



CIRCULARITY IN PRACTISE

INTEGRATING CIRCULAR ECONOMY INTO COUNCIL BUSINESS

ABSTRACT

An overview of findings following industry research and an overseas study tour to Canada and the United States

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2022 Municipal Engineering Foundation Victoria Overseas Study Tour Report

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Executive Summary

Economies across the planet rely on extracting resources and/or making things from them in order to create value and satisfy many of humanity's needs and desires. At present, approximately 100 billion tonnes of materials are consumed globally each year (Circle Economy, 2023) and it is estimated that more than a third of Earth's natural resources have been used by humans in the past thirty years (Overuse of Resources on Earth, 2023).

In contrast to our current global economy, a circular economy keeps materials and products in circulation for as long as possible so that the maximum amount of value is extracted from each resource, and materials are not wasted. The concept mimics many of nature's cycles which can occur almost indefinitely with little to no loss of resources (Wadhvani, 2022). The benefits of a more circular economy include a more sustainable rate of material use, reduced biodiversity loss, lesser pollution, better air quality and a decoupling of economic activity from resource use.

Legislation arguably has the greatest potential to stimulate a shift towards a more circular economy, but it should not be solely relied upon. Given most people can contribute towards a more circular economy in the way they live and do business, a collective effort is needed to have the greatest impact.

Whilst the development of a more circular economy is not currently core business for Councils, they can contribute towards a more circular economy given the breadth and scale of services and works they deliver.

This report contains 12 recommendations in relation to applying the circular economy concept to municipal infrastructure. The recommendations relate to:

- Advocating to the State Government to broaden the Circular Economy (Waste and Recycling) Act 2021 to oblige resource intensive sectors like the construction industry to minimise waste and maximise resource reuse (Recommendation 1);
- Using the planning scheme to incentivise the provision of more sustainability measures in developments (Recommendation 2);
- Integrating circular economy principles into Council's procurement policy, key strategies and its business case framework (Recommendations 3,4 and 5);
- Procuring renewable energy (Recommendation 6);
- Conducting a material flow analysis to better understand the circular economy and identify opportunities for both economic and environmental outcomes (Recommendation 7);

- Raising the bar on sustainability requirements when renewing major service contracts (Recommendation 8);
- Having a strong community education and engagement program to encourage better household waste management (Recommendation 9);
- Objectively evaluating trials of new products, technologies and services to minimise the risk of them being prematurely “written off” (Recommendation 10);
- Collaboration and the need to share information about successes and failures (Recommendation 11); and
- The importance of investing in professional development so that industry professionals stay up to date with best practise and industry advancements (Recommendation 12).

There is a need for a considered approach to contributing towards a circular economy as it is one of many different pursuits that organisations can embrace. This includes:

- Focussing on reviewing and tweaking current work practices and activities to be more circular rather than doing additional work on the periphery;
- Setting up an evaluation methodology so that successes are recognised, failures are learned from and decisions in relation to circular economy initiatives are data driven;
- Objectively analysing “green” or “environmentally friendly” products and services to ensure they offer more than just clever marketing; and
- Watching out for solutions where materials lose inherent value, particularly where recyclable materials are reused in a way where they become effectively unrecoverable.

1 Introduction

Until late 2022, I managed several key functions for a municipal Council in one of the fastest developing areas in Victoria. This included the delivery of Baw Baw Shire Council's Capital Works Program, its environment sustainability efforts as well as its waste management and resource recovery.

This spread of responsibility provided insight into the variety of different challenges that each area/team faced, but also highlighted some consistent overarching themes. Each area/team was trying its best to:

- Preserve the environment whilst delivering services and works to support a growing population in a financially responsible fashion;
- Minimise the environmental impact of the municipal population and visitors to the area;
- Respond to increasing expectation for sustainable works practises and services;
- Stay up to date with, and work within, the boundaries of relevant legislation;
- Prioritise what it invested its time into given a multitude of different pressures, including working within a heavily constrained financial and labour force (primarily the result of a rate capped environment); and
- Find enough time to plan and deliver strategic initiatives whilst keeping up with day to day demands.

Over recent years, the circular economy concept had started to get some traction in the local government sector in Victoria. After completing a course delivered by the United Nations System Staff College on the Circular Economy in 2022, it became clear that on face value the concept in action could help to address challenges like environmental degradation, biodiversity loss, waste and pollution. Whilst broadly there are clear benefits of a more circular economy, I felt that further research was needed in order to understand how a Council like Baw Baw Shire could practically contribute.

This research and report was made possible through the Municipal Engineering Foundation of Victoria's Overseas Study Tour Scholarship program as well as support from Baw Baw Shire Council. It summarises my observations and thoughts about how to practically apply the circular economy concept in a Council setting whilst being considerate of the multitude of other demands and pressures that Councils face.

2 The Challenge

People need to consume to live.

The basic consumables to support humanity include air for breathing, water for drinking, food for eating and materials for clothing and maintaining appropriate sanitation and shelter. However, in addition to these essentials, we have developed to consume an ever increasing amount of goods and services in order to enrich our lives, including various means of private transport, houses, appliances, computers, phones, furniture as well as travel and entertainment (World Centric, 2021).

Since 1970, global consumption of materials has more than tripled to approximately 100 billion tonnes per year (a breakdown of this volume is provided in Table 1).

| Materials consumed | By weight in 2022 (Billion Tonnes) |
|------------------------------------|------------------------------------|
| Non-metallic minerals | 42.8 |
| Metal Ores | 9.4 |
| Fossil fuels | 15.5 |
| Biomass, including crops and trees | 24.9 |
| Recycled materials | 7.2 |

Table 1 Distribution (by weight) of materials being consumed globally (Circle Economy, 2023)


The percentage (by weight) of materials recycled compared with extraction volumes has been in decline since at least 2018 and is primarily a result of increased virgin material extraction and supplying more materials into roads, homes and durable goods.

According to a study by the World Wildlife Fund (WWF), more than a third of Earth's natural resources have been used by humans in just thirty years. In addition, it is estimated that the world currently needs 1.8 planets to sustain current rates of resource consumption (Overuse of Resources on Earth, 2023), and this is expected to creep to 2 planets by 2030 (Sustainability for all, n.d.).

Many economies are founded upon the consumption of finite resources, given the incentives for employment, wealth and trade. It is therefore not surprising that first world countries consume more resources per capita than developing countries and it is a known fact that resource consumption is not shared equally across the global population. Currently, 80% of the world's resources are used by 20% of the world's population (Sustainability for all, n.d.).

“If the Earth’s history is compared to a calendar year, modern human life has existed for 37 minutes and we have used one third of Earth’s natural resources in the last 0.2 seconds”

(Overuse of Resources on Earth, 2023)



With urbanisation, a growing global population and more countries maturing from their developing past, demand for materials across the planet is at an all-time high. This places significant pressure on the planet to support us.

A framework was developed in 2009 by the Stockholm Resilience Centre called the Planetary Boundaries Framework for the purpose of assessing our planet's health. Nine planetary boundaries were established to identify key ingredients to Earth's stability and resilience, and to articulate the limits under which humanity can safely continue to thrive. In 2023, five of the nine planetary boundaries have been exceeded which means we are causing irreversible change to the planet. The exceeded boundaries include climate change (measured in carbon dioxide concentration in the atmosphere), chemical pollution, biodiversity loss and land system change (Circle Economy, 2023).

3 What is a circular economy?

A significant chunk of our current global economy is based on extracting materials from the Earth, making things and then eventually disposing of them as waste. This is a relatively linear process from extraction through to disposal.

In contrast, a circular economy keeps materials and products in circulation for as long possible so that the maximum amount of value is extracted from each resource (see Figure 1), and materials are not wasted. The concept mimics many of nature's cycles which can occur almost indefinitely with little to no loss of resources (Wadhvani, 2022).

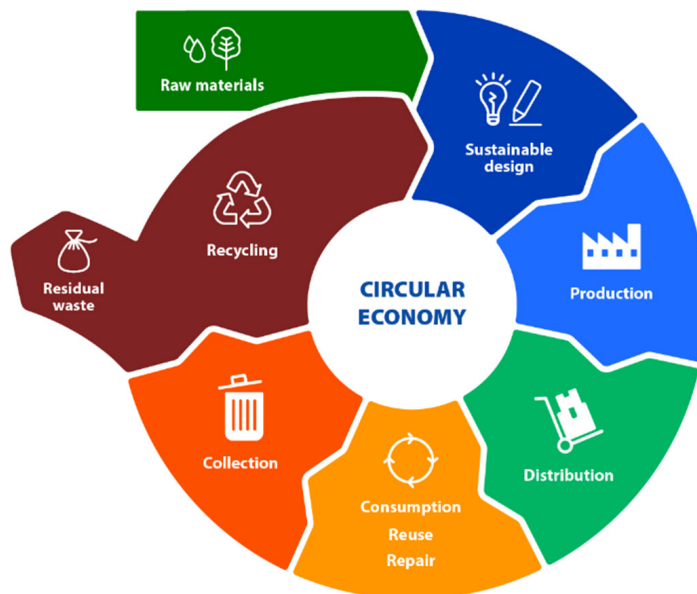


Figure 1 A summary of the circular economy concept.
Image source: European Parliament, 2023

The circular economy concept also seeks to accelerate the transition to renewable resources sooner, so that our reliance on ultimately finite resources is addressed. The concept recognises that resource extraction, consumption and disposal cannot continue in its current form forever, on the basic principle that the planet's resources are finite and cannot sustain an ever growing global population over the long term.

It is estimated that virgin material extraction could drop by around one-third if a circular economy can be developed for the global food system, the built environment, manufactured goods and consumables as well as for mobility/transport. This would result in the five currently exceeded planetary boundaries being reversed. Unfortunately, we have a long way to go before this occurs. It is apparent that the global economy is becoming less circular. At present, only 7.2% of all material inputs into the global economy are from materials that have been recycled. This has reduced from 9.1% in 2018 (Circle Economy, 2023).



4 Why is the circular economy concept important?

The circular economy concept is a useful tool to assist with holistic thinking and decision-making to create less wasteful and more sustainable economies. It can help people appreciate the bigger picture but also understand what they can do to contribute.

If greater circularity can be achieved, the pressure of human existence on the planet will be reduced. Whilst the circular economy in practise will result in changes to the way society operates, substantial economic benefits are predicted through new job and service creation.

A shift towards considering the circular economy concept in Victoria?

There are several drivers influencing a shift towards using the circular economy concept in Victoria. These include:

- There are presently significant challenges in delivering infrastructure projects. An unprecedented investment into infrastructure has impacted material availability and costs, as well as affected the supply and demand for most trades. The circular economy concept can be used to assist to crosscheck the need for replacement infrastructure as well as to optimise material consumption and works practises.
- Waste management practises are currently shifting, partly as a result of legislative drivers but also as a result of landfill capacity limitations. The circular economy concept can be used to identify measures to minimise the creation of waste in the first place.
- Councils are facing financial strain as a result of rate capping not keeping up with the cost of materials and services. There are opportunities for financial savings when considering Council business from a circular economy perspective.
- Government in general has a social responsibility for current and future generations. Working towards a more circular economy will ultimately benefit the current generation as well as those ahead of us.

Example 1: Circular Economy (Waste Reduction and Recycling) Act 2021 - Victoria, Australia.

Victoria has made some headway on its circular economy journey with the State Government's introduction of the Circular Economy (Waste Reduction and Recycling) Act in 2021. The Act provides the foundation for Victoria's transition to a sustainable and thriving circular economy, including enabling laws for the new container deposit scheme and new state-wide four-stream household waste and recycling system.

This legislation is driving behaviour change and is influencing the way in which household waste is managed across the state. Victorian Councils have been changing their waste management services to meet the requirements of this legislation; a change that will see greater consistency of service standard across the state as well as an increase in the amount of waste diverted from landfill into the developing onshore recycling sector.

6 Legislation – a key instigator for change

Legislation holds a key role in the transition to a more circular economy. It can drive behaviour change, force market innovation where commercial drivers don't currently exist and fast track standardisation.

Legislation arguably has the greatest potential to stimulate a shift towards a more circular economy, but it should not be solely relied upon. Given most people can contribute towards a more circular economy in the way they live and do business, a collective effort is needed to have the greatest impact. Should we rely upon legislative drivers alone, a key opportunity is missed for crowd sourcing a swell of change in this space based on people wanting to make a difference rather than just responding to new regulations and laws.

Example 2. The impact of CalGreen - The Michelle and Barack Obama Sports Complex, Los Angeles, CA, US.

The California Green Building Standards Code, known as CalGreen, was first adopted in 2009 as the first state wide green building code in the US. The code was created to improve public health, safety and general welfare by enhancing the design and construction of buildings through the use of building concepts that:

- *Have a reduced negative environmental impact,*
- *Have a positive environmental impact, or*
- *encourage sustainable construction practises.*

CalGreen includes both mandatory and voluntary measures. Mandatory measures typically include site selection considerations, storm water controls, water efficiency measures, electric vehicle charging stations, emissions limits, moisture controls, construction waste recycling, indoor air quality and user comfort.

A visit to the recently completed Michelle and Barack Obama Sports Complex in Los Angeles provided an insight into the project's requirements in relation to CalGreen. In addition to relatively common sustainability measures such as a large solar system installation, electric vehicle charging infrastructure, under carpark bioswales, permeable pavements, alternative transport mode support and glass panel placement/skylights to minimise the need for artificial lighting, CalGreen required a minimum recovery and/or reuse of 65% of non-hazardous construction and demolition waste.

Based on advice from the project's architect, this material recovery requirement has generally added a few percent to the cost of building projects however has resulted in greater consideration at the design stage of waste minimisation and the recyclability of materials for when the building reaches its end of useful life. Ultimately, this practise helps to increase the amount of materials that are recycled during the demolition phase of a building project and to conserve resources across the state of California.

Example 3. Stormwater Utility Fees - The Village of Downers Grove, IL, US.

In 2013, the Village of Downers Grove introduced a stormwater utility fee. The fee is used by the village to support and maintain its stormwater infrastructure. It is charged to all property owners and is determined by the amount of impervious surfaces on their properties.

The Village of Downers Grove offers financial savings in relation to this stormwater utility fee for properties that reduce their stormwater runoff and subsequent reliance on public stormwater infrastructure. Credits are offered for properties that install rain barrels and other water conservation measures such as rain gardens, permeable pavers and dry wells.

In 2015, the Village adopted a revision to its stormwater ordinance that requires all developments that result in a new impervious area of greater than 700 square feet to install Post-Construction Best Management Practises. These regulations reduce the amount of runoff flowing onto adjacent properties but also reduce the amount of stormwater entering the public portion of the stormwater management system.

Both of these initiatives by the Village of Downers Grove help to ensure that the useful life of the existing public stormwater infrastructure is maximised and reduce the need for existing public asset upgrade. This conserves materials and reduces emissions.

RECOMMENDATION 1:

That the Victorian State Government broaden its Circular Economy (Waste Reduction and Recycling) Act 2021 to oblige resource intensive sectors like the construction industry to take greater responsibility for minimising waste and maximising resource reuse.

7 Key opportunities for Councils to integrate circular economy

Whilst the development of a more circular economy is not currently core business for Councils, they can play a key role in contributing towards a more circular economy in their municipality and region. Councils do have the ability to make a difference given their close connection with their communities, the range of services procured and capital works planned, delivered and maintained. Here is an overview of some of the ways in which a Council can support a transition towards a more circular economy.

A. The role of the planning scheme (and relevant bylaws)

One particular mechanism for Councils to instigate change over time is their planning scheme. Under Victoria's planning system, Councils and the State Government have developed planning schemes to control land use and development, as well as protect and conserve land.

There is an opportunity through planning scheme revision to better manage urbanisation through considered and appropriate redevelopment. Compared with half a century ago, there is a greater appreciation of the benefits of constructing natural assets in comparison with purely concrete and steel based installations. Naturalisation (or better integration of the built form into nature) of previously industrialised or urbanised areas during redevelopment is becoming more common. This results in manmade infrastructure installations such as concrete drainage channels being returned to creeks and natural waterways as well as the restoration of habitats previously destroyed by industrialisation.

The planning scheme can also be used as a lever for commercialising the inclusion of sustainability and circular economy outcomes. One of the challenges is that green technologies and sustainable products can be more expensive than their more traditional equivalents. As a result, it is often difficult to rationalise requirements for developers to go above and beyond the status quo. In order to stimulate greater willingness to support green technologies and sustainable products, conditional benefits should be explored for your planning scheme so that mutually beneficial outcomes are achieved for both the developer and the authority.

Several examples of this in practise were noted on the tour, including one city offering considered dispensation on height restrictions for developments in return for the inclusion of a series of active transport and sustainability measures. It was also encouraging to see the take-up of repurposing infrastructure and buildings. Most notably, redundant rail infrastructure and manufacturing facilities were commonly being used for restaurants, food hubs and urban parks. Repurposing infrastructure in this fashion helps with a more circular economy as it maximises an asset's lifespan before needing demolition and reduces the need to build new infrastructure. It also helps to conserve pieces of history in the local areas for the benefits of current and future generations.

Example 4. Little Sugar Creek Greenway - Charlotte, NC, US.

In the 1990s, Mecklenburg County set out to uncover the hidden value of the Little Sugar Creek; a creek which divides the centre of Charlotte. At that stage, the creek had been described as heavily polluted and an eyesore, with its mid town section hidden from view by a substantial concrete cap. Buildings traversed the cap, including a shopping mall dating back to the mid 20th century.

Following a significant investment into the deurbanisation of the creek (through property acquisitions, the relocation of businesses, bank restoration, extensive planting, confirming floodway capacities and consideration of the adjacent freeway) as well as mutually beneficial public/private partnerships for abutting development, the waterway is now recognised as a key community asset and provides greater integration of the built form into the existing landscape.

In particular, the Metropolitan development (a \$162M mixed use development) demonstrates how heavily urbanised areas can be viably redeveloped whilst providing for the reinstatement of natural assets previously destroyed by past development. This development included the revitalisation of 800 metres of creek and adjacent vegetation to provide users of the adjacent shared pathways, private dining areas and plazas (LandDesign, n.d.).



Figure 2 The Metropolitan development adjacent to Little Sugar Creek in Charlotte. Image source: LandDesign, n.d.

The reinstatement of natural assets as part of land redevelopment should be maximised to support a better balance between human impact and natural asset conservation. The City of Charlotte's planning ordinance assisted to reinvigorate biodiversity and the populations view about the value of nature.

Example 5. Repurposed buildings for community spaces

A. Evergreen Brick Works – Toronto, ON, Canada.

In 2010, the non for profit organisation Evergreen transformed a collection of deteriorating heritage buildings (originally a brick manufacturing plant and quarry) into a showcase for green design and public space. The site operates as a community hub and hosts public markets, conferences, events (including an ice rink in winter), outdoor learning, a community garden, pop up retail, public art as well as areas for nature play and education. Over 500,000 people visit the site annually which indicates the community acceptance of infrastructure which has been reinvigorated and repurposed.



Figure 3 Repurposed brick manufacturing equipment retained for onsite heritage value in an event space in Toronto

B. The Distillery District – Toronto, ON, Canada.

The Distillery District of Toronto is a repurposed industrial area which now houses a collection of arts, dining, shopping and entertainment. Nearly fifty buildings over the past two decades have been retrofitted and repurposed. The result is a thriving area that attracts local and tourists alike.



Figure 4 Previously redundant industrial buildings and infrastructure have now been repurposed without the need for substantial demolition and construction in Toronto

C. Roundhouse Park – City of Toronto, ON, Canada.

Roundhouse Park is a 17 acre public park in the centre of downtown Toronto. It includes the John Street Roundhouse which previously formed part of Toronto's railway lands. It now cleverly houses Toronto Railway Museum, a collection of locomotives in the park, a brewery as well as a restaurant and entertainment complex. This is another example of redundant infrastructure being repurposed for another means, reducing the need for demolition and demand for materials to support new construction.



Figure 5 Repurposed rail infrastructure in the heart of Toronto

Example 6. Unified Development Ordinance - City of Charlotte, NC, US.

The City of Charlotte has recently adopted its Unified Development Ordinance (UDO). The UDO:

- Requires electric vehicle charging station installation for all new parking lots associated with multi-dwelling residential and mixed use developments.
- Requires bike parking for most types of development.
- Offers maximum height and open space reduction development bonuses if proposals can include actions such as:
 - additional electric vehicle charging stations,
 - high performance building construction standards,
 - the provision of space for future transit rights,
 - Mitigations for demands on existing transport infrastructure, and/or
 - Electronically locked bike lockers.
- Is supported by Comprehensive Transportation Review Guidelines which requires large traffic generating developments to implement mitigation measures to balance out different transportation modes and support the needs of people walking, biking and using public transport in the city.

This is a notable example of the integration of commercial incentives to build more sustainable developments in a planning scheme. Ultimately this increases the viability of developments that support active transport, the switch to electric vehicles (which are intended to be supported by renewable energy) and have reduced demand for energy during operation.

Example 7. The Toronto Green Standard - City of Toronto, ON, Canada.

The Toronto Green Standard (TGS) was first introduced in 2006 and sets out the sustainable design requirements for private and city-owned developments. It has tiers of performance measures that promote sustainable site use and building design. The first tier of the TGS is required to satisfy the requirements of Toronto's planning approval process. Three other tiers exist and set out voluntary standards.

The City of Toronto have introduced a Development Charge Refund Incentive Program in order to assist with their goal of achieving net zero emissions before 2030. This program provides developers with partial refunds on development application fees in exchange for their development achieving the requirements of the voluntary tiers. To date, 150 projects have participated in the program resulting in more developments being delivered to high performance green infrastructure standards.

This is an example of a local government recognising its ability to influence the commercialisation of sustainability through the implementation of its planning scheme.

Example 8. Green Roof Bylaw - City of Toronto, ON, Canada.

Toronto was the first city in North America to adopt a bylaw to require new developments to incorporate green roofs. The requirements impact developments larger than 2000 square metres, with graduated green roof requirements ranging from 20% to 60% of the available roof space.

There are now over 1000 green roof installations spanning 500,000 square metres exist across the city. This has assisted to reduce pressure on existing utility infrastructure by:

- Improving the energy efficiency of buildings, and*
- Reducing stormwater runoff.*

This has prevented the unnecessary upgrade of existing infrastructure.

RECOMMENDATION 2:

Introduce planning scheme incentives to encourage more sustainability measures in developments.

B. The role of policy and strategy

One of the benefits of the circular economy concept is its holistic nature. However this can make it difficult to develop a collective set of specific actions that will ultimately result in a circular economy.

The circular economy concept can be applied to many different service areas within Councils, and the resultant actions may be very different. The important point to recognise is that each service area can make a contribution to a collective circular economy transition.

Once the circular economy concept becomes more broadly understood, it would be good for the development of policies and strategies to consider it in the same way that other overarching requirements are already accepted as required ie. environmental preservation, climate change adaptation, affordability, human rights and accessibility.

Whilst some organisations have approached their contribution towards a more circular economy through a standalone circular plan or strategy, there is a need to reflect on current working practises, policies and strategies across the organisation rather than a focus on doing more by having another strategy. Existing Council plans and strategies including those relevant to economic development and energy management can have a significant impact on how circular the local and regional economy is.

Example 9: Circular Charlotte - City of Charlotte, NC, US.

In 2018, the City of Charlotte became the first city in the US to adopt a circular economy strategy. It is described as being an economic development strategy than focuses on current waste management practises as an instigator for change and a potential untapped employment market for the City. The Strategy identifies a vision and documents a road map forward, as well as five specific business cases as starting points for action.

We visited the outcome of one of the five business cases being the Innovation Barn – a materials innovation lab. Further information about the Innovation Barn is found later in this report.

The Strategy is a good example of:

- A carefully considered approach which recognises the potential of focussing on a few big ticket items rather than a shopping list of smaller items.*
- Having a go at making a difference from a circular economy perspective.*
- A Council which appreciates the benefits of supporting a more circular economy from not only an environmental perspective but also the opportunities for employment and economic development.*

Example 10: Strategic energy action plan - City of Charlotte, NC, US.

The City of Charlotte's Strategic Energy Action Plan is an excellent example of a Council strategy that has actions that will contribute to a more circular economy. This Plan includes actions such as:

- Amendments to the planning ordinance to require EV charging infrastructure for all new developments.
- Having a fleet policy that mandates the purchase of the lowest emission vehicle that meets the identified needs of the organisation as well as a life cycle cost assessment.
- A network of electric vehicle charging stations across the city (noting that the City of Charlotte already manage approximately 60 charging stations, with another 50 that are privately owned).
- Trials of electric buses, electric utilities and an electric fire truck.
- Revising the City of Charlotte's Sustainable Building Policy to include solar panels and centrally managed climate control systems for all buildings.

RECOMMENDATION 3:

Integrate circular economy principles into relevant policies and strategies, particularly those relevant to economic development, waste management and sustainability.

C. Business cases and project planning

Councils generally have a framework for the development and consideration of business cases for operating initiatives and capital projects. Over time, these frameworks have been developed and refined to ensure that initiatives and projects are well considered before being funded. Many of the business case considerations are linked to political, economic, social, technological, environmental and legal factors. The circular economy concept spreads across all of these factors. Giving consideration to the circular economy concept as part of your business case development and evaluation process will help to ensure that sufficient thought has been put into:

- Considering operating models and demands upfront.
- How the project might contribute to the regeneration of natural systems.
- Waste and pollution minimisation through design.
- What can be done to ensure efficient use of materials.
- The use of recycled products and/or emerging green technologies.
- What will happen at the end of the proposed asset's life.
- Supporting the local economy by ensuring that products and/or services are able to be sourced locally or within the region.
- Whether there is an alternate way to deliver the intended service outcome ie. repurposing an existing asset rather than building new or even the consolidation of assets (checking that there a genuine need to replace the asset).

Whilst it can be a daunting and challenging task to trial new products, technologies or services, a risk based approach as well as research about others' experiences will help to reduce the likelihood of failure. A sufficient level of analysis should be undertaken to ensure that key risks and expected benefits are understood before decision makers commit funding towards any trial.

An agreed approach to objectively evaluating the intended outcome should also be considered in order to inform future decision making about the performance of the trialled product, technology or service. Whilst there is no one agreed method to evaluate projects that deliver circular economy outcomes, there are existing tools that already exist that can assist.

Example 11. Tools that can assist with the evaluation of circular economy initiatives.

A. LEED certification - CA, US.

LEED (Leadership in Energy and Environmental Design) is a third party green building rating system that assesses and certifies buildings from an efficiency and sustainability perspective. It intends to raise the bar on buildings standards to address energy efficiency, water conservation, site selection, material selection, day lighting and waste reduction. It was developed by the U.S. Green Building Council, which is a private membership based non-profit organisation. It claims to be the world's most widely used green building program having assessed over 100,000 projects globally since it was first established in 2000. In 2022, 386 projects were assessed across California alone. It appears that there are similarities between California's green building code CalGreen and LEED. Both contribute to building projects that are more energy efficient and that consider resource conservation through design and delivery.

B. Envision rating system - City of LA, CA, US.

The Institute for Sustainable Infrastructure (ISI) developed and manages the Envision sustainability framework and assessment tool. It is intended to aid decision makers and help project teams across North America to examine the sustainability and resiliency of all types of civil infrastructure. It includes 64 sustainability and resiliency criteria across planning, design and construction as well as the project's operations, maintenance and end of life phases, and provides a third party project verification. Over 200 hundred public agencies across the USA recognise or use Envision to guide infrastructure development. In 2015, the Los Angeles County Department of Public Works adopted Envision. In 2016, the City of Los Angeles City Council also approved the use of Envision. The Envision system can be used to help engineers, planners and decision makers to broadly consider the social, environmental and economic impacts before, during and after a project.

RECOMMENDATION 4:

Integrate circular economy principles into your business case framework so that it is thought about when projects and services are being planned and considered for funding.

D. Procurement

Councils in Victoria expend more than \$8 Billion per year. The way in which Councils expend this on works, goods and services can influence the circularity of materials.

As a requirement of the Local Government Act, each Council has a procurement policy to manage and control their purchasing. Procurement policies in Councils represent an opportunity to build in consideration of the circular economy concept as a business as usual activity. Many Council procurement policies are based on identifying the product or service that offers best value. The circular economy concept can be integrated into the decision making process for determining best value through strengthening the consideration of:

- Recycled content;
- buying higher quality goods that come with a longer expected useful life;
- Repairability; and
- The potential for reuse at end of useful life so that waste to landfill is minimised.

The specifications that each Council define for works, products and services can also collectively influence the circularity of local and regional economies. Many organisations, including Councils, do not have the necessary capacity or capability to undertake their own extensive research and development needed to keep specifications and standards up to date with industry best practise. However, standardised industry standards and specifications provide a way to drive market consistency and can collectively influence supply markets and service providers.

As a result, industry bodies that define and update standards and specifications for both services and infrastructure play an important role in the transition to a more circular economy. Organisations like Councils are reliant upon a multitude of industry based standards and specifications, and trust that the necessary research, development and testing has taken place to ensure that any new standards and specifications will provide acceptable short and long term outcomes for work practises and asset performance.

Councils' primary role regarding industry wide specifications is to ensure that the latest standards and specifications are known about, specified and understood in a timely manner. This will help to ensure that environmentally friendly advancements in industry practises become the norm more quickly. Memberships to a variety of industry bodies can assist the relevant practitioners within Councils to stay up to date with the latest standards and advancements in relation to specifications.

It appears that one of the key starting points for organisations wanting to put the circular economy concept into practise is to undertake a material flow analysis. This work identifies what materials are being used, what they are being used for and what happens to them after use (ie landfill, recycling etc). Given the variety and breadth of services delivered by Councils, a substantial amount of procurement activity is undertaken in a disaggregated manner so it can be difficult for most staff to appreciate what materials are being procured, how they are being used and how they are being disposed of. A material flow

analysis provides a platform for decision makers to appreciate the reliance of the organisation on materials and natural resources and helps to identify opportunities for improvement (both from a circular economy perspective but also an economic perspective) with regards to consolidating disaggregated procurement.

Example 12: Toronto Material Flow Analysis - City of Toronto, ON, Canada.

The City of Toronto initiated a material flow analysis for three key sectors of their economy in 2020 as part of its Baseline for a Circular Toronto study. The three sectors focussed on were construction, waste management and food. The study helped:

- To map out how resources like metals, fossil fuels and biomass move through the city.
- To understand the City's current state of circularity.
- To appreciate that Toronto's economy uses large amounts of materials and natural resources each year (ie. The construction sector alone uses 17 million tonnes of material per year), which is having an impact on the environment.
- To contextualise how Toronto's current economy generates 2.1 million tonnes of waste each year.
- To confirm that with no intervention, material consumption and waste generation are expected to continually increase in each key sector.
- To provide a platform for data driven decision making in relation to the next steps towards circularity for the City.

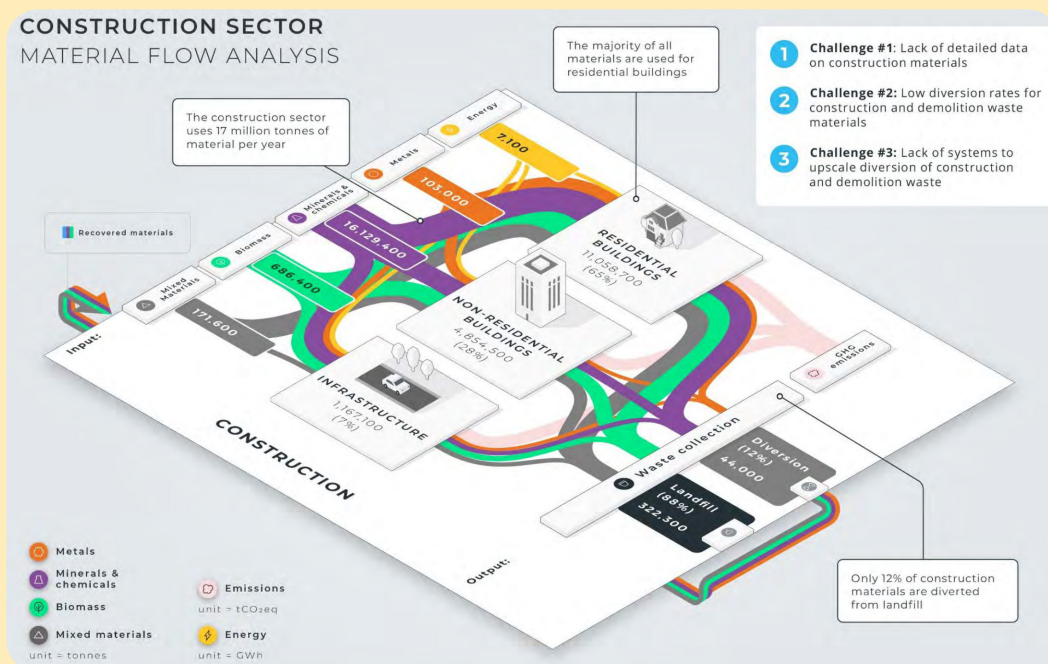


Figure 6 City of Toronto's Material Flow Analysis for the construction sector. Source: City of Toronto; Circle Economy; David Suzuki Foundation, 2022.

A quick win for Councils for contributing to greater circularity is to purchase energy from renewable sources. Globally, over 15 billion tonnes of fossil fuels are consumed each year. The use of these fossil fuels contributes to air quality and emissions. It is encouraging to see most Victorian Councils already purchasing renewable electricity as a result of the Victorian Energy Collaboration – the largest emissions reduction project ever undertaken by the local government sector in Australia.

RECOMMENDATION 5:

Integrate the consideration of circular economy principles into your procurement policy to stimulate behaviour change and innovation through expenditure.

RECOMMENDATION 6:

Purchase renewable energy where available.

RECOMMENDATION 7:

Conduct a material flows analysis to understand what the circular economy is about and to identify ways to increase recycling and reduce material consumption.

E. Project and service delivery

There are significant circularity opportunities in service delivery as well as in delivering projects.

Given it is estimated that 80% of all product-related environmental impacts are determined during the design phase, decisions made by project teams can significantly influence the environment footprint of infrastructure projects during the project planning, design and delivery phases. Day to day project decisions can collectively have a material impact on virgin resource demand, material re use and the preservation of habitat and biodiversity. A project team structure that includes at least one senior ranked person with an understanding of the circular economy will be a step towards achieving a more sustainable future.

As previously mentioned in this report, Council's manage a variety of different services that are either delivered in house and/or outsourced (or a mix between the two). This variety of different services offers point in time opportunities for the integration of greater circularity when contract renewal is needed. Whilst there are operational efficiencies during procurement for like for like replacement contracts, this approach is likely to result in services and works that lag behind best practise. Requirements in relation to minimum percentages and/or volumes of recycled content, material re-use and minimum expected useful life should be drafted, critiqued and then integrated into the new service contracts in order to raise the bar. Many examples exist of organisations pushing the boundaries in relation to these types of requirements so it pays to keep abreast of what is happening in the relevant industries by maintaining industry body registrations, attending webinars/conferences and maintaining a strong professional network.

Example 13: 50% recycled content asphalt - City of Los Angeles, CA, US.

StreetsLA renew and maintain the largest municipal street system in the US, with 23,000 miles of streets and 800 miles of alleys. They operate two municipal asphalt plants, with one plant set up to make asphalt using up to 50% reclaimed asphalt pavement (RAP). This plant generally uses 50% RAP in producing asphalt however the ratio of RAP used is reduced to 30% if the RAP stockpile gets wet. In terms of scale, this plant generally produces about 350 tonnes per hour.

There have been several learnings in producing and using this high RAP content asphalt over the past two decades. They have found that the material's workability is more challenging so they need more experienced works crews during paving. They have also found that their plant needs to run hotter and the product gets cold quicker than a traditional asphalt mix. However, they have found that their high recycled content asphalt has demonstrated its durability in application given the streets on which it is has been used are performing well.

Maximising the re-use of RAP in new asphalt has significant environmental and economic benefits given up to 50% less binder and virgin aggregate is needed. StreetsLA's ratio of RAP in asphalt is far higher than most technical guidelines support. It provides a good case study for those reviewing technical guidelines and standards given the real world testing that the product has been subjected to over two decades on the streets of LA.

The waste management services of Councils are noteworthy in relation to their ability to influence people's waste management practises. Particularly over the past few years, Councils have been changing their waste management services given the introduction of the Victorian Circular Economy Act 2021 as well as other drivers for change including issues with continuity and downstream service delivery in the local recycling sector. Most of the changes focus on increasing the percentage of waste diversion from landfill by providing better options for households and businesses to separate different waste streams at the source.

It is encouraging to see some Councils being more progressive in relation to reducing the size and/or frequency of collection of bins whose contents end up being landfilled. Approximately one third of Victorian Councils are providing a greater contribution to a more circular economy by offering larger recycling bins and/or higher service collection frequencies for recycling, food organics and green organics (FOGO) recycling and glass recycling (noting that a mandatory glass separation service is to be implemented across Victoria by 2027) in exchange for reduced sizing and/or collection frequencies of the residual waste bin. Over time, this service arrangement will drive behavioural change for people to be considerate when purchasing items that generate amounts of non recyclable waste given the practical limitations of not being able to dispose of that waste conveniently.

During project delivery, budget restrictions and the need to “value manage” can be to the detriment of a more circular economy. Approaches which stage the delivery of projects, reduce the quality of the end product or that remove sustainability elements (with a view that they are nice to have rather than essential) in order to satisfy budget restrictions can result in infrastructure which does not meet expected useful life, needs premature rework and/or that builds in operational inefficiencies. Project managers need to do their best to ensure that those involved in decision making about project inclusions, scheduling and budgets are cognisant of the environmental and operational impacts of poorly considered “value management” and works timing.

Example 14. Green Streets Technical Guidelines - City of Toronto, ON, Canada.

The City of Toronto published Green Streets Technical Guidelines (GSTG) in 2017 for staff, developers and consulting engineers. The GSTG provide guidance, standards and selection tools for the planning, design, integration and maintenance of a range of green street options and intend to improve understanding and ensure that green streets are both attractive and functional (City of Toronto, n.d.). The guidelines are accompanied by Green Infrastructure and Vegetation Selection tools to help practitioners identify site specific green infrastructure options that are viable for implementation as part of a street retrofit or reconstruction project. Drawings are provided to ensure that the delivery of green infrastructure is completed consistently.

The GSTG help the City of Toronto to integrate environmental sustainability into street projects by incorporating natural and manmade elements into street retrofits and reconstructions as well as new projects. Examples of the types of green infrastructure delivered include street trees, green walls, high efficiency lighting and low impact development stormwater infrastructure.

RECOMMENDATION 8:

Raise the bar on sustainability requirements when renewing service contracts.

RECOMMENDATION 9:

Have a strong community education and engagement program to encourage better waste management behaviours in the household in order to reduce non-recyclable waste.

8 The need for continued investment into research, collaboration & personal development

There is a need for continued investment into research and collaboration in order to:

- Drive innovation and technological advancement;
- Share learnings and broaden industry understanding;
- Increase the likelihood of new products, works methodologies and services becoming more mainstream within industry;
- Increase the availability of performance data to reduce risk and drive evidenced based decision making; and
- Successfully pool funding to collectively deliver projects and initiatives that wouldn't have otherwise been viable.

Example 15. Waterfront Toronto - Toronto, ON, Canada.

The City of Toronto, Province of Ontario and Canada's Federal Government jointly embarked on a \$2.75B initiative to reinvigorate Toronto's waterfront.

From the mid 1800's until the 1950's, significant filling of Lake Ontario took place in order to expand the shore land and support Toronto's trade (which at the time was primarily undertaken by boat). A significant man made area was created in downtown Toronto by infilling what was once one of the largest wetlands on Lake Ontario (Waterfront Toronto, n.d.). The land was used for industry however much of it was subject to inundation and could not be redeveloped without flood protection works being undertaken.

One of the projects within the Waterfront Toronto initiative includes the Don Mouth Naturalisation and Port Lands Flood Protection. This will reconnect the Don River to Lake

Example 16. Green Infrastructure Partnership Opportunity Program - The Metropolitan Water Reclamation District of Greater Chicago, IL, US.

The Metropolitan Water Reclamation District of Greater Chicago established its Green Infrastructure Partnership Opportunity Program in 2014 to increase the acceptance and investment into green infrastructure in the County. The goals for the program include:

- *Build green infrastructure to reduce stormwater flows to local sewer systems and prevent combined sewer overflows;*
- *Use green infrastructure to address local flooding and draining problems;*

- Promote green infrastructure as a complimentary way to manage stormwater with natural systems;
- Aesthetically enhance public areas and increase a community's "green space"; and
- Provide improvements in water quality.

The program has now partnered with dozens of other agencies to fund projects like rain gardens, bioswales/bioretention areas, permeable pavement systems, and rain water harvesting systems. This program has now resulted in approximately 25 million litres of storage for stormwater, which has significantly reduced the need to upgrade existing combined sewer systems.

Example 17. Toronto and Region Conservation Authority - ON, Canada.

The Toronto and Region Conservation Authority (TRCA) is one of Ontario's 36 conservation authorities and was established in 1957 under the Conservation Authorities Act. The TRCA has six participating municipalities including the City of Toronto and delivers the conservation, restoration, development and management of natural resources. Their Sustainable Technologies Evaluation Program (STEP) provides data, analytic tools and information to support the broader adoption of sustainable technologies and practises in Canada. The TRCA's operating and capital budgets are cofunded by each municipality (City of Toronto, n.d.).

This type of collaboration across municipalities helps to progress environmental regeneration and protection at a regional level, particularly where each municipality in isolation may not have the resources or capacity to focus on delivering meaningful environmental outcomes.

In Australia, the university sector deliver about a third of all research and development for the country including nearly 80% of public sector research (Universities Australia, n.d.). Various universities are looking into the circular economy concept and what it means in practise including Monash University, Melbourne University and RMIT. This research, along with readily available information about trials and new works practises across industry, can help to drive acceptance of newer technologies and products and reduce risk for Councils.

A transition towards a more circular economy will continue to see trials undertaken across the world. It is important to ensure that trials, in particular any reasons for any dissatisfaction and/or failures are understood so that new technologies are not prematurely "written off". As with any new product or innovation, training and education for industry practitioners including designers, contract managers, contractors and site supervisors is essential. In particular, different works methodologies must be understood to reduce the likelihood of avoidable dissatisfaction/failure with the trial.

Example 18. Innovation Barn - City of Charlotte, NC, US.

A materials innovation barn has been setup as an outcome of one of the five key business cases within the 2018 Circular Charlotte Strategy. The Innovation Barn is made

up on a combination of entrepreneurial businesses, zero waste initiatives and a space to convene groups in order to learn more about and implement circular projects.

A range of different initiatives can be seen in action, including:

- Plastic food containers from retirement villages and other establishments being granulated onsite and on sold as an input material for other industries like 3D printing.
- Trialling ways to recycle cans that are still full. When soft drink manufacturers and breweries have non accepted crates of cans that come off their production line, there are current difficulties in recycling the cans.
- Trialling a variety of uses for crushed glass including in concrete and polished floors.
- The provision of reusable heavy duty bags (with QR codes and RFID) to have people source separate certain recyclables like cans. This trial relied upon key community champions working with the innovation barn to provide a high quality low contamination source of certain materials, with contamination rates proving to be less than 1%.
- Growing lettuce and other edible greens using waste water from fish. Water is circulated from a fish tank onto growing greens which use the nutrients but also filter the water before it is returned to the fish tank. Both the fish and greens are reliant upon each other to exist.
- Weaving waste fabrics to make insulation.
- Large event support to ensure recycling takes place ie. with the Coca Cola 600 Nascar event to get all the cans and PET bottles.
- Working with local hardware stores to provide local timber to sell that is sourced from trees cut down in the city.
- Working with local furniture manufacturers to create timber furniture using the trees that are cut down by the City of Charlotte.
- Working with local supermarkets and farmers to coordinate the distribution of near expired foods to lower socio economic areas within the city.
- Hosting corporate events to encourage thinking about sustainable behaviour.

The innovation barn is cofounded by the City of Charlotte and helps to trial and promote circularity. Whilst some of its trials are not viable at a commercial scale, the information is shared for the benefit of others to learn from.



Figure 7 Aquaponics in action – a combination of growing fish and plants in one recirculating environment.
Image source: Envision Charlotte, n.d.

There are many real world examples of circular economy in action for which information can be readily found online. In addition to the benefits to others in each industry of sharing objective information and experiences, opportunities for recognition exist for your organisation's work if you can demonstrate leadership in relation to delivering on sustainability and circular economy outcomes. This is relevant to both the public and private sector.

There has been a demonstrated push for sustainability by consumers and customers in recent years. A 2021 study found that nine in ten Australians and New Zealanders care about sustainability when buying goods and services, and that more than 40 percent of consumers would permanently stop buying from a business if they believed they had done something that wasn't socially or environmentally appropriate (Ward & Fricke, 2021). These statistics indicate what is perhaps a broader shift in social expectation that will continue to influence government and industry decision making/behaviours to be not only talk the talk but also walk the walk with regards to being more conscientious about environmental impact and sustainability. The circular economy concept can be used as a tool for governments and private enterprise alike to identify practical opportunities to contribute.

Whilst big picture outcomes are intended with the circular economy concept, the role of individuals having a go at contributing to a more circular economy will make a difference. As previously touched on, it is beneficial that practitioners stay up to date with industry advancements. Conferences, training, publications, memberships to industry bodies and a strong peer network will help to do this. The introduction of engineering registration in Victoria from 2021 helps to ensure engineers across both the public and private sectors are up to speed with best practise and standard/specification revisions.

RECOMMENDATION 5:

Objectively evaluate trials of new products/technologies/services to understand the reasons for any failures and make use of the learnings so that new products/technologies/services are not prematurely "written off".

RECOMMENDATION 11:

Share successes and failures for the betterment of the industry. Recognition of your organisation will be a by-product.

RECOMMENDATION 12:

Continue to invest in training and professional development so that industry practitioners stay up to date with new concepts such as the circular economy.

9 Things to watch out for

There is a need for a considered approach to contributing towards a circular economy as it is one of many different pursuits that organisations can embrace. Organisations may have an appetite to contribute but will only be able to do so in a way where focus is not lost on core business.

Deliverability appears to be frequently overlooked when new strategies and plans are developed and adopted in a municipal setting. It is apparent that greater progress is made towards a more circular economy when there is focus on a few key actions which seek to improve business as usual activities and influence the way in which staff deliver current works and services. It is important that the delivery of these actions demonstrate progress and value in order to facilitate continued investment.

Example 19. Circular Economy and Innovation team – City of Toronto, ON, Canada.

The City of Toronto established a Circular Economy and Innovation Unit in 2018 making it one of the first municipalities in North America to form a dedicated circular economy team. The Unit focuses on three different areas:

- *Innovation and circular economy projects for Solid Waste Management Services.*
- *Initiatives for the broader municipal government.*
- *Initiatives for the broader community quickly developed.*

The unit quickly recognised that a circular economy requires the support of many different stakeholders to be realised. A cross divisional working group made up of more than 10 city divisions has been setup to help inform the development of the City's strategies and actions. So far, the unit has influenced several City strategies including:

- *Transform TO Net Zero Strategy*
- *Toronto's Resilience Strategy*
- *Toronto Green Standard*
- *Digital Infrastructure Strategic Framework*
- *Corporate Strategic Plan*
- *Black Food Sovereignty Plan*

This approach of influencing a variety of Council initiatives towards circularity has the greatest potential as it leverages the power of the collective resourcing across the organisation to make an impact.

The City of Toronto's Circular Economy and Innovation Unit undertake their work using the following process.



This approach requires an open and objective review of delivered actions where outcomes influence future works and decision making. It enables recognition and data driven acceptance across the organisations of successful trials, but also ensures that any failures are analysed and learned from.

Industry practitioners also need to objectively analyse “green” and/or “environmentally friendly” products or services. As consumers, customers and government continue to raise their expectations in relation to delivering sustainability outcomes, there are commercial benefits of being seen to be operating in a sustainable and environmentally friendly fashion. It is important that evidence and real world outcomes are analysed before “green” and/or “environmentally friendly” products or services are engaged.

The way in which sustainability outcomes are delivered continually evolves. In reflecting on some of the ways in which sustainability outcomes have been integrated into infrastructure in the past, it is now questionable whether those attempts have had the desired outcome. At present, we need to be careful about sustainability solutions that ultimately result in new ways of landfilling materials. One of the key principles of a circular economy is keeping materials in circulation at their highest possible value for as long as possible.

One particular approach where a current sustainability solution could be resulting in an unnecessary loss of value of a particular resource is the use of crushed glass as an alternative to rock aggregate. Crushed glass has been used in infrastructure works as a replacement aggregate (in both concrete and crushed rock) across the world for at least two decades and is arguably becoming more common practise. Whilst this approach is better than landfilling glass (given it has likely reduced the amount of virgin rock required), it is not as good as retaining glass for its higher value uses. When it is used as an alternate aggregate, this resource can no longer be feasibly recycled for its original purpose and has ultimately been changed into a material of inherent lower value.

Example 20: Foam blocks in construction - Lucas Museum of Narrative Art, Los Angeles, CA, US.

In Exposition Park in Los Angeles, there is an approximate \$1B development under construction. The 300,000 square foot Lucas Museum of Narrative Art will feature a large gallery space, two state of the art theatres and dedicated spaces for learning, dining, retail and events.

A site tour showed several significant sustainability initiatives being incorporated into the development. These included:

- A significant reduction in the amount of impermeable surface compared with the site's original school bus carpark (an approximate 50% reduction of impervious area is expected).*
- The integration of a green roof as well as large winding swales with dry wells in landscaped areas to manage stormwater runoff onsite.*
- Foam blocks being used for lightweight fill material to shape and support landscaped areas, footpaths and in the upper parts of the building.*



Figure 8 Foam blocks being used as an alternate light weight sub surface fill material instead of traditional quarried materials

Whilst it could be argued that the use of foam as a void filler and base material in construction is one step away from landfilling the product, it does reduce the amount of virgin materials required for the project by:

- Reducing the amount of virgin material required for supporting and shaping landscaped areas*
- Reducing the dead weight of the building therefore allowing the structure to be designed to support less weight.*

It may also reduce the overall emissions created during the construction given the ease at which the foam blocks can be moved and placed without heavy machinery.

It is an important reminder to us that we need to continue to give new construction methodologies and products a go rather than continuing to fall back on traditional methods in the pursuit of sustainability perfection.

Work also needs to continue to refine recycling practises to ensure that the impact of the process does not outweigh the intended benefit. The logistics and processing involved with recycling products can be energy intensive and negate some (if not all) of the intended environmental benefits. Reducing the amount of waste generated in the first place as well as repairing and reusing products will likely provide a greater environmental benefit than a reliance on energy intensive recycling practises.

10

Concluding remarks

The available statistics about global material consumption (~100 billion tonnes per annum) and current extent of recycling (<8% in 2022 and in decline) demonstrates the need for change. Whilst the circular economy concept is big picture, it is a useful tool to help us stop and reflect on our current way of living and working.

The municipal works sector can contribute to a more circular economy, even in the absence of being holistically forced to do so by legislation. There are many good examples of circular economy in action, both locally and overseas, where information is freely available. Given the acceleration of technology and willingness of people to connect via remote online meetings, it is now even easier to reach out and learn from others about their circular economy trials, initiatives and projects.

In some ways, we are the custodians of the land on which we live. This may assist you and others in your organisation to realise the need to deliver better quality infrastructure, give greater thought about the longer term, and be more considerate about the amount of materials consumed and waste produced in delivering works and services for the community.

One key learning from undertaking this research and study tour was that we cannot let great get in the way of good. We need to continue to give things a go in order to make material progress towards a more sustainable way of living. I would encourage you to think about what legacy our generation will likely be known for when future generations look back, and what you can do to contribute to change that.

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