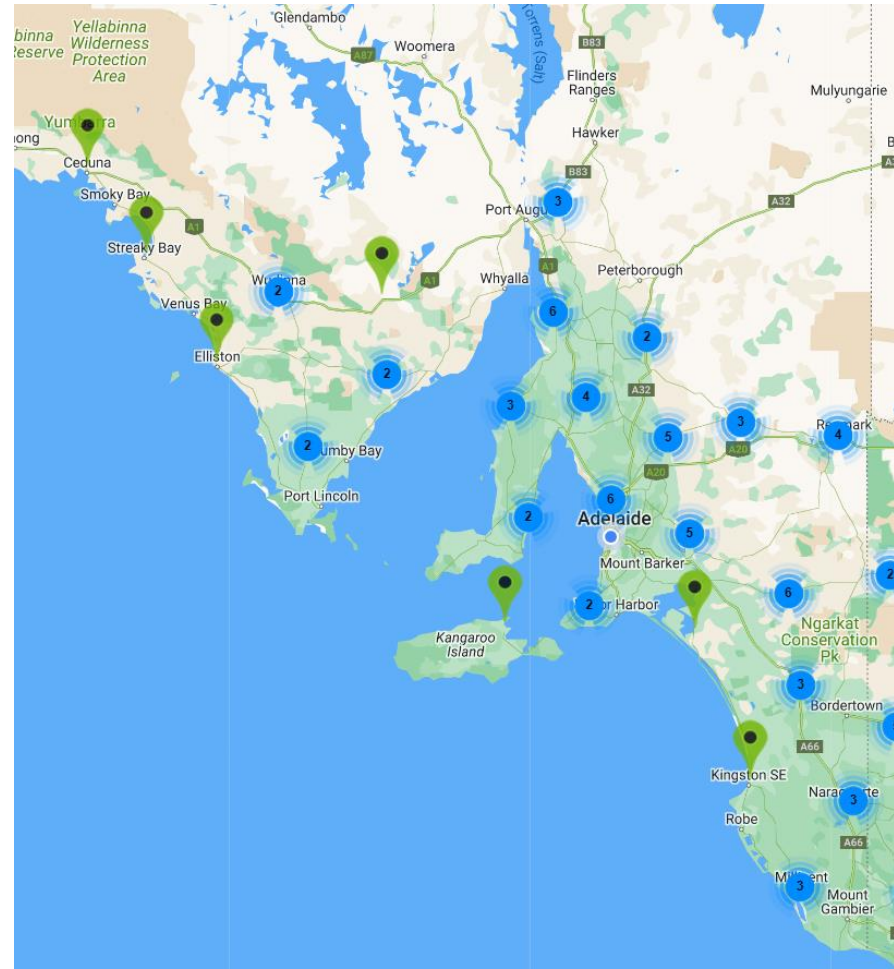
Figure 4-2 – Recycling Pathway 1 in more detail: Key Operational attributes, likely operating costs, and potential emission savings. Participation & diversion rates in Figure are a high-level estimate informed by expected scheme sector coverage and/or feedback from grain farmers on likely participation if cost was perceived as affordable. What is a perceived affordable price in the future cannot be discerned at current time and may depend on future actions by Australian and State Governments to regulate plastic waste disposal. But if was, these might the practical participation rates expected across the State.



(a)



(b)



(c)

Figure 4-3 – Bag baler that can be retro-fitted to a bag extractor / unloader (a), baled bag material secured with twine (before ejection), and map of South Australia showing location of drumMUSTER collection depots. Image Source(s): Loftness (<https://www.loftness.com/>) and drumMUSTER (<https://www.drummuster.org.au/>)

4.2.1.3 Scheme Operator Responsibilities

Under this pathway, the scheme operator would be responsible for the following.

❖ Scheme governance & administration	<ul style="list-style-type: none"> Existing scheme operator to include waste plastic silo bags, and if necessary, negotiate with bag suppliers to register stewardship of this material under the Recycling and Waste Reduction Act 2020. Governance and administration including regulatory, financial, other fiduciary and scheme performance reporting to stakeholders, including to grain farmers. Financial management of disposal fees, subsidies and/or levies collected and payments to scheme participants (depot operators, transport contractor(s), re-processor(s))
❖ Collection depot management	<ul style="list-style-type: none"> Designating suitable drop-off sites (at accessible locations). Supporting the depot operator with training (and potentially equipment if) necessary to handle the waste. Scheduling waste collections with the depot operator, Negotiating a handling fee for depot operator to be paid (e.g., for each waste item dropped off). Collecting and reporting data on waste bag volumes presented for disposal at scheme depots.
❖ Collection and Transport	<ul style="list-style-type: none"> Contracting a suitable and (EPA) licensed transport operator to pick up waste from collection depots (which may include more than one across a region) and take it to a designated re-processor, Negotiating and paying a suitable transport fee to the transport operator.
❖ Re-processing	<ul style="list-style-type: none"> Contracting a re-processor to accept and process the waste plastic into recycle. Negotiating and paying costs to (or receiving revenue from) the re-processor for accepting and processing the material. Report data on waste volumes re-processed and recovered for recycling.

4.2.2 Expected Scheme Performance

Projected scheme outcomes for participation and diversion are summarised below and in Table 4-2 two pages over.

4.2.2.1 Participation levels & Grain Farmer Commitment

We have assumed up to just over half (55%), or 2,500 grain farmers, might participate – but it could range from 30 to 60%.

- These existing schemes are voluntary so unless alternative disposal pathways for waste plastic are prohibited or become more expensive, it may be difficult to achieve high grain farmer participation and commitment.
- Not all farmers may elect to participate in this scheme:
 - If they don't have equipment load and transport bales to a collection depot.
 - The depot may be seen as too far away from their farm (e.g., > 50km).
 - There may be an alternative or more affordable disposal option available to them.
- Participation level may vary between regions depending on the above factors, e.g., it could be higher in regions where collection depots are more readily accessible or where closer to Adelaide and scheme disposal charges are lower (see Section 4.2.3 below).
- It could take several years for this level of participation to be reached after the scheme is launched.

4.2.2.2 Diversion outcomes

Based on above assumed participation, **the diversion outcome could be similar.**

- We estimate **it could reach up to 50 to 60%** (of the annual silo bag waste across the State), **or 510 tonnes / year** in an average year, but it could end up less (e.g., down to 30%) if participation is poor.
- **Diversion volume could wax and wane between higher and lower production years.**
- It may be higher if farmers not participating in the scheme still dispose to recycling (or waste-to-energy) options elsewhere (outside the scheme).

4.2.3 Scheme Costs

4.2.3.1 Projected Outcome

Table 4-2 includes an assessment of scheme costs. It suggests that **costs could vary from:**

- **As high as \$1,290 / t (or \$220 per bag) for the furthest region** (Eyre Peninsula) when the gate fee could be a \$250 / t charge at commencement of scheme.
 - This would equate to nearly 20% on the *ca.* \$1,000 price for a new silo bag.
- **To as low as \$320 / tonne (or \$60 / bag) for a closer region** (e.g., Yorke Peninsula) later in the scheme when a \$250 / t re-processor rebate may be achieved.
 - This would be closer to 5 to 10% of a new bag price (assuming \$1,000 again).

These estimated scheme costs are not too different to a cost range suggested by RCMG for delivering a future National Agricultural Product Stewardship scheme.

4.2.3.2 What these scheme costs include

These estimated scheme costs include the following.

❖ Collection depot handling fee	• Based on feedback from existing scheme and collection depot operators.
❖ Transport costs	• From different regions to Adelaide based on our own independent analysis of likely freight cost assuming a semi-trailer, expected travel distances for depot pick-up and return to Adelaide, and standard industry freight costs ¹⁸
❖ Re-processor gate fee	• Three different re-processor gate fee levels based on range provide by Recycling Plastics Australia: <ul style="list-style-type: none"> ○ Charge at \$250 / tonne (likely at commencement of scheme) ○ No fee or \$0 / tonne ○ Rebate at -\$250 / tonne (4 to 5 years down the track once scale and new equipment / capital investment by the re-processor is paid for)
❖ Scheme Operator Administration costs	• Which could be high due to need to manage up to 60 to 90 collection depots across the State, including training, collecting disposal fees and a nearly all-year round scheme management demand. • It could be possible that these potential costs are defrayed or lower for an existing scheme operator, but this would require much further engagement and discussion with them.

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¹⁸ As published by the Transport Industry Council for 2022-23 (August 2022)

Table 4-2 – Projected performance, cost, and emission reduction outcome for Pathway 1

PERFORMANCE & EMISSIONS:

Projected Diversion Participation Rate	2,470 farmers (55%)
Diversion (Average Year)	510 tonnes (52%)
SA Recycle Activity Review Recycling Benefit	430 t CO2-eq / year
Global Carbon Emission Saving	1,360 t CO2-eq / year
• Scope 1 (Gas Energy)	+270 t CO2-eq / year
• Scope 2 (Electricity)	-240 t CO2-eq / year
• Scope 3 (Upstream Energy Emissions)	+1,330 t CO2-eq / year

SCHEME COSTS:

Region	Collection Depot Handling Fee (\$/t)	Transport Cost (\$/t)	Re-processor Gate Rate (\$/t)			Scheme Operator Cost (\$/t)	TOTAL SCHEME COST (\$/t) by Re-processor Gate Rate			Farmer Transport Cost to Depot by Distance (exc. Labour)		
			Rebate	NIL	Cost		Rebate	NIL	Cost		20km	50km
North	\$60	\$240	-\$250	\$0	\$250	\$390	\$440	\$690	\$940	\$25	\$65	\$125
Eyre Peninsula		\$590					\$790	\$1,040	\$1,290			
Yorke Peninsula		\$190					\$390	\$640	\$890			
Murray & Murray Mallee		\$240					\$440	\$690	\$940			
South-East		\$240					\$440	\$690	\$940			
CH, F & KI		\$180					\$380	\$630	\$880			
TOTAL / AVE.		\$60					\$500	-\$250	\$0			
						Per Bag	\$119	\$162	\$204			

4.2.4 Who would pay scheme costs and where?

Scheme costs would be paid by farmers as disposal fees at collection depots when they drop of their bags.

- They would pay **directly out of their pocket, which could be a deterrent to participation** if it ends up being several hundred dollars for a load of baled bags.
- **These disposal fees could be reduced if a levy¹⁹ at point-of-sale or bag supplier subsidy was included in this scheme (but overall cost to farmers would still end up similar).**

4.2.5 Sharing scheme transport costs?

The major driver of scheme costs is transport from collection depot to re-processor. A decision may need to be made about how disposal fees are shared between farmers in different locations.

❖ Unsubsidized and location dependent	• Disposal fee is dependent on depot location and expected transport costs.
❖ Shared cost	• 'Socialised' as single cost shared by all grain farmers across the State.
❖ Partially Subsidised	• Where costs are still location dependent but further away regions are partially or cross subsidised to reduce their disposal cost.

4.2.6 Role of Bag Suppliers & Cost Offset Opportunity

4.2.6.1 How this might happen

There could be two scenarios for how bag suppliers play a role in this type of scheme.

(1) Bag Suppliers join the Stewardship Scheme & Subsidise Scheme Costs	• In this scenario, bag suppliers subsidise the scheme cost (100% or partially), through some type of levy or other payment (e.g., based on bag supplier and /or bag weight) which would likely be passed on in the sale price.
(2) Agricultural Plastic Waste & Third Party Managed	<ul style="list-style-type: none">• Where grain farmers would participate in one of the existing proposed schemes, like the National Non-Packaging Agricultural Plastics Stewardship scheme or bagMUSTER.• In such broader plastic waste stewardship scenario, it could be less likely for there to be bag supplier subsidy to offset the scheme cost for grain farmers.

4.2.6.2 Would it happen?

- **It could be difficult for this scheme to happen in practice unless all bag suppliers came to the table** voluntarily.
 - If bag suppliers did not participate voluntarily, an option could need to be establishing the scheme as a co-regulatory or mandatory product stewardship requirement under the Recycling and Waste Reduction Act 2020²⁰.

¹⁹ A levy may require authorisation from the Australian Competition & Consumer Commission (ACCC) (For more information, see [Authorisation | ACCC](#)).

²⁰ The Recycling and Waste Reduction Act 2020 provides for voluntary, co-regulatory and mandatory product stewardship schemes. Voluntary schemes can operate independently of Government or apply for accreditation. For more information, see [Product stewardship in Australia - DCCEEW](#).

- **A voluntary arrangement may not work** if scheme costs are not directly linked to disposal fees for their waste bags (and shared across other agricultural plastic waste).
 - **Without majority of bag suppliers committing** to equally contribute, it would be unlikely some would do individually, and it would probably end up that none did give the high potential cost impact on bag sale price.
 - **There could be potential issues to resolve over charges for differing bags sizes, weights, and /or material composition, which could act to delay or deter participation by bag suppliers.**
- **Even then, disposal costs per bag are relatively high, which may discourage grain farmers from supporting a scheme unless there was another driver (e.g., ban or tax in current practices).**

4.2.7 Cost Setting it Up and Running it for grain farmers?

There could be relatively low cost to grain farmers in setting up and delivering this pathway through existing proposed stewardship schemes (assuming these get off the ground and commence nationwide rollouts).

❖ Set-up Costs	<ul style="list-style-type: none"> • It would mainly require negotiation with an existing proposed scheme operator to take on waste grain silo bags (if they do not already) and extend their scheme to South Australia. • A budget of about \$100k to \$150k for Grain Producers SA to facilitate this outcome should be sufficient.
❖ On-going Operating Costs	<ul style="list-style-type: none"> • On-going operating burden for Grain Producers SA would be minimal as all administration, governance and operation would be handled by a third party. <ul style="list-style-type: none"> ○ However, there could be a high operating cost charged by the scheme operator, which would be passed onto grain farmers through the disposal fee(s). ○ Even if a levy is included, this cost will be the same as this cost would be incurred at point-of-sale even if disposal fee at a depot is less. • Grain Producers SA may then only interact with the scheme operator to obtain data on performance outcomes, to advocate on behalf of its members for scheme improvements, and / or help promote the scheme to members.

4.2.8 Could a Grant be obtained to offset costs?

It could be possible to obtain a grant to assist Grain Producers SA with setting up this Recycling Pathway. The following (at time of this report) may be available. *[Note: At time of this report, neither of these schemes were open.]* But if just tapping into an existing scheme (which may have already received a grant) the funding quantum maybe limited.

❖ Green Industries SA,	<ul style="list-style-type: none"> • E.g., Circular Economy Market Development Grant – where up to \$100k may be available (see: https://www.greenindustries.sa.gov.au/funding).
❖ Australian Government National Stewardship Investment Fund	<ul style="list-style-type: none"> • Which offers between \$300k and \$1M (see: https://www.dcceew.gov.au/environment/protection/waste/product-stewardship/national-product-stewardship-investment-fund)

4.2.9 Potential Impact on Greenhouse Gas Emissions

4.2.9.1 Projected Outcome

Table 4-2 includes two estimates of how this scheme could reduce greenhouse gas emissions by recycling waste silo bags based on different methods or scopes. *For simplicity of assessment, these estimates are based on a diversion outcome (of waste silo bags) for the scheme of 55%.*

1. Green Industries SA's assumed Recycling Benefit Emission Factor (EF)	<ul style="list-style-type: none"> • 430 t CO2-eq / year
2. When extra (upstream) emissions from oil and gas exploration and production are considered	<ul style="list-style-type: none"> • 1,360 t CO2-eq / year

The first estimate above provides a more localised Australian saving on emissions based on energy use avoided, whereas the second estimate includes the upstream emissions saved from avoiding oil and gas use in plastics manufacture.

4.2.9.2 How these projections were made

The emission factors for each of above estimates were obtained or derived as follows.

1. SA Recycle Activity Review Recycling Benefit Emission Factor (EF)	<ul style="list-style-type: none"> • This Emission Factor applied to recycling of LDPE is used by Green Industries SA to estimate environmental recycling benefits in its annual State-wide waste and recycling survey. • The emission factor is understood to be based on Life Cycle Analysis (LCA) for HDPE recycling in June 2010 by the NSW Department of Environment, Climate Change and Water NSW (NSW-DCCW, June 2010)
2. Proprietary Recycling Benefit EF	<ul style="list-style-type: none"> • This Emission Factor is still based on the LCA for HDPE recycling prepared by the NSW-DCCW but updated for more recent energy emission factors published by the Australian Government National Greenhouse Emission Reporting (Measurement Determination) 2008. • Additionally, we have included the 'upstream' Scope 3 from oil and gas exploration and production which are not included by the NSW-DCCW LCA but significantly add to emissions to manufacture virgin plastics, to illustrate the global climate change benefit of diverting of this waste to recycling.

4.2.10 Key Pros and Cons

Key pros and cons for Grain producers SA when considering this pathway are summarised below.

Pros	Cons
<ul style="list-style-type: none"> • Leveraging an existing proposed scheme would be easier and more affordable to set up with low on-going management burden and (financial) risk to Grain Producers SA's members. • Taps into already established network of collection depots across the State for farmers to dispose of waste material at (which they may already be using anyway) 	<ul style="list-style-type: none"> • Moderate farmer participation / commitment (estimated at 30-60%), diversion (similar), and emissions savings if scheme is voluntary. • Potentially significant cost farmers must pay themselves (+10-25% of new bag price), at disposal depot and/or in bag price. • Farmers will likely need to cart their bags from their farms to nearest collection depot. • Waste silo bag waste may end up mixed with other agricultural plastic in a shared agricultural sector scheme, which may reduce its future value and utility as recyclate (which may add to scheme cost). • May not include bag supplier commitment and formal participation unless scheme becomes co-regulatory. • Minimal visibility may be available on waste disposal and recycling achieved, diminishing opportunity to demonstrate product stewardship of this waste material.

4.3 Pathway 2 – Producer Led Scheme

4.3.1 Scheme Design & Operation

4.3.1.1 Scheme Operator (& Waste Scope)

The scope of this scheme would be to solely manage silo bag plastic waste in the most efficient and affordable manner with maximum recovery for recycling.

- This would ideally be achieved **by grain farmers establishing and managing their own stewardship scheme** for silo bag plastic waste and providing a pick-up service to farms (or return supply depots) to maximise participation and diversion outcomes.
- **The pathway is summarised** in more detail **by Figure 4-2** overleaf.

This scheme could be set up at:

❖ State level	• By Grain Producers SA on behalf of its members.
❖ National Level	• By Grain Producers Australia (https://www.grainproducers.com.au/) for all grain farmers across Australia.

The operation of the scheme could be outsourced under contract to a third-party operator (as has been done by CropLife to AgSafe for the drumMUSTER scheme).

- But there is no reason it could not be handled efficiently in-house by Grain Producers SA or Grain Producers Australia.

It could use a levy arrangement²¹ applied by bag suppliers at Point-of-Sale (POS) to collect money to pay for the scheme operation.

- For bag suppliers to participate, **a voluntary or co-regulatory stewardship scheme would likely need to be established** with them under the Recycling and Waste Reduction Act 2020.

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²¹ A levy may require authorisation from the Australian Competition & Consumer Commission (ACCC) (For more information, see [Authorisation | ACCC](#)).

PATHWAY 2 – Producer Led Scheme

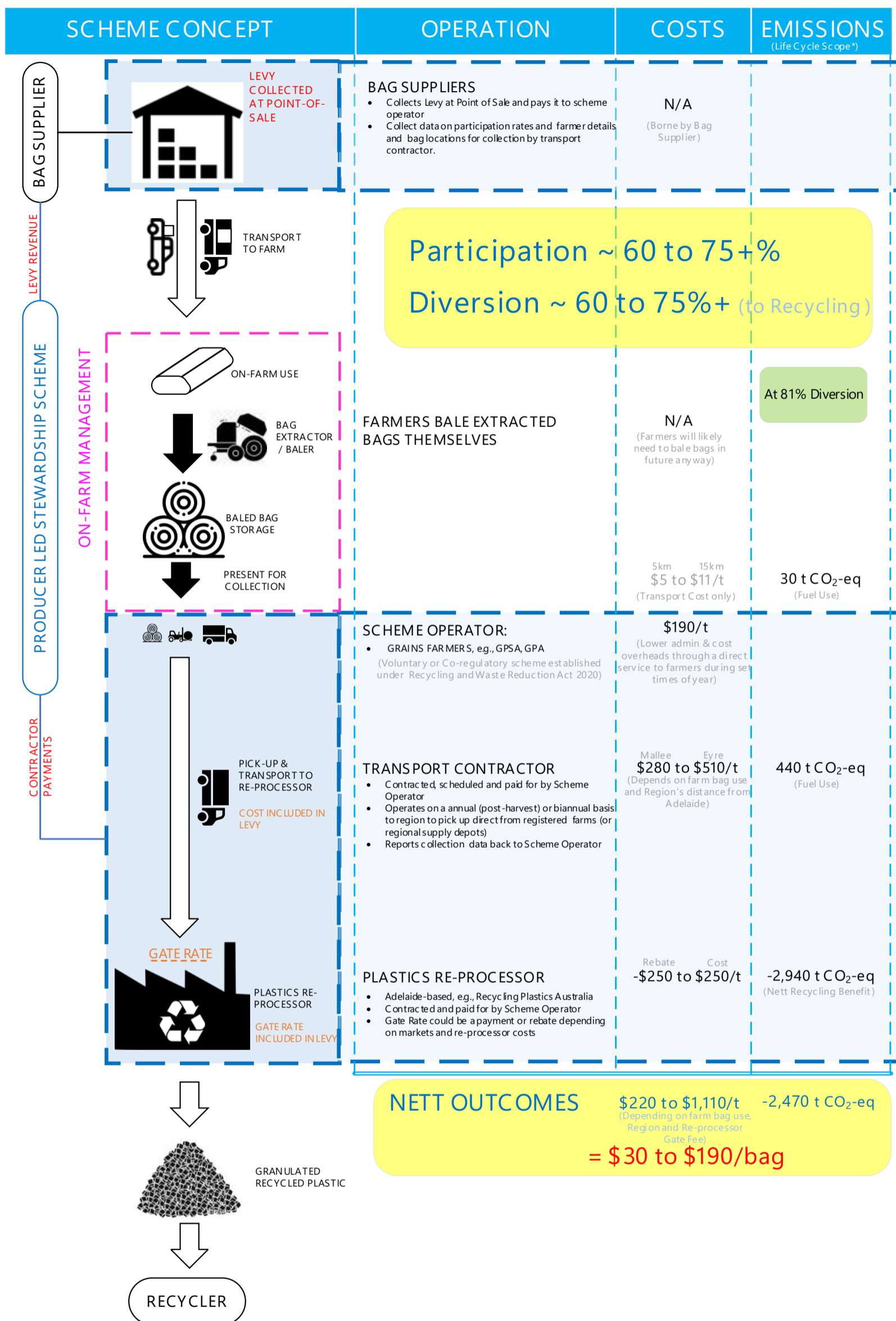


Figure 4-4 – Recycling Pathway 2 in more detail: Key Operational attributes, likely operating costs, and potential emission savings. Participation & diversion rates in Figure are a high-level estimate informed by expected scheme sector coverage and/or feedback from grain farmers on likely participation if cost was perceived as affordable. What is a perceived affordable price in the future cannot be discerned at current time and may depend on future actions by Australian and State Governments to regulate plastic waste disposal. But if was, these might the practical participation rates expected across the State.

4.3.1.2 Scheme Operation

Key steps in operation of this scheme option would be as follows (see pictorialisation in Figure 4-1 and Figure 4-2). Some of these steps and their details are like those that described in Pathway 1 so for brevity are annotated here.

❖ Bag Supplier Participation & Levy	<ul style="list-style-type: none">• Bag suppliers would participate voluntarily or under a co-regulatory model to collect:<ul style="list-style-type: none">○ An agreed levy at POS to cover scheme costs, and○ Data on farmers buying bags, including farm location and contact details to be provided for collection pick-up.
❖ Scheme Operator	<ul style="list-style-type: none">• Would receive levy and use it to pay collection and transport contractor and re-processor for their costs.• The scheme would organise pick-ups a couple of time per year and be able to direct the collection and transport contractor to farms where waste bags are located across the date in the most logistically efficient manner.
❖ On-farm Baling & Storage	<ul style="list-style-type: none">• Farmers would bale their bag material after extraction / unloading and store it on-farm (ideally in a dry area).• They would ensure that details provided at POS for collection are accurate and be available when notified of their collection date and time to bring the bales to the property roadside and help load it onto the truck.• They would be responsible for ensuring it was presented in suitable condition.
❖ Collection & Transport	<ul style="list-style-type: none">• Transport contractors paid by the scheme operator would pick up and collect waste bags direct from farmers and transport to designated plastics re-processor.• As mentioned above, they would be activated only a couple of times per year and may operate for several weeks to travel across the State to visit farms and pick up the waste silo bags.
❖ Plastics Re-processor(s)	<ul style="list-style-type: none">• Would be contracted by scheme operator to accept and re-process the material into recyclate to sell the markets, usually charging a gate rate to accept it or paying for the material if recyclate value justified it.

The ideal outcome from this scheme is that the levy collected should match the operating costs of the scheme.

- **However, scheme costs may vary from year-to-year** and this mismatch (and risk) would need to be managed by the scheme operator.
- **This risk could be managed by being flexible in how much waste is picked up** each year and if there is not enough money leaving some material and picking it up the next year.

4.3.1.3 Scheme Operator Responsibilities

Reiterating the above, the scheme operator would be responsible for the following.

❖ Scheme governance & administration	<ul style="list-style-type: none">• Negotiate with bag suppliers to establish and register a product stewardship scheme for waste plastic silo bags (under the Recycling and Waste Reduction Act 2020).• Governance and administration including regulatory, financial, other fiduciary and scheme performance reporting to stakeholders, including to grain farmers, bag suppliers and Australian Government.• Financial management of levies collected by suppliers at POS, collection and management of farmer bag location data, scheduling of farm (or supplier depot) collections, and payments to scheme participants (transport contractor(s), re-processor(s))
❖ Levy collection	<ul style="list-style-type: none">• Determining the required levy to support the scheme's operation.• Obtaining authorisation for the levy from the Australian Competition Consumer Commission²².• Notifying the bag suppliers of the levy to be charged at POS.• Collection of levy and management of these monies.
❖ Collection and Transport	<ul style="list-style-type: none">• Contracting a suitable and (EPA) licensed transport operator (if required)²³ to pick up waste from farms (or supplier depots(s)) (which may include more than one across a region) and take it to a designated re-processor,• Negotiating and paying a suitable transport fee to the transport operator.• Collecting the POS data from bag suppliers, managing it in a database, and using it to plan and schedule the collections by the transport contractor.• Collecting the transport collection data to evaluate scheme performance and logistics.
❖ Re-processing	<ul style="list-style-type: none">• Contracting a re-processor to accept and process the waste plastic into recycle.• Negotiating and paying costs to (or receiving revenue from) the re-processor for accepting and processing the material.• Collection and reporting data on waste volumes re-processed and recovered for recycling.

²² For more information, see [Authorisation | ACCC](#)

²³ See: [Waste tracking for waste transporters | EPA](#)

4.3.2 Expected Scheme Performance

Projected scheme outcomes for participation and diversion are summarised below and in Table 4-3 overleaf.

4.3.2.1 Participation levels & Grain Farmer Commitment

We would expect much greater and wider grain farmer participation in this type of scheme – as high as 75+%.

- **It would be run by the grains farming sector for Grain Producer SA members** and include up-front agreement **with bag suppliers** to participate, mandated **within an Australian Government endorsed** voluntary or co-regulatory **product stewardship framework**.
- **Waste bags would be collected direct from farms** (or nearby supply depots), reducing the burden on farmers to cart it many km to a regional collection depot and offload it.
- Even though scheme cost would be passed on in the bag price at POS, **farmers would not have to pay disposal fees directly themselves**.
- **It could be the lowest cost recycling pathway** for grain farmers and best alternative if current alternative (non-recycling) disposal methods become unviable in the future.
- Once launched, **it should be more likely to have more rapid uptake** from grain farmers than other recycling disposal pathways.

4.3.2.2 Diversion outcomes

Based on the above assumed participation, the diversion could be similar.

- **We estimate it could reach up to 80+%** (of the annual silo bag waste across the State), **or 790 tonnes / year** in an average year.
- **It may not reach 100% due to leakage as some farmer may avoid buying levy-liable bags or still use an alternative disposal pathway.**

4.3.3 Scheme Costs

4.3.3.1 Projected Outcome

Table 4-3 includes assessment of scheme costs.

- **We estimate that scheme costs could vary from \$260 / tonne (\$30 / bag) to \$1,110 / tonne (\$190 / bag) depending on farmer location and re-processor gate fee.**

It avoids a collection depot handling fee, has an expected lower management cost to run, but it potentially has higher transport costs as stopping off and picking up from individual farms will involve longer collection travel times for transport contractors.

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Table 4-3 – Projected performance, cost, and emission reduction outcome for Pathway 2

PERFORMANCE & EMISSIONS:

Projected Diversion Participation Rate	3,790 farmers (84%)
Diversion (Average Year)	790 tonnes (81%)
SA Recycle Activity Review Recycling Benefit	670 t CO2-eq / year
Global Carbon Emission Saving	2,470 t CO2-eq / year
• Scope 1 (Gas Energy)	+510 t CO2-eq / year
• Scope 2 (Electricity)	-380 t CO2-eq / year
• Scope 3 (Upstream Energy Emissions)	+2,340 t CO2-eq / year

SCHEME COSTS:

Region	Collection Handling Fee (\$/t)	Transport Cost (\$/t)	Re-processor Gate Rate (\$/t)			Scheme Operator Cost (\$/t)	TOTAL SCHEME COST (\$/t) by Re-processor Gate Rate			Farmer Transport Cost to an On-Farm or Agreed Roadside Collection Point (exc. Labour)			
			Rebate	NIL	Cost		Rebate	NIL	Cost		5km	7.5km	15km
North	NIL	\$320	-\$250	\$0	\$250	\$190	\$260	\$510	\$760	+	\$4	\$6	\$11
Eyre Peninsula		\$670					\$610	\$860	\$1,110				
Yorke Peninsula		\$320					\$260	\$510	\$760				
Murray & Murray Mallee		\$280					\$220	\$470	\$720				
South-East		\$370					\$310	\$560	\$810				
CH, F & KI		\$360					\$300	\$550	\$800				
TOTAL / AVE.		NIL					\$620	-\$250	\$0				
						Per Bag	\$95	\$138	\$180				

4.3.3.2 What these scheme costs include

The estimated scheme cost includes the same components as assessed in Pathway 1 (see Section 4.2.3.2) but re-estimated for this new pathway.

- As already mentioned, Pathway 2 has a different cost structure:
 - Zero collection depot handling fee,
 - Expected lower management cost to run,
 - Higher transport costs for stopping off and picking up from individual farms.
- There was no change to re-processor gate fee assumed.
 - However, a dedicated scheme for waste plastic silo bags should generate a better-quality feedstock for the re-processor, which may achieve a lower gate fee more quickly, reducing recycling cost to grain farmers.

4.3.4 Who would pay scheme costs and where?

In this pathway, the **scheme costs would be paid by farmer through an industry levy applied at point of sale (POS) for silo bags.**

- **This cost would be built into the sale price as a levy** or added sale cost component.
- **It could vary between bag suppliers and product** depending on weight of plastic material, and possibly, potential recyclate value – and a formula would need to be agreed in advance with bag suppliers and scheme operator that could be applied across the sector.
 - **This feature** of the scheme **may incentivise bag suppliers to re-design their products** to reduce weight and cost or improve its recyclability (or even allow potential reuse if appropriate and suitable).
- **Bag suppliers would** be obliged to **report bag product sales and pay collected levies** to the scheme operator to cover the scheme costs.
- **The levy may need to be adjusted periodically (e.g., every 3-5 years)** to reflect changes in scheme operating costs and volumes of waste material being generated.

4.3.5 Sharing scheme transport costs?

Pathway 2 would share the same issue of significant transport cost differential between regions as Pathway 1.

- **It would likewise need to consider the same options as outlined for Pathway 1** in Section 4.2.5 **for assigning these costs** between grain farmers.
- **There may be value in looking at utilising collection depots in some regions where farmers can drop off waste bags if this lessens this scheme's transport costs.**
 - **But this refinement may add to scheme management costs**, so could be 'swings and roundabouts' for the total scheme cost.

4.3.6 Role of Bag Suppliers & Cost Offset Opportunity

Bag suppliers would join the product stewardship scheme **under a voluntary or co-regulatory model established through the Australian Government Recycling and Waste Reduction Act 2020.**

- **This arrangement would be essential to ensure success of the scheme** given the price impact of the scheme cost and required levy on bag price to fully offset this cost.
- **Otherwise, there could leakage** through reduced farmer and/or bag supplier participation (and the scheme could fail).

4.3.7 Cost Setting it Up and Running it?

There should be relatively low cost to grain farmers in setting up this pathway through an existing stewardship scheme. But it could take several years to establish and roll-out.

❖ Set-up Costs	<ul style="list-style-type: none">• There could be a substantial cost in setting up this scheme, e.g., \$400k to \$600k.• This cost may include:<ul style="list-style-type: none">○ Australian Government Engagement – To investigate and confirm that a scheme could be registered.○ Policy paper – To outline how the scheme would be established, operate and cost, to be shared with key stakeholders.○ Stakeholder engagement - With grain farmers and bag suppliers○ Bag Supplier agreement – On the product stewardship model and commitment to levy arrangements.○ Third Party operator engagement – If one is to be used.○ Pilot – Conducted with selected farmers to demonstrate the scheme.○ State-wide roll-out – Of the scheme.• There could be considerable investment of time and other in-kind resourcing by Grain Producers SA (or Grain Producers Australia if national scheme).
❖ On-going Operating Costs	<ul style="list-style-type: none">• There would be higher on-going operating responsibility for (or Grain Producers Australia if national scheme).• Our cost assessment allows \$190/t or about \$150k / year (for average year waste volume), which assumed 0.75FTE of resourcing (at State Level), which could be shared with other programs.<ul style="list-style-type: none">○ A third-party operator may be more expensive than running the scheme in-house.

4.3.8 Could a Grant be obtained to offset costs?

The same grant schemes as mentioned in Pathway 1 (viz. Section 4.2.8) could be available (i.e., Green Industries SA Circular Economy grant, Australian National Product Stewardship Investment Fund). **They could offset the cost of setting up to the scheme.**

- However, it may potentially be harder to secure Australian National Product Stewardship Investment Fund grant as they have already substantially invested in the National Non-Packaging Agricultural Plastics Stewardship Scheme.
- It would therefore be necessary for the grains industry to demonstrate why they require a separate scheme to manage their silo bag waste, e.g.
 - It is heavier and bulky waste not suited to collection depot drop-off.

- It is a much cleaner waste material and separate management would maximise its financial and technical utility as recycle for a Circular Economy.

4.3.9 Potential Impact on Greenhouse Gas Emissions

Table 4-3 includes two estimates of how this scheme could reduce greenhouse gas emissions by recycling waste silo bags (assuming diversion rate of 81%). These two estimates are based on the same Emission Factor scopes introduced for Pathway 1 (viz. Section 4.2.9).

❖ Green Industries SA's assumed Recycling Benefit Emission Factor (EF)	• 670 t CO2-eq / year
❖ When extra (upstream) emissions from oil and gas exploration and production are considered	• 2,470 t CO2-eq / year

It should be noted that the carbon saving difference between Pathway 1 and 2 is largely driven by the extra diversion achieved by Pathway 2 – the carbon saving intensity of both pathways are not too different and dominated by the recycling benefit (over transport emissions).

4.3.10 Opportunity for 'Shared' New Silo Bag Procurement

Separate set-up of a dedicated waste grain silo bag scheme could open the door to Grain Producers SA (or Grain Producers Australia if scheme is nationalised) to consider an opportunity of 'bulk' procuring grain bags for their members if this initiative achieved the following.

❖ 'Bulk' procurement cost saving	<ul style="list-style-type: none"> • To grain farmers of buying these bags individually, and which could be used to support extra costs bag return and recycling. • It could generate a commission and revenue to Grain Producers too.
❖ 'Scheme' simplification and cost reduction	<ul style="list-style-type: none"> • Only managing with waste silo bags from one or two suppliers could have substantial sustainability benefits and recycling cost reduction, e.g., <ul style="list-style-type: none"> ○ Bag suppliers could pick up and return baled waste bags when delivering new bags direct to suppliers or farmers (like suggested in Pathway 3 below) – which may significantly reduce transport costs. ○ These bag suppliers can be encouraged to with grain farmers to re-design bags to reduce waste volumes and improve recyclability. ○ The more consistent quality of the waste bags could enhance value of the recycle and reduce re-processor gate fee.
❖ Product Stewardship and Circular Economy from cradle-to-grave management	<ul style="list-style-type: none"> • It could enable the grain farmers to have maximum control (through procurement decisions on their bags to select those which are most suited for recycling) over product stewardship through the grain bag supply chain to maximise Circular Economy outcomes.

But there could be a risk in alienating other bag suppliers by this approach.

4.3.11 Key Pros and Cons

Key pros and cons for Grain producers SA when considering this pathway are summarised below.

Pros	Cons
<ul style="list-style-type: none"> • Dedicated scheme for the grains industry and farmers that best meets their needs and should: <ul style="list-style-type: none"> ○ Maximise farmer commitment & participation (60-75+%), ○ Achieve highest diversion levels (60-75+%), and ○ Minimise scheme costs to farmers. • Could be set up at National level (through Grain Producers Australia), which may further reduce scheme costs. • Delivers best quality feedstock to re-processor, which may maximise recyclate value and reduce gate fee impact on farmer cost. • Provides opportunity to combine with 'bulk' procurement of grain silo bags to deliver savings that could offset the costs of the recycling scheme (and which could minimise the cost of any future levy needed). • Greatest scope for grain farmers to have maximum control and visibility over product stewardship outcomes to optimise Circular Economy outcomes (as they would be operating the scheme and be able to ensure that data is properly collected on recycling outcomes). • Best opportunity to secure a grant that could cover the entire set-up cost. • Direct to farm pick up service to grain farmers, supports quick and high uptake. 	<ul style="list-style-type: none"> • Significant set up costs and on-going management burden to Grain Producers SA (or Grain Producers Australia if set up at a National Level). • Likely requires regulatory implementation to establish a voluntary or co-regulatory product stewardship model under the Recycling and Waste Reduction Act 2020. • Still has a potentially significant cost that would be passed onto farmers in the sale price (+10-20%) of new bags, which may cause disquiet and conflict. • Substantial financial risk to scheme operator if scheme costs change, bag use and waste volumes vary from year to year and scheme 'leakage' happens. • Requires the buy-in and commitment of bag suppliers, which could take several years to negotiate. • Scheme may take several years to establish and roll out across the state.

4.4 Pathway 3 – Bag Supplier Led Scheme

4.4.1 Scheme Design & Operation

4.4.1.1 Scheme Operator (& Waste Scope)

This scheme would encourage and support existing major bag suppliers to introduce their own (individual) product stewardship scheme(s). *[If it works well, such a scheme could be picked up and transformed into a wider industry scheme later.]*

- **Two suppliers** together (Tama, Seed & Forage Bags Australia) **may be responsible for at least 70+% of the silo bag sales** in South Australia (with one alone likely accounting for 50%).
- **Both suppliers have indicated they would prefer to introduce their own bag return schemes for recycling.**
 - It would be offered as an optional (added cost in bag supply price) service to customers looking to manage their waste responsibly.
 - One supplier (Tama), which operates Australia wide and internationally and sells other agricultural plastic products, is already negotiating with an interstate re-processor to take waste plastics (including silo bags) it may retrieve under its own waste plastic product return scheme.
- **The scheme operators under this pathway would therefore be the bag suppliers.**
 - Grain Producers SA (or Grain Producers Australia if scheme is nationalised) could enhance the success of these schemes to achieve product stewardship through the following actions.

❖ Advise on Scheme Design	<ul style="list-style-type: none"> • To assist bag suppliers when designing their schemes to minimise costs and maximise grain farmer participation
❖ Support / Endorse the Scheme(s)	<ul style="list-style-type: none"> • Promote these schemes to grain farmers and encourage them to use these suppliers to minimise silo bag plastic waste. <ul style="list-style-type: none"> ○ This could include registering suppliers that offer this stewardship option and including them in a list of recommended suppliers on their Web site.
❖ Monitor Scheme Performance	<ul style="list-style-type: none"> • The quid pro quo for supporting the bag suppliers could be them reporting data on product stewardship outcomes back to grain farmers through Grain Producers SA.
❖ Partner in Bag Re-design R&D	<ul style="list-style-type: none"> • Grain Producers SA could help bag suppliers undertake R&D to re-design their products for better product stewardship and Circular Economy outcomes

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PATHWAY 3 – Bag Supplier Led Scheme

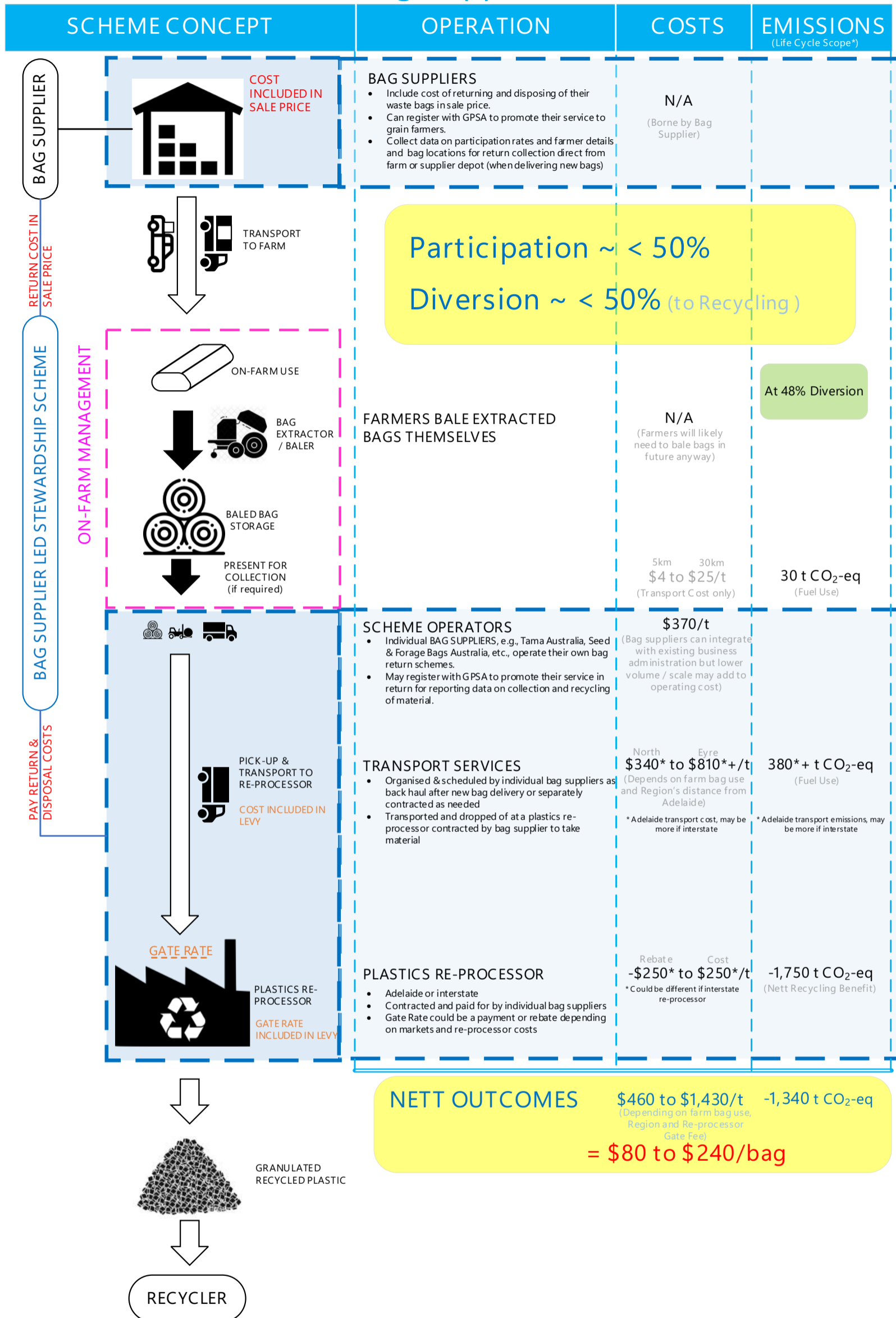


Figure 4-5 – Recycling Pathway 3 in more detail: Key Operational attributes, likely operating costs, and potential emission savings. Participation & diversion rates in Figure are a high-level estimate informed by expected scheme sector coverage and/or feedback from grain farmers on likely participation if cost was perceived as affordable. What is a perceived affordable price in the future cannot be discerned at current time and may depend on future actions by Australian and State Governments to regulate plastic waste disposal. But if was, these might the practical participation rates expected across the State.

4.4.2 Expected Scheme Performance

Projected scheme outcomes for participation and diversion are summarised below and in Table 4-4 overleaf.

4.4.2.1 Participation levels & Grain Farmer Commitment

We would expect lower and lesser member participation in this type of scheme – at best in the range of 40 to 50% (and it could be less).

- **This outcome assumes that the major bag suppliers covering at least 80% of sales come on board and at least up to 3 out 5 (or 60%) of their customers elect the bag return option.**
 - **It would be a voluntary scheme only, there would be no obligation or commitment from farmers to participate.**
- **However, if bag suppliers do not subsidize scheme costs it could have the highest cost per bag – discouraging greater uptake by farmers** that are price sensitive.
 - Even though there may be transport efficiencies in bag suppliers picking up and backhauling waste material after delivering new bags, **these schemes operate at smaller scale** where fixed operating costs add more to collection costs per bag.
- Even if endorsed by Grain Producers SA (or Grain Producers Australia), **it could have a slower uptake, taking up to 5 to 10 years** to achieve this participation level unless there a regulatory curtailment of other disposal options.

4.4.2.2 Diversion outcomes

Once more, diversion outcomes could be to similar participation levels.

- **We estimate it might reach up to 45 to 55%** (of the annual silo bag waste across the State), **or 470 tonnes / year** in an average year.

4.4.2.3 Circularisation Opportunity?

A potential opportunity of a bag supplier led scheme is that with their own **bag waste** being re-processed is that:

- They **may** take buy and ownership of the recyclate produced by re-processor, and
- Return it to their overseas manufacturing site or partner to **be reused in making new bags.**
 - One of the bag suppliers is already practicing this overseas with their manufacturer and looking to achieve up to 30% recycled content in their new silo bags.
 - It could therefore provide a better opportunity to ‘close-the-loop’ and reincorporate waste material back into its original product supply chain.

Table 4-4 – Projected performance, cost, and emission reduction outcome for Pathway 3

PERFORMANCE & EMISSIONS:

Projected Diversion Participation Rate	2,070 farmers (46%)
Diversion (Average Year)	470 tonnes (48%)
SA Recycle Activity Review Recycling Benefit	400 t CO2-eq / year
Global Carbon Emission Saving	1,340 t CO2-eq / year
<ul style="list-style-type: none"> • Scope 1 (Gas Energy) 	+270 t CO2-eq / year
<ul style="list-style-type: none"> • Scope 2 (Electricity) 	-230 t CO2-eq / year
<ul style="list-style-type: none"> • Scope 3 (Upstream Energy Emissions) 	+1,290 t CO2-eq / year

SCHEME COSTS:

Region	Collection Handling Fee (\$/t)	Transport Cost (\$/t)	Re-processor Gate Rate (\$/t)			Scheme Operator Cost (\$/t)	TOTAL SCHEME COST (\$/t) by Re-processor Gate Rate			Farmer Transport Cost to On-Farm Delivery Point or Bag Supplier Depot (exc. Labour)			
			Rebate	NIL	Cost		Rebate	NIL	Cost		5km	7.5km	15km
North	NIL	\$340	-\$250	\$0	\$250	\$370	\$460	\$710	\$960	+	\$4	\$11	\$22
Eyre Peninsula		\$810					\$930	\$1,180	\$1,430				
Yorke Peninsula		\$360					\$480	\$730	\$980				
Murray & Murray Mallee		\$410					\$530	\$780	\$1,030				
South-East		\$450					\$570	\$820	\$1,070				
CH, F & KI		\$390					\$510	\$760	\$1,010				
TOTAL / AVE.		NIL					\$750	-\$250	\$0				
						Per Bag	\$148	\$190	\$233				

4.4.3 Scheme Costs

4.4.3.1 Projected Outcome

Table 4-4 includes assessment of scheme costs.

- **Potential costs were estimated to vary from \$460 / tonne (\$80 / bag) to \$1,460 / tonne (\$240 / bag) depending on farmer location and re-processor gate fee.**
- However, these are much more speculative cost estimates because it is challenging to know what costs of individual bag suppliers might be to operate their own schemes.

4.4.3.2 What these scheme costs include

This projected scheme's costs include the similar components as assessed for Pathways 1 and 2 earlier (viz. Sections 4.2.3.2 and 4.3.3.2).

- **Transport costs for bag suppliers were predicted to be higher** because load efficiency on backhauling may be less than dedicated services to collect and haul waste material.
- **Bag supplier fixed costs per tonne for managing the scheme were projected to be higher** (at \$370/t) because they are spread over smaller volumes of material collected.
- **There was no change to re-processor gate fee assumed.**
 - **Supplier only schemes for waste plastic silo bags should provide best-quality feedstock for the re-processor.**
 - **However, smaller volumes could add to batch processing cost – negating any feedstock quality premium.**

4.4.4 Who would pay scheme costs and where?

Like Pathway 2, **scheme costs would be paid by farmers at point of sale (POS) for their silo bags.**

- **Bag suppliers would probably try and fix this extra charge to provide price certainty.**
- **This may result in it being higher than scheme costs to cover uncertainty** unless the supplier is willing to accept and absorb when scheme cost exceeds revenue from sales.

4.4.5 Sharing scheme transport costs?

The bag supplier is less likely to 'socialise' the scheme costs and farmers in further away regions will probably pay a higher fee in the sale price if they elect a bag return option.

- **The bag supplier would therefore probably break down the bag return fee into at least two charge components:**
 - **Collection & Transport Fee**
 - **Re-processing Fee**

4.4.6 Role of Bag Suppliers & Cost Offset Opportunity

In this pathway, the bag suppliers are their own scheme operators and levy / cost setters.

- They may be more willing to provide a small subsidy to the scheme, but one would expect they would pass on most of the scheme cost (as this cost would likely outweigh any profit margin they might be making on bag sales).

4.4.7 Cost Setting it Up and Running it?

This pathway should have lowest cost to grain farmers as it would be managed and paid for by individual bag suppliers.

❖ Set-up Costs	<ul style="list-style-type: none"> • There may be a small investment in working with major bag suppliers to support them in setting up their individual scheme, e.g., \$70k to \$125k.
❖ On-going Operating Costs	<ul style="list-style-type: none"> • There would minimal on-going operating responsibility for Grain Producers SA (or Grain Producers Australia if national scheme) as this would be handled by individual bag suppliers delivering their own scheme. • The only costs for grain farmers would be for Grain Producers SA (or Grain Producers Australia if national scheme) to support the scheme would be: <ul style="list-style-type: none"> ○ To the bag suppliers to set up and promote their schemes, and ○ Report any performance data received back from bag suppliers.

4.4.8 Could a Grant be obtained to offset costs?

The same grant schemes mentioned in Pathway 1 (viz. Section 4.2.8) could be available (i.e., Green Industries SA Circular Economy Market Development grant, Australian National Product Stewardship Investment Fund).

- But it may be less likely for individual bag suppliers to secure a grant for their own schemes unless there was grain farmer support, and it was developed and implemented in partnership with Grain Producers SA (or Grain Producers Australia).
- For the same reasons noted for Pathway 2 (viz. Section 4.3.8), to secure a grant, it could still be necessary for individual bag suppliers to demonstrate why they require an individual schemes to manage silo bag waste.

4.4.9 Potential Impact on Greenhouse Gas Emissions

Table 4-4 includes two estimates reduce greenhouse gas emissions achieved by recycling waste silo bags in Pathway 3 (assuming diversion rate of 48%). Again, these two estimates are based on the same Emission Factor scopes introduced for Pathway 1 (viz. Section 4.2.9).

❖ Green Industries SA's assumed Recycling Benefit Emission Factor (EF)	• 400 t CO2-eq / year
❖ Considering extra (upstream) emissions from oil and gas exploration and production	• 1,340 t CO2-eq / year

Once more, it should be noted that the carbon saving is mainly proportional to diversion achieved and carbon saving intensity of different pathways are not too different due to dominant contribution of (nett) recycling benefit achieved.

4.4.10 Opportunity for 'Shared' New Silo Bag Procurement

Like Pathway 2 and suggested in Section 4.3.10, Pathway 3 could provide an opportunity for Grain Producers SA to coordinate a 'bulk' procurement opportunity (including bag delivery to farmer) with participating bag suppliers **if savings achieved helped to offset extra costs of recycling.**

- This could be helpful in lowering the cost per bag of the recycling scheme for farmers **and encouraging greater participation.**
- But it would involve additional investment and administration effort by Grain Producers SA and could be a risk of misperceptions that it undermines their independence as a peak industry body if they favour one bag supplier over another.

4.4.11 Key Pros and Cons

Key pros and cons for Grain producers SA when considering this pathway are summarised below.

Pros	Cons
<ul style="list-style-type: none"> • Lowest financial risk and cost pathway for Grain Producers SA. • Can commence more quickly as bag suppliers can start whenever they want. • Single supplier silo bag waste may have highest value and technical utility as recyclate (which may reduce re-processor gate fee). • Bag suppliers may be more inclined to return recyclate to overseas manufacturer to be used as (up to 30%) recycled content in new bags, improving Circular Economy outcomes. 	<ul style="list-style-type: none"> • May have lowest farmer participation / commitment (<50%), diversion (45-55%), and emissions savings as scheme as participation would likely be opt-in. • Still potentially significant (and perhaps highest) scheme cost (per tonne) that farmers will have to pay in the new bag price. • Where bag suppliers do not deliver direct to farm, farmers may need to cart their bags from their farms to nearest supplier depot (which may be many km away in some regions). • Minimal visibility may be available on waste disposal and recycling achieved, diminishing opportunity to demonstrate product stewardship of this waste material. • Fragmented schemes by individual bag suppliers with minimal opportunity to secure grant funding.

5 Alternative Disposal Pathways

In addition to recycling, **existing and other disposal pathways were raised or identified from stakeholder engagement during this study.**

- Table 5-1 overleaf lists and describes the key attributes and pros or cons of these alternative disposal pathways.
- **It is important that these alternative pathways are acknowledged and understood as these represent disposal options that grain farmers may contrast with proposed recycling pathways identified and presented in Section 4.**
- **The reasons why these other disposal options may not be suitable for grain farmers are summarised below.**

<ul style="list-style-type: none"> ❖ Reuse 	<ul style="list-style-type: none"> • Would require: <ul style="list-style-type: none"> ○ Substantial re-design and thickening of walls in existing bags to strengthen them for reuse and prevent vermin damage (that could prevent reuse), ○ Potentially new farm equipment to: <ul style="list-style-type: none"> ▪ Clean extracted bags to remove contaminant and ensure food safety when being reused, and ▪ To handle, load and extract the much heavier bags (as more plastic is added to strengthen them for reuse). • Is an area that can be investigated with bag suppliers, but likely: <ul style="list-style-type: none"> ○ Involves several years of R&D to achieve the above. ○ Still requires a future recycling scheme anyway to handle the waste material (even if reduced in volume by reuse of bags).
<ul style="list-style-type: none"> ❖ On-farm Disposal 	<ul style="list-style-type: none"> • By land storage or incineration is not a Circular Economy solution and has potential legal risks to grain farmers (unless approved by the EPA).
<ul style="list-style-type: none"> ❖ Off-farm Disposal to Incineration or Waste to Energy 	<ul style="list-style-type: none"> • This strategy is also not a Circular Economy solution. • It likely still requires transport of material to Adelaide to a licensed facility that would charge a gate fee of at least >\$200/t, so has not cost saving over recycling

Table 5-1 – Alternative Disposal Options (to recycling)

Alternative Disposal Pathway	Key Attributes & Pros / Cons
❖ Landfill Disposal	<ul style="list-style-type: none"> • Some grain farming regions, e.g., Eyre Peninsula, of South Australia still have access to local landfill for disposal (either directly or through a transfer station). <ul style="list-style-type: none"> ○ The disposal gate rate available may vary from as low as \$100 to tonne to as much as \$300 / tonne depending on how presented and if charged per tonne or vehicle size. • Other grain farming regions, e.g., York Peninsula, would only have access to a transfer station that carts the waste back to a landfill near Adelaide (e.g., e.g., Inkerman or Dublin). <ul style="list-style-type: none"> ○ The disposal gate rate in these situations may be > \$300 to 400 / tonne. • As noted in Section 3.2.2, the South Australian Environment Protection (Waste to Resources) Policy 2010, even though somewhat ambiguous and /or not enforced, may limit future landfill disposal of aggregated plastic waste if not subject to resource recovery first.
❖ Land Disposal (on-farm)	<ul style="list-style-type: none"> • The South Australian Environment Protection (Waste to Resources) Policy 2010 limits land disposal of waste and only permits it in a manner that does not cause “environmental harm” “site contamination”, “environmental nuisance”, “fire hazard”, or “vermin infestation”. • The onus would be on the farmer to demonstrate the above, properly manage the waste on their land, and they could become liable if the waste causes any such problem. • Long-term land disposal may cause on-going legacy risks for farmers.
❖ Incineration (on-farm)	<ul style="list-style-type: none"> • An authorisation from the South Australian Environment Protection Authority (SA-EPA) would be needed under most circumstances to burn “waste” such as grain silo bags. • Even if authorised, burning waste may additionally require a permit from the local council and restricted during high fire risk periods of the year. • An option for on-site incineration could be where a licensed operator with mobile system visits farms and can take away residual with them (if the service is affordable).
❖ Incineration (off-farm)	<ul style="list-style-type: none"> • Waste could be carted to an SA-EPA licensed waste incineration facility, but these would likely be in Adelaide (unless regional facilities are available), charge a gate fee (e.g., > landfill disposal), and be more expensive than carting the material to a re-processor for recycling.
❖ Waste-to-Energy (off-farm)	<ul style="list-style-type: none"> • Like incineration above, material could be carted to an SA EPA licenced Waste-to-Energy (WtE) facility, e.g., Veolia - ResourceCo Alternative Fuels at Wingfield. • But again, such facility would charge a gate fee similar or comparable to landfill disposal and same transportation costs could apply. • There has been talk about regional or mobile WtE plants in regional South Australia, which could substantially reduce transport costs, but small scale and higher processing costs often means there is no saving here (and they don't currently exist). • WtE is not an appropriate Circular Economy solution as it destroys the technical utility of the material (can never be recycled after) and is regarded as “leakage” to be avoided.
❖ Reuse	<ul style="list-style-type: none"> • Reuse of plastic bags would be a superior Circular Economy outcome to recycling. • However, feedback from bag suppliers suggests it could be challenging for grain storage and farm situations where food safety is required, and bags are often damaged when used. <ul style="list-style-type: none"> ○ Bags would require cleaning before reuse to remove contamination and such on-farm equipment does not exist and requires access to water (which may not be available). ○ Even if walls of bags were substantially thickened to enable reuse, e.g., +50%, this may not prevent penetration by some vermin, rendering the bag not suitable for reuse after. ○ Such wall thickening would add more plastic and weight to the bag making it bulkier and more difficult and impractical for farmers to use (and to collect for recycling after). • It is an area worthy of further R&D with bag suppliers to see whether a reuse is feasible. • But even if achieved, a future recycling solution of even reused bags would still be needed.

6 What Key Stakeholders think?

6.1 Stakeholder Feedback & Preferences

The three potential recycling pathways described in Section 4 were discussed with stakeholders as part of the engagement process to obtain their feedback and preferences.

- This feedback and preferences of different stakeholders is summarised below.

❖ Grain Farmers	<ul style="list-style-type: none"> • Looking for a scheme that would not cost them more than 5 to 10% of current silo bag price (or an extra \$50 to \$100 / bag). • Prefer on-farm pick up and costs included in new bag sale price (rather than inconvenience of disposal fee they paid afterwards at a collection depot). • Like idea of joining an existing scheme or bag suppliers taking the lead too. • Best model could be hybrid or mix of elements from Pathways 1, 2 & 3.
❖ Bag Suppliers	<ul style="list-style-type: none"> • Prefer a Bag supplier led scheme, Pathway 3; sceptical about other Pathways.
❖ Re-processors	<ul style="list-style-type: none"> • Prefer a model where best quality feedstock is presented and maximises volumes for processing (e.g., Pathway 2 or 3 where not mixed with other plastic waste). • Need other plastic waste material to build scale and capital investment in new plant to help support acceptance and affordable processing of silo bag waste material, so may be a couple of years before ready.
❖ SA EPA	<ul style="list-style-type: none"> • Would prefer a regulatory feature to any scheme to encourage supply chain commitment and participation and minimise future “leakage” issues. • Looking for industry to develop their own solution to meet current Government policy of reducing plastic waste disposal to landfill.
❖ Green Industries SA	<ul style="list-style-type: none"> • Encourages any initiative to reduce plastic waste in line with current Waste Strategy. • But appreciates challenge and potential cost burden for grain farmers. • May help with funding to set up scheme within scope of available funding programs.
❖ Primary Industries & Regions SA (PIRSA)	<ul style="list-style-type: none"> • Aware of issue and keen to see an affordable solution for grain farmers. • Suggests levy strategy could be best solution to covering costs of any future scheme. • Can help facilitate future stakeholder participation.
❖ Other Product Stewardship Scheme Operators	<ul style="list-style-type: none"> • Dairy Australia – Keen to explore collaboration of its own proposed scheme of utilising depots and disposal fee pathway with Grains Producers SA. • bagMUSTER – Would be please to develop a proposal to register a stewardship scheme with the Australian Government for grain silo bags and operate it, which would leverage existing drumMUSTER depots with cost recovery by mix of supplier levy and farmer disposal fee. • National Agricultural Plastics Stewardship scheme – Would be happy for grain farmers to join their future scheme which would use existing collection depots and charge a disposal fee to farmers dropping off waste plastic material.

Table 6-1 – Stakeholder feedback on or preferences for different Recycling Pathways

Stakeholder	Key Feedback Themes, Preferences or Messages to Grain Producers SA
❖ Grain Farmers	<ul style="list-style-type: none"> • Nearly (but not) all grain farmers spoken to were keen to recycle their waste silo bags if an affordable solution could be provided. • The cost sensitivity of the grain farmers in favour of a recycling solution relative to a new bag price (e.g., at \$1,000) was most would be willing to accept 5% (e.g., \$50 increase to bag use cost) or at most 10% (an extra \$100 per bag). • They therefore preferred the pathway that could minimise their extra costs for recycling. • Moreover, there was a preference towards: <ul style="list-style-type: none"> ○ Disposal costs being included in the sale price of bags, and ○ On-farm pick-up if this was available and could be achieved. • This feedback would suggest a preference for Pathway 2 (if the set-up costs could be covered by a grant) but most farmers were non-committal to picking one scheme over another especially if the cost was going to exceed their cost sensitivity. <ul style="list-style-type: none"> ○ They could appreciate the simplicity of joining a third-party stewardship scheme through Pathway 1. ○ They liked the lower hurdle and responsibility approach of bag suppliers taking the lead for Pathway 3. • Most would only favour a 'bulk procurement' model if they still had some flexibility in bag supplier selection and it delivered a substantial price discount.
❖ Bag Suppliers	<ul style="list-style-type: none"> • There was a strong preference by bag suppliers for Pathway 3 where they operated their own bag return scheme on an opt-in basis for their customers. <ul style="list-style-type: none"> ○ Two of the major bag suppliers had already been looking at such a scheme with one engaged with in interstate re-processor to take material they collected nationally. • However, neither could not furnish substantial information on how such a scheme would operate and what the cost might be to the farmers. <ul style="list-style-type: none"> ○ They had either not assessed the costs of running such a scheme yet or were not able or unwilling to disclose them. ○ The impression was that the costs would be fully passed on to farmers that opted in. ○ They would look to leverage existing bag supply deliveries direct to farm or regional supply depots to minimise transport costs. • They would be reticent to participate in Pathway 2-type scheme unless all bag suppliers did so too. • There was no strong opinion about Pathway 1 except that it could diminish the potential to track product stewardship outcomes and prevent opportunity to send recycle back to silo bag manufacturer to 'close-the-loop'.
❖ Re-processor(s)	<ul style="list-style-type: none"> • All the re-processors (Adelaide and interstate) spoke too were enthusiastic about receiving and re-processing the waste silo bags (to add to other types and volumes of plastic waste). <ul style="list-style-type: none"> ○ Some has taken grain silo bag was in the past (e.g., about a decade ago, before plastic waste processing was offshored).

Stakeholder	Key Feedback Themes, Preferences or Messages to Grain Producers SA
	<ul style="list-style-type: none"> ○ They were taking some small volumes of agricultural non packaging plastic waste from existing pilots of stewardship schemes by RMCG and Dairy Australia. ○ Some were current negotiating with major supermarket retailer to take plastic packaging waste to help create local re-processing capacity to re-start the REDcycle scheme for consumer packaging which collapsed early in 2023. ○ They mentioned the need for major capital investment in new plant (for cleaning and compaction of the material) to support the above, and their ability to take the silo bag waste was tied up with this investment too, so may not be able to take it until 2024 or 2025. ○ This other plastic packaging waste would amount to tens of thousands of tonnes of material, so a thousand tonnes of silo bag waste was not significant to whether they made this investment or not. ○ One was negotiating with an international silo bag supplier about taking waste material from their proposed bag return scheme. • They did not have strong preference for a particular Pathway, but generally said: <ul style="list-style-type: none"> ○ Volume and feedstock quality would decrease re-processing cost and value of recyclate – reducing gate fee, and even potentially enabling a rebate. ○ They would welcome grain sector support to help them access grants to support new capital investment. ○ They would be welcome the opportunity to be part of a product stewardship schemes for this material and work with bag suppliers and grain farmer representative organisation to help establish such.
<ul style="list-style-type: none"> ❖ SA EPA (Regulatory Authority) 	<ul style="list-style-type: none"> • The SA-EPA would be keen to see the grain farmers to join or set up a product stewardship scheme to recycle plastic waste. • Their preference would be for regulatory scheme, followed by a co-regulatory scheme, then a voluntary scheme with widespread commitment and involvement across the supply chain. • Their preference for a regulatory feature to any future product stewardship scheme was their belief that this would maximise sector commitment and participation and minimise “leakage”. • They felt that was timely for the sector to look at this issue as the South Australian Government is focussed on eliminating plastic waste across supply chains in the economy.
<ul style="list-style-type: none"> ❖ Green Industries SA (Policy Setter) 	<ul style="list-style-type: none"> • Green Industries SA was strongly supportive of any initiative to reduce plastics waste in line with the current Waste Strategy goals but recognise the challenge and potential cost burden it can place on grain farmers. • Like the SA EPA, they preferred a scheme that would maximise sector commitment and participation, diversion outcomes, and minimise “leakage” and was consistent with Circular Economy principles. • They could be willing to provide funding to help the grain farmers set up a scheme within scope of available funding programs.

Stakeholder	Key Feedback Themes, Preferences or Messages to Grain Producers SA
❖ Primary Industries & Regions SA (PIRSA) (Sector Supporter)	<ul style="list-style-type: none"> • PIRSA is aware of this issue and is cognisant of the future implications, potential impact on farmers and recognises the important of addressing so farmers can meet growing ESG obligations and expectations of export market customers. • It highlighted that any such scheme should be affordable to grain farmers. • It would prefer a voluntary and industry led scheme to address, like the current proposed Agricultural Plastics National Product Stewardship scheme. • But it also suggested that a levy on product would be best strategy to fund the scheme. • PIRSA offered to help facilitate development and participation in such a scheme.
❖ Other Product Stewardship Scheme Operators	<ul style="list-style-type: none"> • Dairy Australia – <ul style="list-style-type: none"> ○ Developing its own scheme in line with Pathway 2 based on the NZ Plasback model but potentially a depot disposal fee instead of on-farm collection fee. ○ Could be happy to collaborate with grain famers on logistics, administration, and management and welcome a discussion. • bagMUSTER – <ul style="list-style-type: none"> ○ Has already been in contact with Grain Producers SA about potential to expend this scheme to cover waste grain silo bags. ○ Like drumMUSTER and plans for bagMUSTER, they preferred approach would align with Pathway 1, leveraging of existing collection depots on their existing network, but where costs are recovered by a mix of supplier levy and disposal fee for farmers too. ○ They would be pleased to work with Grain Producers SA to develop a joint proposal for such, which would include a pilot with supporting funding from the Australian Government. ○ Key to success would be commitment from bag suppliers to a levy that might apply to any future scheme. • National Agricultural Plastics Stewardship scheme – <ul style="list-style-type: none"> ○ RCMG have already spoken with Grain Producers SA too. ○ Their preference is Pathway 1, leveraging off existing collection depots operated by local government (like their recent pilots) with cost recovered by a disposal fee paid by farmers dropping off the waste material. ○ They would be pleased to continue working with Grain Producers SA to encourage their members to participate in the scheme to dispose of their waste plastic material, including waste silo bags and other plastic waste too.

6.2 Practical Interpretation / Conclusions

1. **There was no clear preference on which identified Pathway would best meet grain farmers, bag supplier, or other stakeholder requirements.**
2. **Except that any future scheme should:**
 - **First look to leverage off an existing scheme or operator as a partner,**
 - **Investigate a levy component on bag sales to reduce any disposal fee paid by farmers,**
 - **Consider how to facilitate farmer preference for on-farm collection pick-up** due to the bulky and heavy nature of grain silo bag waste,
 - **Better understand if and how the tyranny of distance and high transport costs for collection of bags** from remote regions – where most of the waste is generated, e.g., Eyre Peninsula – **could be minimised,**
 - **Review if cost recovery can be ‘socialised’ to reduce the disposal cost charged to remote farmers,** which if too high or unaffordable would discourage participation,
 - **Consider farmer requirements for access to equipment to bale the silo bags,** and
 - **Look at Australian Government registration of any future product stewardship scheme(s) for waste grain silo bags** to ensure that bag suppliers participate and avoid leakage.
3. **A scheme may not be welcomed by grain farmers if extra costs from participating were more than 5 to 10% of current new bag prices** (e.g., > \$50 to 100 / bag).
 - **This outcome does not appear immediately feasible.**
 - **Even if they join an existing** or proposed product stewardship **scheme.**
 - Many existing schemes have operating and disposal costs starting at > \$500 / tonne (\$85 / bag) and potentially up to as much as \$1,300 / tonne (\$220 / bag).
 - **It may be necessary to re-frame the business case to grain farmers for higher charges,** so are presented relative to farm operating costs or other storage solutions, e.g.
 - A bag holding 260 tonnes and \$1,000 cost equals \$3.85 / tonne of grain.
 - An \$200 / bag disposal cost increases this by an extra 75¢ / tonne.
 - If the grain price is \$300 / tonne, this extra cost is 0.25% of this price.
4. **Re-processors do not yet appear able to accept waste silo bags,** and even if they do, are not operating **at scale to minimise the gate fee for grain farmers.**

7 Pathway Selection and Implementation

7.1 Pathway Feasibility?

As reported in Section 6.2, **none of the identified Recycling Pathways were presently found to be feasible to match the main requirement of grain farmers for an affordable and practical scheme at current time.**

- Likely scheme costs could be more than 10% of the new bag price or \$100 / bag for most grain farmers and even more (up to \$200 / bag) for those in more remote regions.
- The grain farmers, which may not presently pay for disposal, probably won't see this extra cost as affordable (based on their existing reference frame).

In addition, **there are mixed preferences from stakeholders on how a Recycling Scheme should best operate.**

- The farmers appear to prefer:
 - A POS charge/levy to cover scheme costs rather than disposal fee at collection point,
 - On-farm collection or pick-up model due to the bulky and heavy weight of baled silo bags which makes them difficult to easily transport to a collection depot.
- Many farmers may not yet have latest on-farm equipment to bale extracted bags – a necessary step for efficient transport to re-processors.
- Re-processors are probably a several years away from being set-up to accept the grain silo bag waste at scale to offer lower gate fees.
- Bag suppliers seem interested in offering their own voluntary opt in bag return schemes, which they think is better for sales attractiveness to customers, but these may end up offering a fragmented solution that is more expensive than an organised sector wide product stewardship scheme.
- There are opportunities for grain farmers to join or partner with existing or proposed product stewardship schemes for other waste agricultural plastics.
 - But these schemes are still early in their development (i.e., at pilot stage still) and there is a lack of clarity on their potential costs.
 - Moreover, they may not provide grain farmers with optimal visibility on waste product stewardship performance outcomes.
- There are grant opportunities and potential design advantages with having a scheme registered with the Australian Government under the Recycling and Waste Reduction Act 2020, so that there is a regulatory feature to encourage all bag suppliers to equally participate and contribute.
 - This regulatory obligation for bag supplier participation could be essential to maximising participation and minimising future scheme costs to grain farmers.
 - But it could take several years to develop and register such a scheme.

7.2 Recommended next steps to select pathway?

In view of the above, **the steps recommended for Grain Producers SA to progress towards developing a feasible pathway and successfully implementing are pictorialized in Figure 7-1 below.**

- **Table 7-1 overleaf provides more detail on each recommended step including potential actions that Grain Producers SA could consider in each of these recommended steps.**
- **These recommended steps may take several to 10 years to complete and deliver a successful outcome for a Circular Economy Recycling scheme that grain farmers see practical and affordable relative to other disposal alternatives.**
- **Potential actions in Step 1 that Grain Producers SA could undertake in the next 12 to 24 months include:**
 - Consider a pilot with bag supplier(s), farmers, local re-processor(s), and existing scheme operators to demonstrate proof-of-concept for recycling waste plastic grain silo bags and raising awareness about Circular Economy disposal options.
 - Keep a watching brief on how existing or new scheme(s) develop and/or future funding opportunities for a State-wide scheme.
 - Use the outcomes of the pilot to look at opportunities for a larger waste grain silo bag scheme, including design, partners, and funding model.
 - Look at opportunities including whether grant funding is available to expand farmer access to on-farm equipment to bale extracted bags, so they are 'recycle-ready' to participate in any future waste grain silo bag scheme.

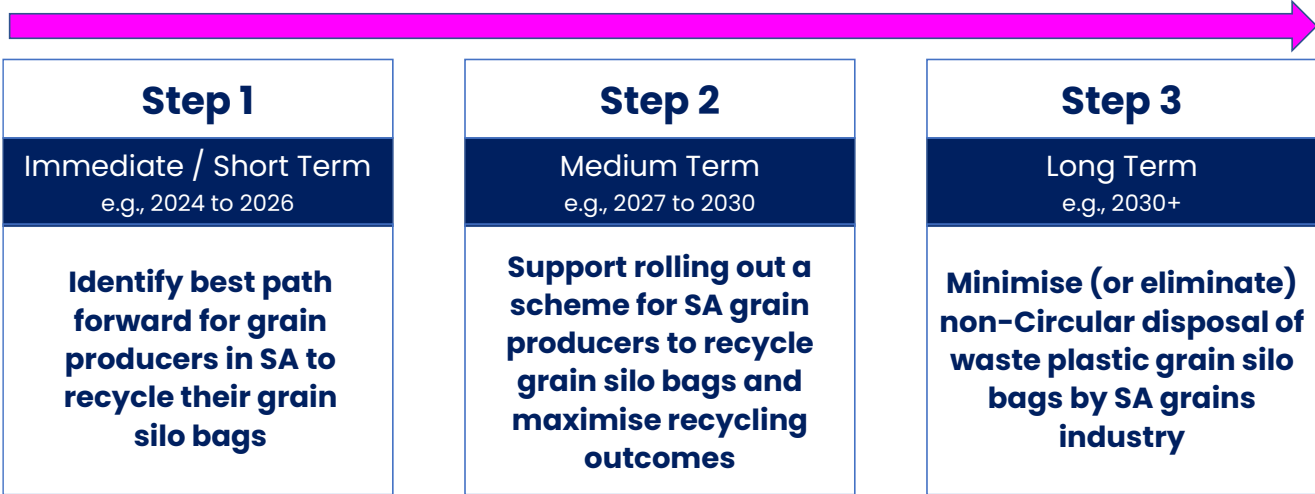


Figure 7-1 – Pictorial overview of recommended steps to develop a feasible Circular Economy solution for recycling waste plastic silo bags.

Table 7-1 – Recommended steps with more detail and explanation

Step (& Timeframe)	Goal	Potential Actions
1. Immediate / Short Term , e.g., 2024 to 2026	Identify best path forward for grain producers in SA to recycle their grain silo bags.	<ol style="list-style-type: none"> 5. Develop and support a pilot scheme with bag supplier(s), farmers, local re-processor(s), existing scheme operators to demonstrate proof-of-concept for recycling waste plastic grain silo bags and raise producer awareness about Circular Economy disposal options. 6. Keep a watching brief on how existing or new scheme(s) develop and/or future funding opportunities for a State-wide scheme. 7. Use outcomes of the pilot project to look at opportunities for a larger waste grain silo bag scheme, including design, partners, and funding model. 8. Investigate opportunities (including grant funding if available) to expand farmer access to on-farm equipment to bale extracted bags, so they are 'recycle-ready' to participate in a future waste grain silo bag scheme.
2. Medium Term e.g., 2027 to 2030	Support a scheme (or schemes) for grain producers across SA to recycle grain silo bags and look to maximise recycling outcomes (or fate).	<ol style="list-style-type: none"> 3. Support launch of a State-wide recycling scheme for product stewardship of waste plastic grain silo bags available to all Grain Producers SA members. 4. Work with bag suppliers, grain producers, R&D agencies, and government to research new silo bag designs that can reduce members' grain silo bag storage cost and/or product stewardship costs and/or that improve recycling outcomes.
3. Long-term , e.g., 2030+	Minimise (or even eliminate) non-Circular disposal of waste plastic grain silo bags by the grains industry in SA.	<ol style="list-style-type: none"> 4. Work with grain producers, bag suppliers, and government to minimise non-Circular disposal of waste plastic grain silo bags by the grains industry in SA. 5. If not happening already, support expansion of State scheme(s) nationally. 6. Support the launch of any new silo bag designs that can reduce members' grain silo bag storage cost and/or product stewardship costs and/or that improve recycling outcomes.

8 References

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Appendix 1 – Summary of transport cost assessment methodology

A.1 Transport Cost Data Source(s)

Transport Industry Council ([Transport Industry Council](#)) published rates and cost schedules were adopted for likely vehicle types expected to be used for collection and transport of baled waste grain silo bags from depots or farms to re-processor depot. These rates and cost schedules include:

- **Fixed Costs** – Costs that the business (or driver) must pay each year regardless of how many kilometres the vehicle travels.
- **Variable costs** – These are the costs (such as fuel and tyres) that vary with how many kilometres are travelled.
- **Payment for labour** – Labour rates for drivers.

This data was adapted to model collection and transport costs for each pathway – see A.2 below.

A.2 Transport Cost Assessment Methodology

The key steps to assessing transport costs by region were as follows. This assessment method was essentially the same for each pathway and its description below has been generalised.

1. **Waste volume generated in each region** – These volumes were as estimated in this report for each major grain farming region per Table 2-1 (on Page 20).
2. **Waste volume to be collected and transported for recycling (by region)** – Was estimated based on the above waste volumes and expected farm participation.
3. **No. bags transported and collected for recycling (by region)** – Number of bags to be collected from each region were then estimated.
4. **Key transport assessment parameters (by region)** – The following parameters for estimating transport cost were assessed for each region.
 - a. Volume and no. of bags per collection load from the source (or pick-up) point (e.g., farm, recycling depot, supplier).
 - b. No. of collection trips or events required per year based on the assumed vehicle size and number of bags per collection load.
 - c. Average travel distance (km) for collection vehicle to complete a collection trip or event to and/or from each region and to and/or from the source point to collect the waste grain silo bags and to drop them off at a re-processor in Adelaide.
 - d. Travel time (hrs or days) per collection event based on:
 - i. Above average travel distance and expected average travel speed, and
 - ii. Expected time spent loading and unloading the waste grain silo bags.

5. **Transport cost assessment (by region)** – Annual transport costs were then estimated from:
 - a. The assessed number of collection trips or events (4b) and travel distances (4c) and times (4d), and
 - b. Expected fixed and variable and labour transport costs from A.1 above.
6. **Transport cost per tonne and bag (by region)** – Were calculated by amortising annual transport cost over no. of tonnes or bags collected annually.

A.3 Important Assessment Clarifications

- These transport costs are a desktop assessment only (e.g., should only be considered $\pm 20\text{-}30\%$ accurate) for each of the pathways and more detailed assessment informed by budget quotes from local transport contractors would improve accuracy.
- Estimated transport costs are an average for a region, and in some regions (e.g., Eyre Peninsula), they more be more expensive for remote or further away farms (e.g., at Ceduna) due to large distances these regions can span.
- This assessment of transport costs reasonably considered the expected different modes of collection and transport that would apply to each pathway, e.g.,
 - **Pathway 1** – Collection trucks more frequently visiting regional recycling depots and picking up smaller volumes of (pre-baled) bags along with other plastic waste items to cart back to a re-processor.
 - **Pathway 2** – Collection trucks only be visiting regions annually or bi-annually on a dedicated milk run (or runs), travelling direct to farms (or agreed supplier depots) and picking up larger numbers of (pre-baled) bags per collection trip.
 - **Pathway 3** – Trucks would be operated by bag suppliers, and likely be the same trucks they use to deliver new bags, they would be different in size and load or number of (pre-baled) bags) they could take back to a re-processor.