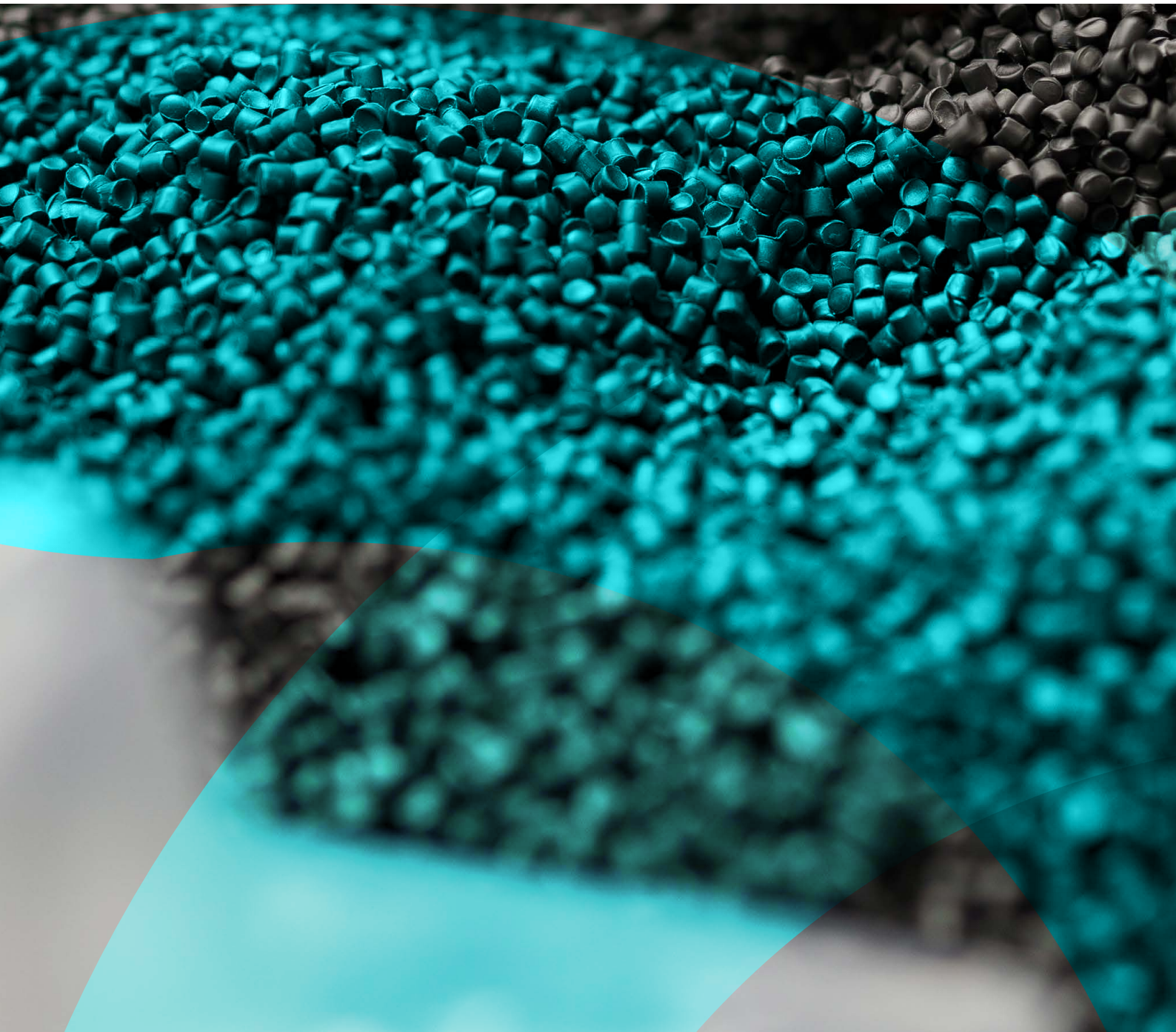
PIPA
PLASTICS INDUSTRY
PIPE ASSOCIATION
OF AUSTRALIA LIMITED

The use of recycled material in plastic pipes

Plastic pipe systems. Safe. Durable. Sustainable.

July 2025 Version 2



CONTENTS

KEY DISCUSSION POINTS

100+ Year Lifespan

Plastic pipe systems are designed to last over a century, reducing replacement needs and long-term environmental impact.

Engineered for Circularity

Made from stable, high-quality polymers—often a single material—plastic pipes are designed for long life, repair, reuse and recycle, supporting a circular economy. They are very different from single-use plastics.

Still in Their First Life Cycle

Most plastic pipes in service today are still in their original life cycle, so the volume available for recycling remains low. Broad recovery data often fails to distinguish between different plastic types—making comparisons between total plastic consumption and recovery misleading. Not all plastics are the same, and long-life, infrastructure-grade plastics like pipes should be considered separately from short-life or single-use products.

Strong, Durable & Versatile

Plastic pipes are engineered to handle decades of loads and stresses, making them reliable for a wide range of infrastructure applications.

Certified for Long-Term Performance

Australian and international standards (AS/NZS and ISO) ensure plastic pipes meet strict durability and performance requirements.

Recycled Content Where It Counts

Non-pressure pipes can safely include recycled materials without compromising performance—supporting sustainability while meeting technical needs.

Valuing Plastics as a Resource

The plastic pipes and fittings industry proactively reclaim and reuses suitable materials in various ways, recognising the long-term value of plastic.

Efficient, Low-Waste Manufacturing

Sustainable practices include reusing production rework and incorporating recycled materials, all contributing to reduced waste and more efficient use of resources.

INTRODUCTION

Australia's pipeline infrastructure is vital to the way we live today, delivering essential services and utilities to our homes and communities.

Plastic pipe systems distribute drinking water, gas and electricity. They protect the network of wires and cables that provide electricity, internet and telephone services. They are widely used in irrigation systems for food production. And they safely convey sewage and stormwater, protecting the health of our communities and waterways.

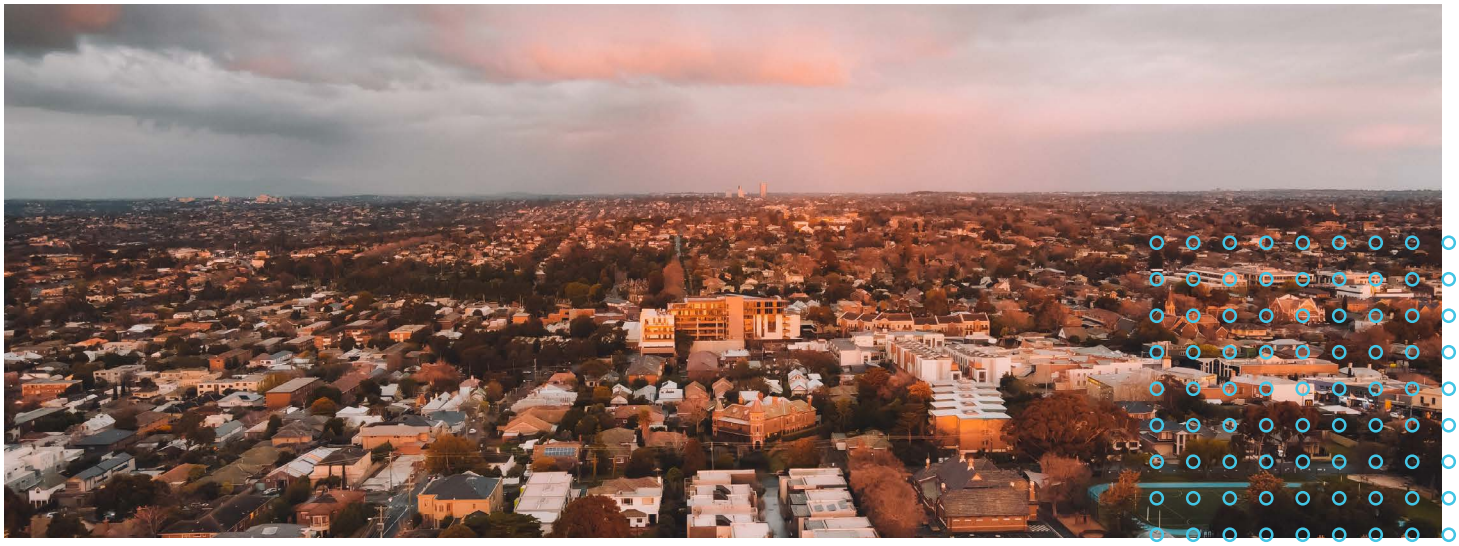
The Plastics Industry Pipe Association of Australia (PIPA) and its members are acutely aware of the problem society faces with plastic pollution.

For over two decades, our industry has aimed to recycle the maximum amount of usable plastic pipe and other suitable materials into new plastic pipes. We are committed to maximising the use of post-consumer and pre-consumer recycled content in products while ensuring that products remain fit for purpose.

As a vital component of critical infrastructure, plastic pipes are engineered to last a very long time. Our industry has developed detailed Australian Standards and technical specifications, ensuring plastic pipe systems are designed and manufactured to perform safely, reliably and effectively for at least 100 years.

Across the infrastructure and construction industries, there is a strong focus on the sustainability of plastics pipes and fittings. As demand for recycled products increases, specifiers and procurers must understand the:

- **range of sustainability benefits offered by plastic pipes systems**
- **the opportunities and technical limitations of using recycled content in products**
- **limited supply of suitable recycled material available for use**
- **how plastic pipe systems contribute to circularity with a focus on long service life, reuse, and recycling as the last stage.**



ENGINEERED POLYMERS DESIGNED FOR LONG LIFE

Pipes are required to have a long life span, supporting infrastructure needs decades into the future. Plastic pipe systems have a service life of over 100 years—one of the many sustainability advantages offered by plastics pipes and fittings.

Plastic pipes are made using engineered polymer materials that are highly stable. The majority of pipes are manufactured from a single type of plastic material—a design that facilitates simple recycling. The polymers can be easily reprocessed into new pipes with the same life expectancy as the original ones.

The plastics used in pipes and fittings are vastly different to single-use plastics, such as flexible packaging. Plastic packaging is composed of multiple polymers and incorporates other materials, such as aluminium foil. This makes plastic packaging difficult to separate and recycle.

What types of plastics are used for pipe applications?

Plastic pipes are predominantly manufactured from thermoplastics, which are 100% recyclable and sustainable. The commonly used thermoplastics for pipe applications are Polyvinyl Chloride (PVC), Polyethylene (PE) and Polypropylene (PP).

A thermoplastic is a plastic that can be cut up, remelted and reformed into another shape or new product. This makes it easy to reprocess and recycle.

FIGURE 1

Example of a thermoplastic material

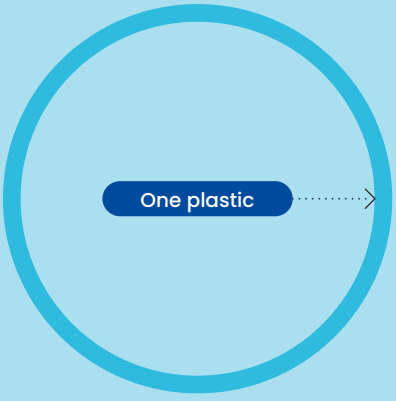
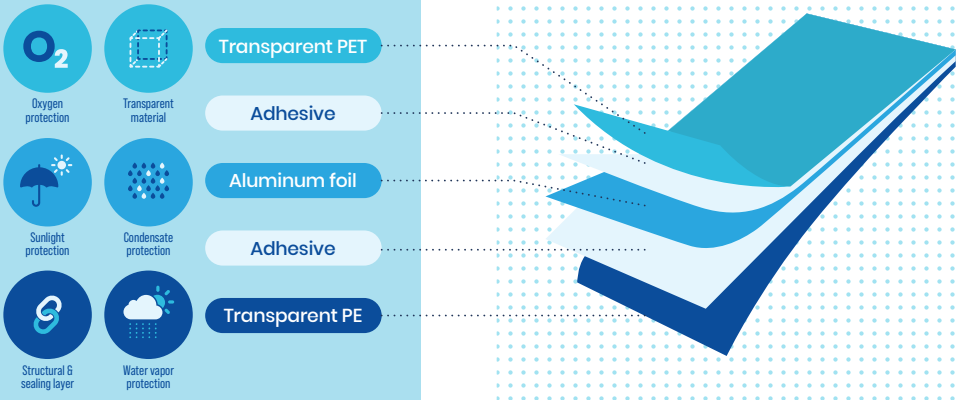


FIGURE 2

Example of flexible packaging – multiple layers



DESIGNED TO BE ROBUST & RELIABLE

Plastic pipes are engineered to withstand various loads and stresses over many decades. They must be strong and reliable, suitable for each specific application.

Specific uses require specific performance properties

Plastic pipes deliver drinking water, safely transport gas, protect electrical cables and securely divert stormwater under roadways and structures. Each application demands a specific combination of material and design performance requirements.

Plastic pipes are used for either pressure or non-pressure applications.

Pressure pipes are designed to operate under pressure. The pipe wall must withstand stresses generated by liquid or gas transported under pressure inside the pipe.

Non-pressure pipes are designed to operate under no or low internal pressure. They are generally only partially filled with fluid or used as a physical barrier to protect cables.

Pressure and non-pressure pipes have different performance criteria, allowing them to be engineered and manufactured in different ways. Non-pressure pipes can incorporate recycled materials without compromising performance.

STANDARDS THAT PROTECT ESSENTIAL SERVICES & UTILITIES

We rely on plastic pipes to deliver essential services and utilities across Australia. It is vital that they are designed and manufactured to perform safely and reliably.

The integrity of our plastic pipeline infrastructure is protected by Australian (AS/NZS) and International (ISO) product standards. These standards cover a range of applications, from the infrastructure in the street through to the pipework inside buildings. Standards specify the performance properties plastic pipes must have to ensure long-lasting durability.

Australian Standards are developed by expert panels

Australian Standards have been developed by expert groups of people, including engineers, pipe and fitting manufacturers, end-users, such as water and gas authorities, and government regulators. They are reviewed and updated regularly to encompass new technical developments, including the use of recycled materials.

Australian Standards define pipe colours

Colour is an important requirement to safely identify and differentiate the substances inside pipes. Blue is used for potable water, purple for recycled water, grey for wastewater, orange for electrical conduits. These colour requirements apply whether using virgin or recycled materials.

SUSTAINABILITY IS MORE THAN RECYCLING

Sustainability Is More Than Just Recycling

When people think about sustainability, recycling is often the first thing that comes to mind. But true sustainability goes far beyond what happens at the end of a product's life. It's about designing smarter, using resources efficiently, reducing waste from the start, and ensuring materials stay in use for as long as possible. This is where plastic pipes stand out—as a practical example of circular economy principles in action.

Plastic Pipes and the Circular Economy

Plastic pipes are engineered for performance, durability, and longevity—supporting a circular economy by keeping valuable recourses in use and out of landfill. Unlike single-use plastics, most plastic pipes in Australia are still in their first life, delivering critical services like water, sewer, and stormwater management. With service lives exceeding 100 years, these systems are designed to last—reducing the need for frequent replacement and conserving resources over time.

Even at the end of their service life, many plastic pipes don't need to be removed. Instead, they're often used in situ as structural hosts for new pipe systems—minimising disruption, reducing energy use, and cutting environmental impact. This reuse approach is a powerful example of how circular thinking can extend the value of materials well beyond their original purpose.

Engineered for Efficiency and Environmental Benefit

Plastic pipes also support sustainability through efficient, low-impact manufacturing. They release fewer emissions and have lower embodied energy compared to alternative materials. Manufacturers integrate rework (in-house generated scrap) directly into production—diverting plastic from landfill and eliminating waste at the source.

Beyond their manufacturing and material advantages, plastic pipe systems play a vital role in protecting the environment and supporting healthy communities. Their long-term, leak-free performance helps reduce water loss, safely transport sewage—protecting waterways, manage stormwater - minimising flood risks, and contributing to more sustainable infrastructure.

Examining plastic pipes in construction and demolition waste

A very small proportion of construction and demolition waste is made up of plastic pipes. This was confirmed by the New South Wales Government audit of Construction and Demolition Waste[1]. In one landfill site, 600,000 tonnes/annum of construction and demolition waste was examined to find that plastic pipe and fittings waste comprised only 0.1-0.5%.

The durability and exceptional service life of plastics pipes and fittings make them ideal for use in building and infrastructure projects. Today, the vast majority of plastic pipes are still in their first life cycle.

1 Report into the Construction and Demolition Waste Stream Audit 2000-2005, Sydney Metropolitan Area, Department of Environment & Climate Change NSW, published 2007.

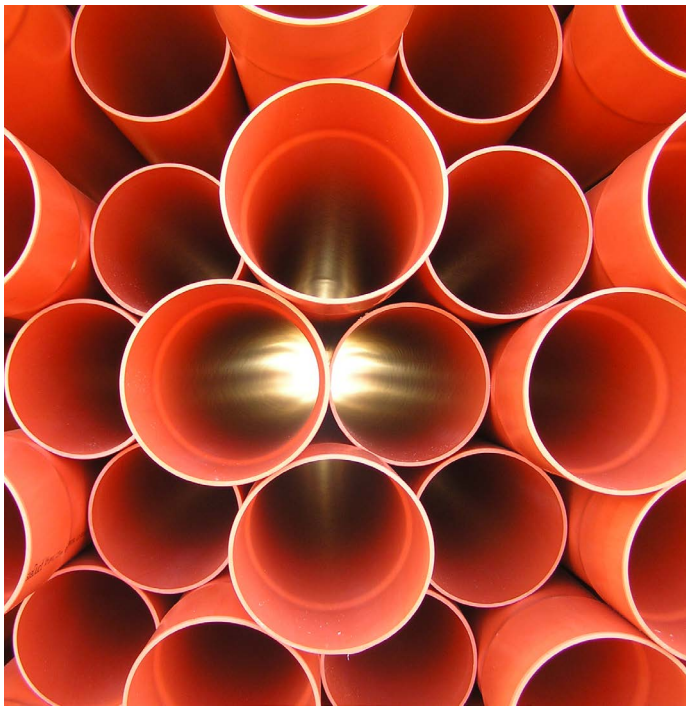


FIGURE 3

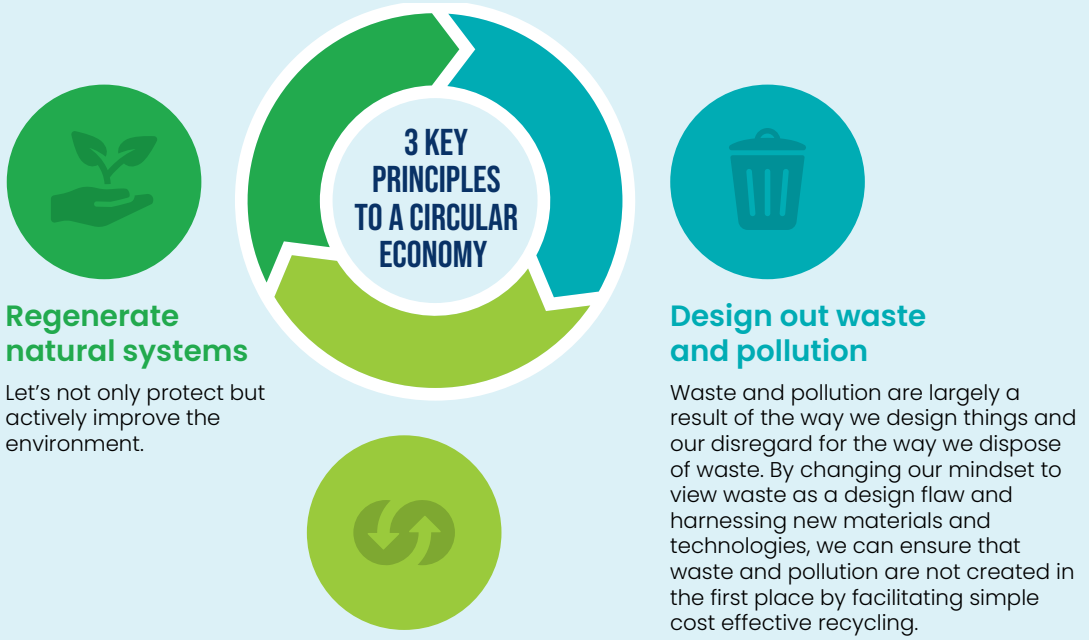
Closing the loop - manufacturing non-pressure plastic pipes from post and pre- consumer recycled material.

Plastic pipes like PVC can be recycled mechanically 8 to 10 times without loosing their technical properties. Assuming a pipe lifetime of 100 years, this plastic pipe material may have a lifetime exceeding 800-1000 years.

Source: PVC4Pipes https://pvc4pipes.com/sustainability/circular-economy/

FIGURE 5

Plastic pipes play a vital role, aligning with the three key principles of a circular economy.



Source: What is the circular economy? (ellenmacarthurfoundation.org)

Rethinking Recycling Targets for Long-Term Sustainability

Focusing narrowly on recycling targets can unintentionally overlook the broader sustainability benefits of plastic pipes. These products are designed for durability and long-term performance—often exceeding 100 years—which aligns with higher-order circular economy principles such as reducing resource use, extending product life, and minimising waste.

Recycling metrics based on short-term material flows (e.g., annual recycling rates) fail to capture the full circularity of plastic pipes. Because most pipes are still in use, end-of-life material is limited—not due to inaction, but because the products are still performing as intended. This means low recycling volumes should not be interpreted as low circularity.

Moreover, rigid recycled content targets and policies can conflict with safety and performance requirements. In critical infrastructure applications (e.g., water, gas), recycled materials must meet stringent standards. If not properly managed, pressure to meet recycled content quotas could compromise product integrity.

Instead, sustainability measures should take a more holistic approach—valuing design for longevity, reuse potential, low embodied energy, and material efficiency alongside recycling. Long-life products like plastic pipes contribute to sustainability by keeping materials in use at their highest value for as long as possible, reducing the need for replacement and resource extraction.

Comparing consumption and recovery

The plastics pipe industry consumes approximately 50%[1] of the total PVC and HDPE (High Density Polyethylene) raw materials imported each year to manufacture long-life plastic pipes. As these pipes have a service life of over 100 years, it is misleading to compare annual plastics consumption and the total annual plastics recovery. Most plastic pipes are still in their first life cycle.

What the Pipe Industry Is Doing to Drive Sustainability

The plastic pipe industry is already making a strong contribution to sustainability by keeping valuable materials out of landfill and designing products built to last. With a focus on long-life performance, efficient manufacturing, and reduced waste, plastic pipes offer a smart, low-impact solution for essential infrastructure.

Working alongside the building and construction sector, the industry is driving practical circular economy initiatives, including:

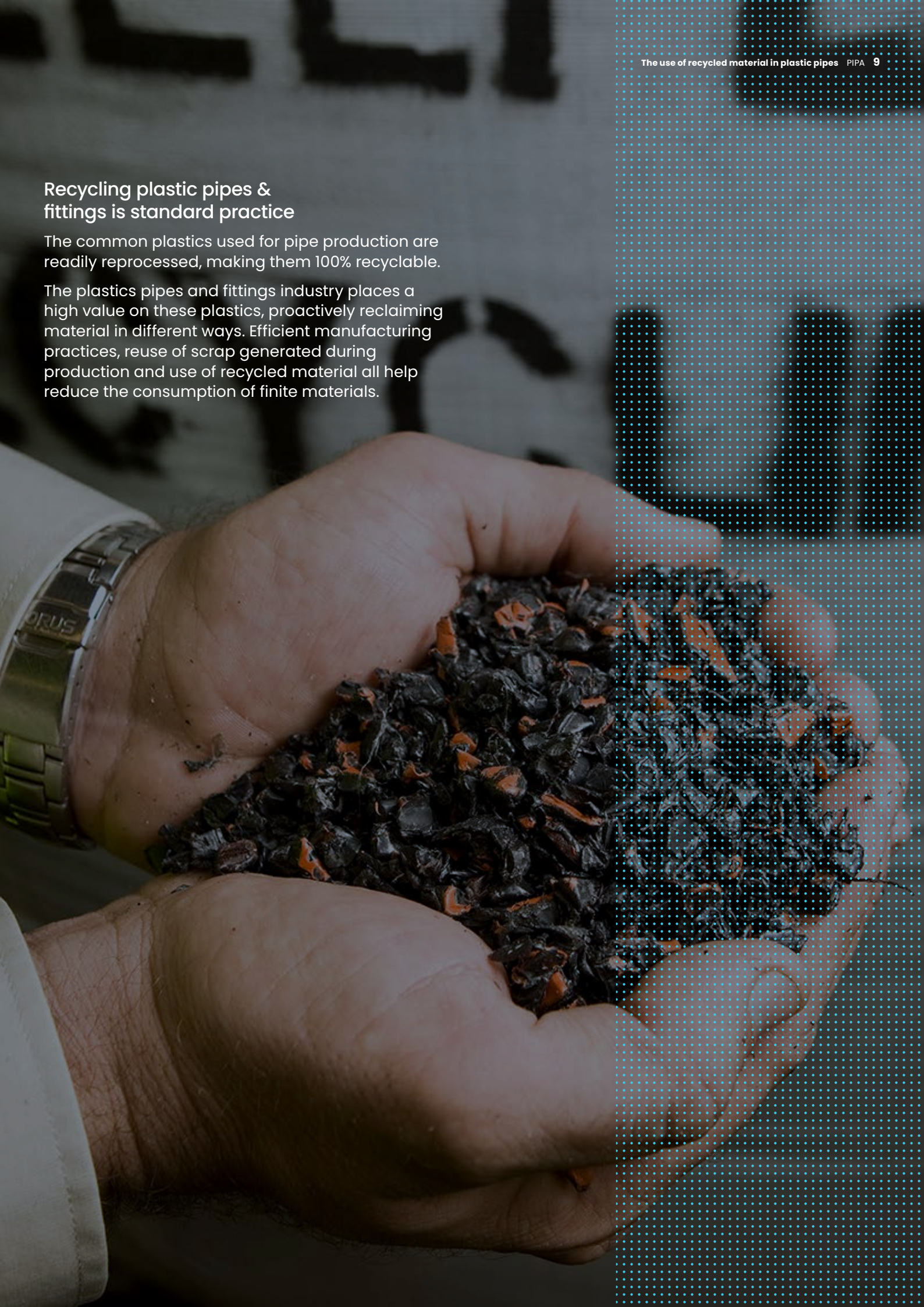
- Take-back schemes to recover off-cuts and unused products during installation
- Accessible disposal options to boost post-consumer material recovery
- Education and awareness programs for end users to encourage responsible practices
- These efforts are helping to close the loop—supporting smarter resource use and reducing environmental impact.

1 Based on the Australian plastics consumption in 2018-2019 of the 2018-2019 Australian Plastics Recycling Survey (Table 7).

Recycling plastic pipes & fittings is standard practice

The common plastics used for pipe production are readily reprocessed, making them 100% recyclable.

The plastics pipes and fittings industry places a high value on these plastics, proactively reclaiming material in different ways. Efficient manufacturing practices, reuse of scrap generated during production and use of recycled material all help reduce the consumption of finite materials.



THE RIGHT RECYCLED MATERIAL MUST BE USED IN PLASTIC PIPE SYSTEMS

Performance First: Recycled content done right

Plastic pipes are not generic products - they're precision-engineered for performance.

While recycled content can be used, it must meet the same rigorous standards as virgin material.

Australian Product Standards clearly define what materials are suitable for different applications, especially in critical infrastructure where failure is not an option.

No matter the source, every pipe must be fit for purpose and built to last.

Sources of recycled materials for manufacturing plastic pipes and fittings

The recycled plastics used in plastics pipes and fittings come from three types of material:

- **Post-consumer:** [1&2] Plastics material generated by households, or by commercial, industrial and institutional facilities, in their role as end-users of the product that have fulfilled their intended purpose or that can no longer be used.
- **Pre-consumer:** [1,2&3] Plastics material diverted from the waste stream during a manufacturing process or from unused products. This excludes a manufacturer's own rework, regrind or scrap.

While manufactures use re-work this is not classified as recycled content.

Note: Transportation from one plant to another of the same legal entity is considered as retained.

1 Definition is based on AS 14021 Environmental labels and declarations – Self declared environmental claims (Type 2 Environmental Labelling) (ISO 14021:2016MOD).

2 Definition is based on CEN/TS 14541.1 Plastics pipes and fittings – Utilisation of thermoplastics recyclates Part 1 Terminology.

3 Previously defined as Post-Industrial.

Where does the recycled content come from?

HOW WE EMBED CIRCULARITY PRACTICE IN THE MANUFACTURING PROCESS

POST-CONSUMER PIPE & FITTINGS

Pipes & fittings = **Recycled, reground & reused** = **Low availability of recycled material due to long life** = **Diverting waste from landfill**

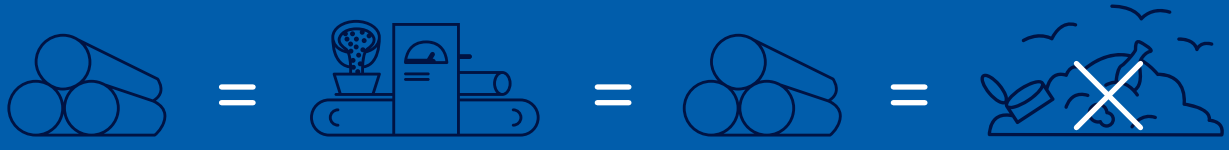
Pipes and fittings are being recycled now through recycling and takeback schemes. Volume of available recycle is low due to the products long life and is still in their first life cycle.

PRE-CONSUMER MATERIALS

Suitable engineered plastics = **Recycled, reground & reused** = **New pipes** = **Diverting waste from landfill**

Not all plastics are the same. Plastic pipes are engineered products and therefore you can't just use any plastic material. Recycled material needs to have the right properties to ensure performance is not compromised.

MANUFACTURING REWORK MATERIAL



Rework material* = **Reground & process** = **New pipes** = **Nothing in landfill**

Rework material is reground and reused in the manufacturing process to make new pipes.
No waste generated = nothing goes to landfill.

*Rework is not classified as recycled content.

No Recycled Materials in Pressure Pipes—Here's Why

Pressure pipes carry critical products like gas and drinking water that directly affect community health and safety. Therefore, the materials used must be consistent, reliable, and fully traceable.

Australian Product Standards prohibit the use of post-consumer and pre-consumer recycled materials in pressure pipes due to their variable and unpredictable nature, which makes quality assessment impossible.

However, manufacturers are allowed to reuse their own rework material—of the same composition and known origin—in pressure pipe production. This certified rework ensures safety and performance without compromising standards.

Australian Product Standards that allow the use of a manufacturer's own rework material in pressure pipes and fittings include:

- AS/NZS 1477 PVC pipes and fittings for pressure applications
- AS/NZS 4441 Oriented PVC (PVC-O) pipes for pressure applications
- AS/NZS 4765 Modified PVC (PVC-M) pipes for pressure applications
- AS/NZS 4130 Polyethylene (PE) pipes for pressure applications
- AS/NZS 4129 Fittings for Polyethylene (PE) pipes for pressure applications.

Non-pressure pipes support recycled content

Non-pressure pipes have greater flexibility to accommodate all forms of recycled materials—post-consumer, pre-consumer and rework material. This is partly due to the use of smart, multi-layer extrusion technology.

Australian Product Standards that allow the use of post-consumer, pre-consumer and the manufacturer's own rework material in non-pressure pipes and fittings include:

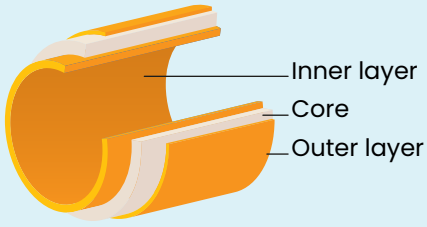
- AS/NZS 1254 PVC-U pipes and fittings for stormwater and surface water applications
- AS/NZS 1260 PVC-U pipes and fittings for drain, waste and vent applications
- AS/NZS 61386.21 Conduit systems for cable management
- AS/NZS 2053 PVC conduit for electrical installations
- AS/NZS 5065 Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications
- AS/NZS 4401 Plastics piping systems for soil and waste discharge (low and high temperature) inside buildings – Polyethylene (PE)
- AS/NZS 2439 Perforated drainage pipe and associated fittings.

Smart, multi-layer extrusion technology

For some non-pressure pipes, such as PVC, there is special technology known as multi-layer or sandwich construction. This process allows recycled material to be used in the core layer of the pipe between the inner and outer layers of virgin material. This means the core layer can be any colour, density or formulation of rigid PVC. Multi-layer pipes have the same performance as single-layer solid wall pipes.

FIGURE 6

Diagram of a multi-layer pipe showing the three layers



A LONGSTANDING COMMITMENT TO SUSTAINABILITY

The plastic pipes industry has a strong track record of environmental responsibility, with a clear focus on reducing waste and diverting valuable materials from landfill. Our efforts span the full product lifecycle—from best-practice material sourcing and efficient manufacturing to robust end-of-life stewardship programs.

For more than two decades, we've successfully incorporated post-consumer and pre-consumer recycled materials into new pipes where standards permit. These products retain their performance and durability, supporting long service lives while reducing environmental impact.

Importantly, there is now capacity to increase the use of recycled materials across a wider range of non-pressure products—provided that suitable waste stream volumes become available. This presents a significant opportunity to further advance circularity within the industry, without compromising quality or compliance.

We're Part of the Solution

PIPA and its members are taking real, measurable action to reduce the impact of plastic pollution. Through industry collaboration and practical programs, we're helping divert plastic waste from landfill into high-quality, long-life pipe products—manufactured to meet strict Australian and international standards.

Our key initiatives include:

- Plastic Pipe Recycling Program – A national initiative providing locations and contact details for PIPA members and established recyclers, making it easier for end users to return surplus and waste pipe for recycling.
- Collaborative Industry Engagement – Partnering with key stakeholders including government, Standards Australia, Green Building Council of Australia (GBCA), Infrastructure Sustainability Council (ISC), and water and gas industry bodies to drive sustainable practices across the sector.
- Education & Pilot Programs – Working with industry to improve post-consumer recovery through awareness campaigns and on-the-ground trials.
- Recovery Partnerships – Establishing direct agreements with major plastic pipe users to collect off-cuts and end-of-life products for responsible recycling.
- Technical Support – Offering expert guidance on recycled material evaluation and performance testing to ensure recycled content meets all quality and safety benchmarks.

Our Commitment

Across every stage of the pipe lifecycle, PIPA members remain committed to advancing sustainability—without compromising product performance, industry standards, or public safety.

GLOSSARY OF TERMS

POST-CONSUMER [1 & 2]

Plastics material generated by households or by commercial, industrial, and institutional facilities in their role as end-users of the product that have fulfilled their intended purpose or that can no longer be used.

PRE-CONSUMER [1, 2 & 3]

Plastics material diverted from the waste stream during a manufacturing process or from unused products. Excluding manufacturers own rework, regrind or scrap.

PVC

An economical and versatile thermoplastic polymer, derived from vinyl chloride monomer – a chlorinated hydrocarbon. PVC is 57% chlorine by mass which is sourced from the abundant natural resource – common salt.

POLYETHYLENE (PE)

It is the world's most widely used thermoplastic polymer and is produced by the polymerisation of ethylene gas, a derivative of the petroleum industry. The polymer consists essentially of long-chain molecules of very high molecular weight, made up of many thousands of the – CH2 – repeating unit.

POLYPROPYLENE (PP)

A tough, rigid and crystalline thermoplastic polymer produced via chain-growth polymerisation from the monomer propylene. It is the second most widely produced commodity plastic after polyethylene.

REWORK MATERIAL [2]

Plastics scrap material which is generated from the manufacturers own production of pipes or fittings that has been retained within plants owned and operated by the same legal entity (also known as own re-processed material).

Rework is not classified as recycled content.

Note: Transportation from one plant to another of the same legal entity is considered as retained.

RECYCLED MATERIAL [2]

Plastics material resulting from the recycling of post-consumer and/ or pre-consumer plastics products, reprocessed that can be made into pipes or fittings in accordance with the relevant product Standard.

THERMOPLASTIC

In simple terms it means they can be cut up, remelted, and reformed into another shape or new product and hence easily reprocessed and recycled.

VIRGIN MATERIAL [2]

Plastics material in a form such as granules or powder, which has not been previously processed other than for compounding, and to which no rework or recyclable materials have been added.

Notes:

1 Definition is based on AS 14021 "Environmental labels and declarations – Self declared environmental claims (Type 2 Environmental Labelling) (ISO 14021:2016MOD)."

2 Definition is based on CEN/TS 14541.1 "Plastics pipes and fittings – Utilisation of thermoplastics recyclates Part 1 Terminology."

3 Previously defined as Post-Industrial.

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