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NSW Waste Sector
Volume I: Key Findings

NSW Environment Protection Authority

April 2019

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The Report has been prepared by PricewaterhouseCoopers and Sphere Infrastructure Partners (together, the Advisers) on the basis set out in Section 1 of the Report. It contains opinions, advice and recommendations for consideration by the NSW Government in the development of a 20-year Waste Strategy for NSW.

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1. Introduction

1.1 Background

The Environment Protection Authority (EPA) is the primary environmental regulator for NSW. It partners with business, government and the community to reduce pollution and waste, protect human health, and prevent degradation of the environment.

The EPA is working with Infrastructure NSW to outline a scope and concept for the development of a 20-Year Waste Strategy for NSW. The purpose of the Strategy will be to set a 20-year vision and directions to reduce waste to landfill, driving sustainable recycling markets and identifying and improving the state and regional waste infrastructure network.

As part of this work, the EPA has engaged PricewaterhouseCoopers (PwC) and Sphere Infrastructure Partners (Sphere) together, the "Advisers' to prepare a situational analysis and demand projections for the NSW waste sector, and to benchmark the NSW waste sector against international or domestic best practice to identify innovation and areas of improvement.

The Report is subject to the restrictions of use set out in the Important Notice at the front of this Report. This Report has been prepared by the Advisers for the EPA pursuant and subject to the terms of engagement with the EPA.

1.2 Key Findings

This Key Findings Report summarises the key findings from the research undertaken on the situational analysis of the waste sector in NSW, including identifying long term challenges, risks and opportunities (with references to learnings from the Benchmarking Review).

The key findings are not exhaustive and should not be read in isolation, but within the context of the Situational Analysis (Volume II) and Benchmarking Review (Volume III) reports. All data contained in this volume is referenced in the Situational Analysis and Benchmarking Review Volumes. The key findings are included to assist the EPA in the development of the 20-year waste strategy.

1.3 Approach and Methodology

The Report has been prepared in accordance with the following methodology:

- analysis of EPA data;
- analysis of independent research
- consultation with the NSW Government;
- consultation with representatives from stakeholders involved in the NSW waste industry;
- analysis of waste policies and practices implemented by the NSW and other Governments domestically and internationally.

1.4 Scope of works

This report considers the current state of the waste management and resource recovery sector in NSW, including identification of factors which currently influence demand and associated risks, challenges and opportunities.

The focus of this report is on the solid wastes from the following waste streams in NSW:

- Commercial & industrial (C&I) - waste from commercial and industrial businesses;
- Construction & demolition (C&D) - waste from construction and demolition activities;

- Municipal Solid Waste (MSW) - municipal solid waste, from households and public places.

Waste from additional waste streams such as mining, forestry and agriculture are not specifically considered within this report. This report primarily focuses on solid waste, rather than liquid or gaseous waste.

The report also briefly considers hazardous waste, e-waste and liquid trade waste as significant and particularly challenging components of the three core waste streams.

The scope of work comprised:

Situational analysis (Volume II) and demand projections

a) review available material (provided by the NSW EPA) and undertake any further research (of publicly available information) to analyse the waste sector in NSW covering:
    - generation, sorting, distribution, storage, recovery, resource recovery destinations/ markets, and disposal located domestically and internationally disaggregated by:
        - Construction and Demolition waste, Commercial and Industrial waste and Municipal solid waste
        - waste types, including e-Waste
        - waste recovered, and waste disposed
    - rates of waste generation, distribution, recovery, storage and disposal
    - synopsis of waste market and participants in the waste market
    - macro and micro factors that positively and negatively affect the waste market including (but not limited to):
        - household attitudes and behaviour, and consumer demand
        - the role of government, markets (including product and waste markets)
        - regulatory, policy and contractual frameworks
        - the extent, nature and hierarchy of the waste infrastructure network and industry structure
        - spatial issues and implications (for the State and interstate and international supply chains as well as within and between metropolitan and regional areas)
        - innovation
        - initiatives or arrangements to avoid or minimise waste generation

International benchmarking (Volume III)

Based on jurisdictions agreed with NSW EPA and subject to availability of information:

b) review available material, undertaking any further research and taking necessary soundings to analyse the current NSW waste sector. This includes understanding the factors that affect the generation and management of waste, the avoidance, of waste, use of recovered materials and the role of the waste industry

c) undertake research of best practice domestic and global leaders in the waste sector in an agreed number of jurisdictions, which includes (but is not limited to) investigating:
    - household attitudes and behaviour, and consumer demand
    - the role of government
    - markets (including product and waste markets)
    - regulatory, policy and contractual frameworks
    - the extent, nature and hierarchy of the waste infrastructure network and industry structure
    - spatial issues and implications (for the State and interstate and international supply chains as well as within and between metropolitan and regional areas)
    - innovation frameworks

- initiatives or arrangements to avoid or minimise waste generation
- lessons learnt from policy failures and market impediments

d) incorporate the latest thinking, research and evidence from policy and civil society institutions or from the academic community.

e) develop outcomes-focused objectives and criteria to support benchmarking analysis

f) benchmark NSW with best practice jurisdictions

g) develop draft and final reports to report on findings of benchmarking exercise and proposed areas of innovation and for improvement. These areas must explore:
   - the conditions for waste market investment attraction and retention
   - the competitiveness of the waste market
   - consumer behaviour change
   - waste system regulation, policy, monitoring and reporting
   - the choices available to use a range of government levers
   - the conditions for when and how government levers are exercised

h) develop a set of overarching directions and complementary recommendations in relation to these findings for inclusion in the draft and final reports. These recommendations must consider levers available to the State Government and could include levers beyond State-based environment protection legislation. The Service Provider may also make observations about the use of Commonwealth and local government levers too.

The nature and extent of the procedures undertaken by the Advisers in respect of the scope of works were subject to the availability of information and any revisions to the Adviser's approach and analysis, agreed with NSW EPA during the course of the engagement.

1.5 Data

The generation, disposal and recycling data presented in this report has been primarily provided by the EPA and reflects reporting by licensed waste recovery and disposal facilities (in the regulated areas or receiving waste from the regulated area) through the Waste Avoidance and Resource Reporting Portal (WARRP).

The nature of the data collected is considered to be more comprehensive than the data collected prior to FY16 and is considered by the EPA to provide a more robust assessment of waste flows in NSW and the state's performance against targets under the Waste Avoidance and Resource Recovery (WARR) Strategy 2014-21. In this regard, reporting during the period FY16-FY18 is not considered to be on a comparable basis with FY15 and prior years, limiting any direct comparison of data between these periods. As a result data reported in this report primarily focusses on FY16-18. Where beneficial to the situational analysis, the report commentary does consider comparable data in prior periods to aid the analysis.

FY16 was the first year in which licensed facilities were required to report into WARRP, and the first time that recovery facilities were required to report to the EPA. Implementation of the new reporting regime resulted in a number of errors and quirks in data reported by licensed facilities. The EPA has reviewed the data submitted and made adjustments for reporting errors / quirks for calculation of the FY16-18 datasets. Where a facility was required to report in FY16 but did not do so, FY17 data has been included as a proxy for FY16.

Whilst the WARRP provides a useful insight to waste flows in NSW, it does not capture all relevant information. Further the EPA acknowledges the need to make simplifying assumptions to address gaps in information captured by WARRP. Further analysis of data limitations is contained in Appendix A of Volume II.

1.6 Sources of information

The information, statements, statistics and commentary contained in the Key Findings Report (Volume I), the Situational Analysis (Volume II) and the Benchmarking Review (Volume III) have been prepared by the Advisers based on material provided by the NSW EPA, consultation with overseas stakeholders and from other public data sources external to the Advisers and the NSW EPA. The content reflects a synthesis of the Advisers' analysis and the views and facts provided by the underlying sources, but the Advisers are not responsible for any errors arising from the underlying sources and the Advisers' use of those sources.

Where the report summarises overseas policy and regulation or findings from other adviser reports, reasonable efforts have been made to attribute the content to the relevant source at the commencement of the relevant section in Volumes II and III.

1.7 Timing of Work

PwC was engaged in January 2019. Our work was completed during the period January 2019 to March 2019, with the Report finalised in April 2019.

The Report has not been updated for any information or market developments that occurred post March 2019.

The Report is based on data available at that time (including data provided by the NSW EPA) and has not been updated for any new data which may now be available or for amendments to data previously provided.

1.8 Structure of the Report

The Report comprises three volumes:

- Volume I: Key Findings is intended to provide a summary of the key findings, observations and recommendations arising from the Situational Analysis and the Benchmarking Review;
- Volume II: Situational Analysis;
- Volume III: Benchmarking Review.

Key Finding 1

Waste diversion has increased to 65%, but remains below the target of 75%.

1.1 Total waste performance

In 2017-18, NSW generated 21.4 million tonnes (Mt) of waste, including 12.8 Mt from construction and demolition (C&D, 60%), 4.4 Mt from commercial and industrial (C&I, 20%) and 4.2 MT from municipal solid waste (MSW, 20%).

Total waste volumes grew between FY16 and FY18 by 14%. This result was largely due to high growth in C&D volumes from large-scale infrastructure projects in NSW. MSW volumes declined by 3% between FY16 and FY18, whilst C&I volumes grew by 5.5% over the same period.

The NSW population grew by 3.1% between FY16 to FY18, with most of this occurring in metropolitan areas.

NSW waste per capita grew by 11% between FY16 to FY18. This result was distorted by the growth in C&D volumes (26%), with MSW waste volumes per capita indicating a 7.0% decline between FY16 and FY18. The decline in MSW per capita largely occurred in metropolitan areas.

C&I growth is above NSW population growth. Separating growth rates in waste generated from population and GSP growth rates should be an area of focus for the 20-year waste strategy.

1.2 Waste diversion rates

Waste diversion rates provide insight to the volumes of waste that are diverted from landfill. The percentages provided are calculated by dividing the amount recycled by the total amount of waste that is recycled and landfilled. Total waste diversion was 65% in FY18 (up from 63% in FY16), but below the longer term target of 75%, driven by:

- Municipal solid waste (MSW): diversion rates have plateaued at 42% across FY16-18 (FY21 target: 70%);
- Commercial and Industrial (C&I): diversion rates have increased from 48% to 52% (FY21 target: 70%);
- Construction and Demolition (C&D): diversion was at 77% in FY18, after peaking at 81% in FY17 (FY21 target: 80%).

1.3 Barriers to recycling

Significant capital has been invested by the EPA under the WARR Strategy to improve diversion rates. Whilst additional waste processing capacity has been developed and is expected to come on line in the coming years, the Situational Analysis has identified a number of barriers to improving recycling across all waste streams.

Barriers exist at the householder; small business; regulatory; infrastructure; end markets and at an individual waste material level. A number of issues were also identified in stakeholder feedback. These issues are considered separately in the rest of the Key Findings section.

1.4 Considerations for the 20-year waste strategy

The Situational Analysis has indicated that an integrated strategy addressing barriers at each step of the waste generation, recycling and re-use, collection, processing and disposal steps in the waste flow are more likely to be effective in improving waste diversion rates than strategies targeting just one step of the waste flow. Such a strategy needs to be supported by waste specific policies to drive a sustainable shift in the market for re-used and recycled materials.

Key learnings can be drawn from other jurisdictions that have sought to tackle the same problems that are currently facing the NSW waste industry. These are explored further in the international benchmarking study.

Barriers to improved diversion and recycling rates are considered further in the remaining sections.

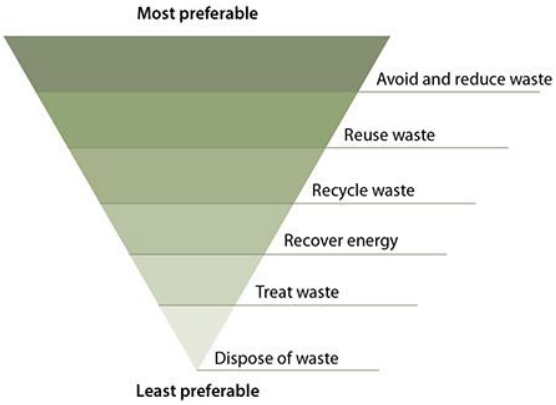
Key Finding 2

A stronger focus on waste avoidance and re-use would support existing policy initiatives

2.1 Waste hierarchy

The WARR Strategy is based on a 'waste hierarchy,' which prioritises options for waste management.

The hierarchy outlines approaches in order of most to least preferable, with the most preferable option being to avoid and reduce waste, and disposal the least preferred option.



2.2 WARR Strategy

The WARR Strategy has a number of objectives covering the avoidance and reduction of waste generation through to increasing recycling; diverting more waste from landfill; and managing problem wastes better.

The WARR Strategy is supported by the Waste Less, Recycle More initiative, which provides funding for waste and recycling improvements across NSW, from education and infrastructure through to programs targeted at individual waste streams (e.g. the Bin Trim program targeted C&I waste diversion).

The WARR Strategy also sets the direction for other related programs, policies and plans directed at minimising the impact of waste on the environment and human health.

2.3 Considerations for the 20-year waste strategy

The WARR Strategy has a strong focus on education, support and funding industry led initiatives to build greater capacity to process waste. Whilst critical to achieving improved waste outcomes, experience in markets with better diversion rates indicate the need to have an equally strong focus on waste avoidance and reduction; the re-use of waste (including repair and repurposing); and the development of end markets for recycled materials.

The Love Food, Hate Waste program is an important step in avoiding food waste in the MSW and C&I waste streams, however, this may need to be supported by stronger regulatory requirements and policy settings.

The 20-year waste strategy should examine options to tackle waste reduction and re-use on a broader basis, as well as targeting problem wastes. Options may include:

- Embracing a circular economy approach (as discussed in Key Finding 4);
- Extended product stewardship and producer responsibility schemes with a potential shift away from voluntary schemes (which some stakeholders believe have not been as effective as co-regulatory or mandatory schemes in reducing waste – see Key Finding 5);
- Stronger focus on high volume waste streams, such as reducing the volume, complexity and mix of packaging waste materials;
- Development of industries that can re-use or repurpose end of life products;
- Strategies that require generators to keep end of life options (for re-use or recycling) front of mind when designing products.

- Elimination of single use waste materials and the phased transition to a scheme that potentially attaches a levy to single use waste materials;
- Requirements to increase the use of recyclable materials in products which will support the end markets for recyclables;
- Increasing the procurement of recycled materials by industry and government through voluntary or mandated requirements;
- Targeted funding to support investments in R&D, product innovation, new waste processing technology and capacity to support greater levels of re-use and recycling; and
- Strategies to prevent waste being sent directly to landfill without being processed.

These and other options are considered further in the remaining Key Findings.

Key Finding 3

The domestic market for recycled materials is underdeveloped

3.1 Overview and context for change

At present, domestic demand for recycled materials in NSW is not sufficient to absorb the amount produced. Post the China Sword Policy, there has been no noticeable development of the domestic markets for recyclables. The waste industry has shifted export volumes from China to new countries in South East Asia and these countries have now stopped or have significantly reduced acceptance of waste volumes. Stockpiles of waste are increasing and reaching critical levels. Some councils interstate are sending recycling direct to landfill.

In feedback to the Advisers, industry (including the waste industry and large waste generators with capability to invest in circular economy infrastructure solutions) reflected a reluctance to invest in further processing capacity if there was no end market for the product. While this does not necessarily refer only to domestic end markets, the cost of shipping products overseas makes international end markets less desirable.

Industry has also indicated that there is a perception that pursuing higher diversion rates would not be effective whilst there was a lack of a demonstrated commitment to the domestic use of recyclate.

3.2 Barriers to greater domestic use

Factors identified as contributing to the low domestic consumption of recycled materials include:

- the cost competitiveness of recyclate compared to virgin materials or imported recycled materials. Contributing factors include:
    - virgin materials not fully reflecting the cost of environmental impacts;
    - domestic product being impacted by a lack of scale and low production efficiency, which can lead to fluctuations in unit cost of production;
    - high domestic processing costs (energy and labour) relative to imported materials;
    - high rates of contamination in feedstock, delivering lower yields and the need for additional processing or rendering feedstock unsuitable for processing and is therefore landfilled.
- some materials are difficult to recycle, such as complex multi-material plastics (see Key Finding 10), whether it is through the design of the plastic product or the type of plastic used;
- perceptions as to the capacity of the waste industry (and generators of waste) to provide recyclate to a quality standard ready for the remanufacture of goods;
- the capacity of the waste industry to regularly produce recycled materials in sufficient quantities (which may be at short notice e.g. glass sands – see Key Finding 13). An inability to stockpile certain waste materials may also be contributing to this issue;
- a lack of innovation in end products to use recycled materials;
- the incidence of single use materials or materials with very limited re-use options;
- a lack of policy supporting the greater use of recycled materials. Industry has pointed to overseas jurisdictions that are moving to mandate the use of a minimum levels of recycled materials in products (for example, a coalition of European organisations has called on the EU to implement a 30% minimum requirement for recycled plastics in new products by

2025; the UK Plastics Pact have committed to achieving 30% average recycled content across all plastic packaging by 2025);

- a lack of policy focussed on the development of domestic markets (see Key Finding 4);
- the effectiveness of existing product stewardship schemes and the failure of other voluntary schemes (see Key Finding 5) to contribute to collection and processing costs (which in combination with the waste levy could support investment in technology and improve the cost competitiveness of recycled materials;
- perceptions amongst some end users (both commercial and industrial users and individual consumers) that products using recycled materials are of a lower quality.

3.3 Considerations for the 20-year waste strategy

It will be important that the 20-year waste strategy develop policies that demonstrate a commitment to the increased use of recycled materials domestically (consistent with circular economy principles – Key Finding 4) and provides processors and investors with the confidence to invest in recycling activities. This will need to be undertaken in collaboration with other jurisdictions, including the Federal Government, to be effective. Issues to be considered as part of the 20-year waste strategy include:

- developing (and enforcing) Australian quality standards for recycled products to provide quality assurance, particularly for those materials that may be used in the infrastructure sector (e.g. plastic and glass sand);
- education (to address perceptions that products using recycled materials are lower quality) and other programs promoting the use of products using domestically recycled materials to support increased consumption;
- improving the information available to influence householders and businesses on purchasing decisions (e.g. product labels identifying the proportion of recycled Australian material used; identifiers that indicate the product manufacturer contributes to the cost of recovery and recycling (e.g. Germany's Green Dot program) or other comparable identifiers that will influence the purchasing of products with recycled content);
- reducing regulatory barriers for the investment and development of recycling infrastructure to increase capacity and reduce cost of materials processing in NSW (see Key Finding 16);
- greater use of domestically recycled materials in Federal, State and local government procurement, where appropriate;
- support for end market development of recycled products, such as incentives for product R&D that supports the greater use of recycled materials;
- investment in programs to increase waste recovery and reduce contamination (e.g. source separation);
- expansion of existing funding programs to support innovation in:
  - packaging and other priority waste materials (e.g. smarter and more recyclable materials);
  - manufacturing processes (to make material re-usable and recycling easier);
  - recycling technologies (to improve processing efficiencies; reduce costs and develop export opportunities);
  - new product development (using recycled materials);
  - investments in new processing technologies and capacity (research; pilot plants; commercialisation of new technology), such as the Danish Innovation Fund (see Section 12.3 of Volume III).

Key Finding 4

There is an opportunity to fully adopt a circular economy approach to waste

4.1 Overview

A circular economy designs out waste and pollution, keeps products and materials in use and regenerates natural systems. Waste is viewed as a resource and revises the waste avoidance and management system from a linear model to one that is circular, incorporating efforts to re-use, recycle and reprocess materials and retain the value of materials within the economy for as long as possible.

Research of international waste management practices indicates that there is a global trend towards adopting 'circular economy' principles in approaches to material re-use, recycling and waste management (see Volume III). However, most jurisdictions also acknowledge that a "pure" circular economy will take some time to achieve, and effective policy is centred on a form of circular economy, which acknowledges the continued use of some raw materials and the existence of some residual waste.

NSW has, to date, failed to implement appropriate policies or focussed support for investments in technology and infrastructure to establish a circular economy. While NSW has recently issued a Circular Economy Policy, this is largely focused as a means of addressing the challenges associated with China National Sword and domestic and export markets for recyclables.

Implementing a circular economy requires the establishment of a framework to define minimum requirements for waste processing in NSW, but also needs to address issues at the individual material level to design out waste to landfill and other leakages. Once an individual material focus has been undertaken, the transition to a more pure circular economy can occur, where focus is on specific sectors and all that is undertaken in the sector, not just waste management. As has been the approach in The Netherlands (Section 5, Volume III), a staged approach to achieving a circular economy is recommended. Such an approach will help de-risk implementation by:

- informing the market earlier as to the longer term direction of policy;
- providing industry with the opportunity to work with Government on the design of specific elements; and
- providing sufficient lead time for industry to prepare and modify systems and approaches and to invest where necessary.

Lessons can also be taken from Scotland's transition to a circular economy (Section 7.2.2, Volume III), and the challenge of reconciling policy and commercial realities. The Dutch and Scottish experiences are both explored in the Benchmarking Review (Volume III).

4.2 Implementation challenges

This report does not address the implementation requirements of a full circular economy in NSW, but instead addresses how approaches to waste management might be adjusted to commence the transition to a circular economy. Implementation of a circular economy requires actions such as those detailed in the section below (based on the EU experience), including measures to address product design, primary material extraction/use, manufacturing, assembly, retail, use and end-of-life waste management.

Existing participants in the waste industry will be key stakeholders in the shift to a circular economy. Without some buy-in from key stakeholders and the application of policy levers that directly affect them, there is a risk that they will apply their market power to resist the shift. For example, waste recyclers have advised that they are supportive of the adoption of circular

economy principles in their activities, but advise on the need to recognise the potential implementation challenges including:

- understanding the volume and movement of materials in the system and the extent to which they are imported vs generated domestically;
- the movement of materials across state borders (and therefore the need for a national approach to a circular economy – not just a NSW approach);
- the distribution of materials across metropolitan, regional and remote locations and recognition that economics may prevent a state-wide uniform approach;
- physical and process limitations of certain waste materials (e.g. paper cannot be recycled indefinitely);
- recognition that circular economy principles will not work unless there is a substantial improvement in the quality of the material being processed;
- the cost competitiveness of recyclate compared to virgin materials (see Key Finding 3).

These issues and options to address are considered further later in the key findings.

4.3 EU Implementation approach

In 2015, the European Commission adopted an ambitious Circular Economy strategy, which included measures to transition Europe to a circular economy model. As part of the implementation process, the EU established an Action Plan for the Circular Economy.

The Action Plan documented a programme of actions to be completed before 2020, covering the whole waste cycle: from production and consumption through to waste management and the market for secondary materials. The Action Plan (see Section 4.3 of Volume III) outlined the required waste legislative requirements.

The revised legislative framework on waste came into force in July 2018. It sets clear targets for the reduction of waste and established a long-term path for waste management and recycling.

Key implementation measures were set out across:

- production
- consumption
- waste management
- market for secondary raw materials
- sector actions
- innovation and investments

The EU scheme also included key targets, a stakeholder engagement strategy and a plan for monitoring of performance. Further information on the EU implementation approach and Action Plan is contained in Section 4.3 of the Benchmarking Review (Volume III).

4.4 Considerations for the 20-year waste strategy

There is an opportunity to develop a circular economy approach to underpin the 20-year waste strategy.

The 20-year waste strategy should outline the program of work to expand the initial approach of the Circular Economy Policy. This includes recognising the need for a long term commitment, as well as adoption of short and long term policies and strategies (including commitments from industry, mandated or otherwise) and milestones for implementation. Adopting a phased implementation with clearly defined milestones (similar to the EU approach) is recommended.

There are significant challenges to adopting circular economy principles. Industry, waste generators and policy makers must work collaboratively to address these challenges. Although they are key stakeholders, this is not just a matter for the waste management industry. Indeed, circular economy is as much about design of products and services, to ensure minimal waste.

Adopting a circular economy approach represents a complete overhaul to existing strategies and approaches. As the EU experience demonstrated, it is a significant undertaking which will impact on many parts of the NSW (and Australian) community. It therefore requires significant time, resourcing and commitment from different government departments. Regard will need to be had to appropriate resourcing (financial and individuals) to achieve the goal, recognising that it is not only the EPA who should be responsible. Representatives from different government departments are required for success and these representatives should ideally work together as one team with a common goal of successful delivery of a circular economy for NSW. The adequacy of existing resourcing and funding for what will be a multi-year program should be undertaken prior to any implementation activities.

The key findings and related sections in this report further address circular economy principles within their respective sections.

Key Finding 5

Stronger product stewardship will support a shift to a circular economy

5.1 Overview and context for change

Producer responsibility and product stewardship schemes are key policy levers used extensively internationally to impose positive obligations on generators of waste to influence behaviours to:

- avoid, reduce or eliminate the volume of waste generated through product innovation, improve design and obsolescence;
- promote the use of materials in product design that can be easily recovered and re-used;
- avoid the use of hazardous or single use materials in products; and
- design products with re-use and material recovery processes in mind.

These schemes also:

- provide valuable funding to support recovery, collection; transportation and processing costs, which may be important to improve the competitiveness of recycled products with virgin materials;
- support the establishment of re-use and recycling infrastructure;
- support source separation and lower levels of contamination;
- provide improved visibility to the recycling industry over access to a future stream of waste materials to be processed (this is also critical to the development of end markets who require comfort as to the certainty of supply).

5.2 Barriers and impediments

Australia has no mandatory schemes, with only two voluntary schemes (mobile phones and lamps containing mercury) accredited under the Product Stewardship Act (PSA). Other schemes exist in respect of tyres; mattresses and paints, however, these are not accredited (see Section 2.4.3 of Volume II).

Whilst existing schemes are supportive of the recovery and recycling of waste material, it is not clear whether the potential benefit of such arrangements have been fully optimised. The voluntary nature of the schemes does not ensure that all waste generators contribute to scheme objectives. The terms of schemes do not ensure an appropriate focus on avoidance and re-use as well as recycling.

Analysis of wastes being sent to landfill indicate wastes covered by existing schemes are not being fully recovered. Other problem waste streams such as e-waste (see Key Finding 14) are also showing significant levels of growth and the existing scheme does not cover all e-waste categories.

5.3 Considerations for the 20-year waste strategy

The 20-year waste strategy should consider actions to work with Commonwealth to modify the approach to producer responsibility and product stewardship schemes to drive further short term gains (e.g. next 3-5 years) in waste avoidance, reduction and re-use by:

- expanding the list of problem wastes to be covered by schemes (e.g. microbeads; batteries and large energy storage batteries; photovoltaic systems; a wider range of e-waste; plastics (including oil containers); packaging materials; and tyres;

- establishing clear goals and targets and action plans under schemes aligned to the waste hierarchy and the National Waste Strategy (and NSW specific requirements);
- establishing clearer guidance or a minimum set of obligations that scheme participants must comply with including:
    - minimum waste avoidance; re-use and recovery targets that align with State and national policy targets;
    - financial and other contributions by waste generators (potentially based on their proportional contribution to total generation volumes) to support recovery, collection; transportation and processing costs and scheme administration costs;
    - data reporting obligations to the scheme administrator, the EPA and the Commonwealth (to support monitoring of generation, re-use, recovery and recycling);
    - waste material specific strategies that will support a reduction in contamination or processing costs or support the shift to a circular economy (such obligations would need to be developed through consultation with generators, recyclers and infrastructure providers);
    - transitioning voluntary and unaccredited schemes to mandatory schemes (similar to approaches taken in international jurisdictions). This may occur over a short time frame (e.g. 2-3 years) or may be linked to any future failure of industry to achieving minimum waste re-use or recycling targets or failure to implement an agreed strategy;
    - leveraging the Sustainable Development Goals and the work of the United Nations on global economic systems for sustainable consumption and production patterns (for example the recent UN Environment Assembly, recently convened with the theme of "Innovative Solutions to Environmental Challenges and Sustainable Consumption and Production" where member states discussed, for example, a ban on single use plastics).

Scheme design should recognise that strategies and targets are set in a dynamic environment and will need to be reviewed and reset periodically.

Interdependencies

- The PSA is subject to a review by the Department of the Environment. This may provide the opportunity for strategies developed under the 20-year waste strategy to be incorporated into scheme revisions. The 20-year waste strategy will need to take into consideration the findings and recommendations of the review PSA.
- Revisions to the PSA should align with the proposed approach to the circular economy (e.g. timetable, key waste material focus etc.).
- The development of more effective schemes needs to be undertaken in conjunction with the development of end markets for waste materials, otherwise recovered materials will still end up in landfill.
- Material processing and end markets for recycled materials extend beyond the NSW border. As such any strategies that are developed need to be consistent with the timing and approach taken by other states. This does not imply a uniform approach needs to be adopted or that the same approach is required for each waste material, however, potential impediments need to be identified and addressed in planning.
- Scheme will need to comply with international commitments (e.g. under the UN Environment Assembly).
- Extensive consultation will be required with the Commonwealth, other states and waste generators and recyclers.
- Agreed programs and timetables will need to be supported by other initiatives under the 20-year waste strategy. These may include:

- source separation of wastes;
- modifications to waste collection and transportation programs;
- programs to support investment in infrastructure;
- licensing requirements for waste processors and treatment of residual wastes;
- coordinated and streamlined planning considerations.

- Obligations and strategies under schemes may need to incorporated or be supported by other arrangements, for example:
  - education programmes;
  - compulsory source separation of wastes;
  - bans or taxes on non-recyclable materials;
  - financial incentives (for households and business to source separate materials) or funding support (e.g. grant programs for new infrastructure ~ new technology investments to separate and recover waste materials from comingled wastes);
  - support for the development of a re-use industry;
  - phasing out the use of hazardous or single use materials in products; and
  - banning single use or problem waste streams e.g. plastic bags, straws and cutlery.

Further considerations are set out in Sections 2.4.3 and 2.4.4 of Volume II.

Key Finding 6

Current waste disposal practices create challenges for recycling

6.1 Overview

Analysis of waste disposal practices identified a number of issues that are not supporting the diversion of waste from landfill.

Municipal solid waste

The results of a 2011 kerbside audit (Section 4.2.3 – Volume II) indicated:

- up to 67.1% of residual waste (red bin) could be diverted from landfill, comprising 45% food and organics; 22% dry recyclables;
- 84% of general waste and 3% of dry recyclables are presented at Material Recovery Facilities (MRFs) as bagged waste;
- dry recyclable bins contained 7.3% contamination which reduces the volume of recyclate that will be recovered; and
- organics bins contained 2.1% contamination.

More recent 2017 kerbside audit data was generally consistent with the 2011 observations.

Bagged dry recyclables or bagged organics are generally treated as a contaminant and sent to landfill. Food, plastics and other contaminants may render paper unsuitable for recycling. Certain contaminants (e.g. electrical cables, rope and other stringy wastes) may damage processing equipment.

35% of residual MSW waste going to landfill comprises food organics. Any significant reduction in food waste will have a significant impact on landfill volume. MSW food organics are estimated to comprise c.11% of total landfill volume.

Hazardous wastes remain in the general waste stream including materials such as electrical items/peripherals; dry cell batteries; toner cartridges; other batteries, computer equipment and mobile phones. Alternate treatment processes (outside of kerbside collection) exist for these waste streams.

Stakeholder feedback indicated that waste collected through the CDS has significantly lower levels of contamination and produces higher yields in production. This is creating export markets for some recovered materials and the direct sourcing of materials by the recycling industry from the CDS network operator.

The extraction of CDS materials from kerbside collections is resulting in existing contamination in the dry recyclables bin increasing as a percentage of the recyclable waste. The risk exists that recyclers may review their ongoing processing of certain recyclate sourced from MRFs.

Commercial and Industrial

A 2014 audit (see Section 4.4 of Volume II) of C&I waste indicated:

- 68% of waste arriving at the disposal point arrived in mixed waste loads, with only 32% arrived as single material loads;[1]
- 28% of C&I waste is delivered in garbage bags, which have not been subject to any sorting processes. Bagging waste makes it difficult to identify and recover recyclable materials. Bagged waste is generally sent directly to landfill;
- 51% of the C&I waste in the regulated area comprised degradable organic materials;
- 55% of the C&I waste not being diverted (and not presented in garbage bags) could be recovered. This figure increases to 83% if it is assumed that the contents of the garbage bags can be accessed.

Historically there has been minimal processing of residual C&I waste and sorting of C&I waste is largely dependent on separation at the source. Stakeholder feedback indicated that source separation was generally undertaken by larger corporates; organisations with specific waste or recycling policies or organisations where it is financially beneficial to do so.

6.2 Considerations for the 20-year waste strategy

61% of waste to landfill (4.5Mt) in FY18 was from MSW and C&I waste streams. Significant reductions in landfill can be realised through a greater recovery of recyclate (inclusive of organics) through these streams.

Education programs have an important role to play, however, this needs to be undertaken in conjunction with other programs targeted at delivering sustained recyclate recovery and reductions in contamination.

Some education programs have been effective in delivering significant reductions in contamination rates (see Section 4.2.7 of Volume II).

The development of strategies to increase the diversion of waste at source or through subsequent processing will need to consider the behavioural and structural impediments that exist in the market. Options for consideration are outlined in further detail under Key Finding 7 and Key Finding 8.

[1] A single material load comprises a waste load where one material comprises more than 90% of the total load)

Key Finding 7

Diversion rates in Municipal Solid Wastes have plateaued at 42%

7.1 Overview

Municipal solid waste (MSW – see Section 4.2 of Volume II) generation totalled 4.24Mt in FY18 (a 3% decline since FY16, with waste per capita declining 5.9% over the same period).

70% of MSW in FY18 was generated in the Metropolitan Levy Area (MLA).

MSW comprised 22% of total waste generated across FY16 - FY18, but accounted on average for 35% of total waste to landfill over the same period.

MSW diversion rates have plateaued at 42% across FY16-18, well below the 70% target rate. MSW diversion rates are well below C&I (52%) and C&D (77%).

High levels of organic materials in residual waste

Kerbside audit information indicated that the MSW residual waste stream contains a significant portion of dry recyclate (22%) and organic materials (45%) that could be recycled (see Table 11, Section 4.2.3 of Volume II). Recyclate that is not recovered are sent to landfill.

If all paper and containers were placed in the dry recycling bin and all organics (food and vegetation waste) were captured in green recycling bins, landfill diversion rates would exceed 70%.

Kerbside audit information indicated an unacceptable level of contamination in the dry recyclables bin (see Key Finding 6). Contamination reduces the volume of recyclate that can be recovered in subsequent processing.

Multi-Unit Dwellings (MUDs)

NSW has experienced significant growth in Multi Unit Dwellings. With NSW policy supportive of increased medium density housing, the number of MUDs is expected to increase. Resource recovery services to single-dwelling domestic households can divert more than 50% of domestic waste from landfill; however, the current recovery level in MUDs is often significantly less than this.

Research has indicated recycling rates in MUDs are lower than Single Unit Dwellings (SUDs). Effective waste management and recycling in MUDs presents a greater logistical challenge than standard housing (see Section 4.2.6 – Volume II).

Given the trend in increased housing density and the waste management challenges presented by MUDs, it is important for property developers, state governments and local councils to embrace best practice in MUD waste management from building design through to waste management practices post construction (see Key Finding 7.3).

7.2 Barriers to greater levels of recycling

General waste that has not been source separated currently goes to landfill, some via a MBT process.

Recycling behaviours

Research undertaken on NSW resident behaviours (see Section 4.2.5 of Volume II) indicated:

- only 55% of householders try to minimise the amount of packaging on purchased items;
- recycling practices were often found to be over-simplistic or out-of-date, with waste items being placed in the wrong bins (leading to higher contamination of recyclate);
- problematic wastes were generally allocated to the wrong bins;
- residents who do not consistently use an in-home receptacle for collecting recyclables were less inclined to set materials aside for recycling; and
- the distance to council bins (and the number of flights of stairs) from the dwelling influences recycling. Disposing of recyclables in the in-home general waste bin was considered an easier option compared to carrying them by hand to the council bin.

These factors contribute to the high volume of dry recyclate not being captured in the yellow bin and the high contamination levels being experienced. Better recycling practices in the home would significantly improve waste diversion rates.

Love Food Hate Waste Program

EPA research (see Section 4.2.6 of Volume II) into knowledge, attitudes and behaviours towards food waste revealed:

- 38% of respondents care only a little (or less) about environmental problems;
- the proportion of households engaged in food waste avoidance behaviours has declined and is now on par with 2012 levels;
- 50% of respondents believe they throw away very little uneaten food, yet food waste accounts for 35% of waste in residual waste bins;
- Awareness of food waste has risen, with 91% of respondents identifying packaging (58%) or food (33%) as the largest waste item in residual waste bins.

The research also indicated that the groups who wasted the most food (based on estimated volumes) included residents aged 18–34 (21% higher than the average NSW resident); households with gross annual incomes above $100,000, especially those in the $150,000+ bracket (6% higher); families with children (15% higher).

Key actions recommended by the research includes:

- increasing community knowledge about the volume of food waste generated and sent to landfill and the environmental, social and economic impacts of food waste;
- promoting behaviours that support avoidance of food waste in the home (such as menu planning, shopping from a list, correct portion sizes and more effective food storage techniques), as well as what to do with food waste;
- supporting intergenerational transfer of knowledge and skills in more efficient food purchasing, preparation and consumption;
- providing a platform for increased knowledge and awareness of food waste in business.

Research and stakeholder feedback, indicate there are a broad range of factors than negatively impact on the levels of recycling:

- lack of sufficient incentive for householders to recycle: households pay for their waste collection services through their council rates (usually a flat fee, although it may vary depending on the number and configuration of bins). This limits the visibility of the service and its cost. Poor waste management practices (such as contamination of sorted waste or failure to sort waste altogether) does not have an immediate or visible financial impact for households;
- lack of effective education on what materials can be recycled;
- lack of understanding of contamination and its consequences in terms of cost; ability to recycle and resultant landfill volumes; and
- lack of understanding on options available to deal with problem waste materials.

7.3 Considerations for the 20-year waste strategy

7.3.1 Education

EPA research indicated that those who were aware of seeing food waste (and presumably waste in general) in the media were more likely to adopt waste avoidance behaviours than those who were not. This suggests that keeping the food and other waste issues front of mind through a sustained presence in social and other media may influence behaviour.

Influencing householder behaviours is a critical aspect to improving MSW diversion rates (domestically and internationally), however, experience indicates the need to modify and tailor education approaches and implement policies to embed their effectiveness.

EPA research and learnings from other programs domestically contain a large number of recommendations on strategies to improve the effectiveness of education programs (e.g. see Section 4.2.5 – Volume II).

The following is a sample of areas that the EPA should work with local councils to develop information programs:

- Focus on key waste issues
  - key waste issues (such as what plastics to include in the dry recycling bin; reducing contamination in the dry recycling and organics bins);
  - the correct treatment for problem wastes (e.g. batteries; e-waste; shredded paper);
  - promotion of the use of community collection centres and kerbside collection to deal with bulky items; paints; electronics etc.;
  - effective recycling practices in MUDs (see below).
- Waste avoidance
  - promote habits, tools and norms of behaviour that support more efficient approaches to food purchasing, storage, preparation and consumption (see Section 4.2.6 – Volume II);
  - strategies to reduce packaging (avoid single use plastic bags; purchasing unpacked food; utilising boxes rather than bags at grocery stores);
  - promote the use of food recycling programs;
  - education of proposed revisions to product stewardship and producer responsibility schemes.
- Re-use and repair – example programs may include:
  - promotion of the ease of use of community; not for profit and other programs that support the repair and re-use of waste items that would otherwise end up in landfill;

  - work with councils to develop social media and web-based information on re-use and repair programs operating in their LGA (including links to relevant websites);
  - education of when waste materials should be provided to optimise their re-use.

- Recycling
  - promote informed purchasing decisions: educating consumers on what to look for on product labels (e.g. what packaging can be recycled; what portion of products use recycled Australian materials; programs similar to the German "green dot" program (which allows consumers to know that the manufacturer of the product contributes to the cost of its recovery and recycling) or other comparable identifiers currently in use or to be developed);
  - programs that recycle specific products (e.g. tyres, mattresses; batteries, TV and electronics and any other new programs developed under the 20-year waste strategy).

New programs

Education programs should also draw attention to any new programs that will impact MSW patrons (either positively or negatively and the objectives and rational for the program).

The EPA may wish to consider options to improve the effectiveness and consistency of education programs including sharing learnings across all councils, recognising the differences between regional and metropolitan locations and the differences required between MUDs and SUDs.

The EPA should work with councils to develop social media campaigns (which have been effective in influencing business behaviours in overseas markets); develop waste champions within housing developments and the broader community; and develop programs for schools to support greater levels of engagement.

Education is an important element to promote positive behaviours consistent with circular economy principles, however, this will need to be implemented in conjunction with other more proactive strategies.

Multi-unit Dwelling (MUDs)

Lower levels of recycling are achieved in MUDs. With NSW policies supporting higher density living, recycling rates will come under further pressure unless significant improvements are realised. The 20-year waste strategy should look at options to support improvements in MUD recycling practices (see Section 4.2.7 – Volume II) including:

- stronger planning and review processes in respect of new developments. Common problems (see Section 3.9.3 – Volume II) noted include:
  - insufficient consideration of ease of access of bins or use of on-floor waste rooms (for dry recyclables);
  - review and enforcement of minimum design considerations for new builds (chute systems for recyclables; on-floor dry-recyclable collection systems; storage areas for source separated dry recyclables) through to the design of waste storage and collection areas;
  - inadequate access for waste contractors to collect waste by automated means;
  - insufficient consideration of the number and size of bins and their collection;
  - inadequate consideration of access requirements for waste vehicles.
- implement MUD inspection programs to provide direct feedback to building owners, strata managers and waste contractors on opportunities to improve recycling (changes to the number and size of recycling bins; options for in-home source separation e.g. temporary storage receptacles for dry waste; use kitchen cadies);

- use of inside/outside recycling bin stickers as a means of reducing illegal dumping and contamination in recycling bins;
- building relationships with real estate agents and strata management to discuss opportunities to work together, opportunities could include:
  - Lease inclusions (for misuse of the waste services);
  - Bond reductions (for tenants who leave hard waste);
  - Waste services inductions (run by either council and/or building management);
  - Rent reductions (for tenants who manage the bins and hard waste bookings).

Other options to influence behaviours

The EPA may wish to explore (on a state-wide or council by council basis) other options to influence behaviours including:

- expanded kerbside waste inspections and temporary suspensions of waste collection from households that repeatedly put contaminated bins out for collection[3] or implementation of weight based charging for waste collection (see Section 5.2.5 of Volume III);
- trialling weight-based charging programs in partnership with local councils (this is already undertaken in the C&I space for some customers);
- greater transparency in council waste charges and incentive arrangements (e.g. rebates) for outperforming minimum waste diversion targets;
- review of existing waste collection practices on a council by council basis and options to divert a greater level of recyclables out of general waste (see Key Finding 7);
- expansion of the number of recycling bins (e.g. separation of glass and plastics from paper and card to reduce cross contamination (see Key Findings 10 and 11); implementation of FOGO programs (Key Finding 12). Multi-bin programs have been successfully run in overseas jurisdictions – see Key Finding 13.3)

Food and other organics

A significant portion of residual waste comprises food and other organics. Source separation and capture of these materials would significant increase diversion rates. See Key Finding 12.

E-waste and other problematic waste

E-waste comprises a significant portion of contamination in the recyclables bin. Research indicates improvements could be realised through better understanding of the correct treatment of e-waste and other problematic wastes (e.g. batteries) and the promotion of the use of free drop off programs run by councils and the use of community collection centres (see Key Finding 14).

Waste charges

Some councils have implemented waste collection arrangements that incentivise the service provider to achieve higher quality waste streams. Such approaches place the onus on the service provider to influence householders. Some service providers have taken steps to recognise households who adopt good recycling habits.

[3] Such schemes have already been implemented in WA and are being considered by NSW Councils

The 20-year waste strategy should include a program to review current waste charges (across MSW and C&I) and options to provide better signals to the market to influence outcomes (see Key Finding 20).

7.3.2 Processing and recycling

Residual MSW waste is predominantly in bags which, unless sent to an MBT will be sent directly to landfill. If a decision is made that unprocessed waste should not be going directly to landfill, then options will need to be examined to increase the level of processing of residual waste.

The EPA will need to work with industry to form a view on the preferred technology to process residual waste in light of the current issues with MBT plants (see Key Finding 12).

Householders are generally charged a fixed fee by councils to cover their waste collection services. These arrangements do not provide a price signal to households to influence waste reduction and recycling behaviours. There are generally no financial penalties for failure to source separate, place wastes in the wrong bins or create contamination. There is also no financial benefit to reduce total waste; maximise waste sent for recycling; or to remove problem waste items from collection programs.

Consideration should be given to examining alternate feed models that:

- provide financial incentives for councils (and indirectly householders) to reduce the volume of waste being sent to landfill (which could be rebated back to householders);
- provide financial incentives for councils (and indirectly householders) to reduce the level of contamination in recyclables (this may reflect flow through arrangements from contracts with the waste processors);
- revenue sharing models (for delivering higher quality recyclate).

Contracting models will also need to contain a rise and fall clause to ensure councils are not penalised under fees linked to minimum volume requirements, if they can achieve reductions in landfill volumes.

7.3.3 End markets

Creation of end markets for recycled materials should create a pull effect for waste collectors and processors as additional revenue streams (from recyclate) will become available.

Programs that reduce contamination and source separation of waste will improve the volume and quality of materials available to end markets. This will lead to greater demand from end markets.

As noted in Key Finding 3, the State will need to implement programs to support the development of end markets.

a) Interdependencies

As noted and explored further in Section 3:

- end markets will need to be developed in parallel with changes in recycling behaviours and increases in recovered recyclate;
- additional processing capacity will be required to support high recovered recyclate;
- the market will need clear guidance on where new processing capacity is required (reflecting the State's preferred infrastructure and transport strategy); and
- programs will be required to support innovation in processing technologies; development of new products; development of materials that are easier to recover and recycle.

Key Finding 8

Waste reduction strategies are improving C&I diversion, but a broader based approach may deliver greater outcomes

8.1 Overview and context for change

4.4Mt of Commercial and Industrial (C&I) was generated in FY18, 68% from the MLA (see Section 4.4. of Volume II).

The majority of C&I waste (c.70%) is generated from a wide range of small to large businesses, including manufacturing (25%); mixed small businesses (17%); shopping centres and retail (18%); healthcare and social assistance (7%) and accommodation and food services (5%).

Whilst small improvements have been realised in the level of recycling (2% per annum over FY16-FY18), the rate of improvement is unlikely to deliver the 2021 diversion target of 70%. The C&I diversion rate was 52% in FY18.

A 2014 audit of C&I waste indicated:

- 68% of waste arriving at the disposal point arrived in mixed waste loads;
- 32% arrived as single material loads.[4]

28% of C&I waste was delivered in garbage bags, which had not been subject to any sorting processes and was likely to be sent directly to landfill from the generator. The balance of C&I waste comprised a mixture of fines (such as residue from waste processing), shredder floc and pulp (18%); wood (14%); masonry (12%); plastics (7%); paper and cardboard (7%); textiles (4%); food (2%); and a further 2% metals and glass.

Analysis of garbage bags indicated 26% of the waste comprised food, with a further 31% paper and cardboard and 21% plastic.

Redistributing the contents of the garbage bags indicated 51% of the C&I waste in the regulated area comprised degradable organic materials.

Based on the 2014 audit findings, 55% of the C&I waste not being diverted (and not presented in garbage bags) could be recovered. This figure increases to 83% if it is assumed that the contents of the garbage bags can be processed and recyclable materials recovered (Section 4.4.3 – Volume II).

8.2 Business behaviours

In the absence of overriding company objectives (e.g. environmental objectives) businesses generally seek the most cost effective option for waste disposal.

Businesses that have social and environmental objectives or industries that are the subject of product stewardship/ producer responsibility schemes (Section 2.3.3, Volume II); or subject to pressure from their clients (to achieve better environmental outcomes) are increasingly developing policies and targets aimed at reducing their waste generation, increasing recycling and re-use and reducing their impact on the environment.

Consumers are expected to exert greater influence over business and purchasing decisions, with larger businesses needing to be seen as supporting improved environmental outcomes (see

[4] A single material load comprises a waste load where one material comprises more than 90% of the total load

Section 3.9.5, Volume II). Environmental considerations (e.g. use of recycled materials; capacity to recycle; impact on the environment) are expected to start influencing Consumer purchasing decisions to a greater extent.

Waste tends to be a relatively small cost of an SME's business, which does not provide any motivation to improve waste outcomes. Whilst environmental outcomes can be an important factor influencing decision making, this generally remains subject to financial considerations.

Waste generators generally require incentives, either regulatory, behavioural or economic, to motivate changes towards recycling.

8.2 Barriers to greater levels of recycling

There is minimal processing of residual C&I waste and sorting of C&I waste is largely dependent on separation at the source. Stakeholder feedback indicated that source separation was generally only undertaken by larger corporates: organisations with specific waste or recycling policies or organisations where it is financially beneficial to do so.

Other factors contributing to low source separation and recycling rates include:

- no obligation on businesses to separate waste at source;
- the comparatively low cost of waste management in business and the size of the potential gains vs the additional cost (both financially and operationally in terms of time and hassle relative to salaries, rent or utilities);[5]
- a lack of infrastructure that can process mixed C&I residual waste;
- on-site constraints that inhibit source separation e.g. lack of space for multiple bins or insufficient access for waste collection vehicles;
- few and volatile end markets for recycled materials;
- education and other programs are often needed to deliver source separation, which is time consuming and costly for SMEs;
- a lack of access to recycling facilities, particularly in regional and remote locations.

Other factors are considered in Section 4.4.4 of Volume II.

Efforts have been made by the EPA to increase the source separation of C&I waste. The EPA implemented the Bin Trim program, to support SMEs to improve the avoidance, re-use or recycling of waste in the workplace. The program targeted individual businesses, rather than influencing SME's on a broader scale.

A recent evaluation of the Bin Trim program found that it made a direct contribution to the aims of increasing the recycling of C&I waste. Opportunities were identified to improve the program, including more targeted marketing of rebates, additional oversight and technical training for assessors, improved monitoring of waste bins for composition and volume, independent advice and improved communications with participants.

Whilst the Bin Trim program has demonstrated a degree of effectiveness in improving recycling rates, the size of the gains being realised are insufficient to achieve significant improvement at a whole of state level. Further the program targets individual businesses, rather than influencing SMEs on a broader scale.

[5] Bin Trim results indicate potential savings of $100 to $500 per annum which may not be sufficient motivation when taken into account with other considerations.

A number of behavioural impediments have been identified (see Section 4.4.2, Volume II) which influence C&I waste management behaviours, including the firm belief by most SMEs they have done all they can do to minimise waste and maximise recycling (reducing the likelihood of SMEs modifying existing practices).

8.3 Considerations for the 20-year waste strategy

Analysis conducted on the C&I sector identified a number of strategic intervention points to improve recycling rates. The 20-year waste strategy may include consideration of opportunities that will be effective in achieving sustained improvement in C&I waste diversion:

8.3.1 Avoidance and re-use

The EPA should review the design of the Bin-Trim program and the opportunities to apply to the learnings across a broader base. SME's would benefit from comprehensive support and guidance to reduce their waste generation.

Reducing wastes will deliver cost savings not only from a waste disposal perspective, but from the consumption of less resources. A sample of opportunities may include:

- Moving to a paperless work environment;
- Use of technology to minimise manual processes and materials consumption (e.g. electronic invoicing and statements);
- Reviewing order processes; inventory holdings to reduce stock obsolescence;
- Requiring suppliers to implement re-usable packaging or requiring them to remove packaging upon subsequent deliveries;
- Replacing disposable items with re-usable products;
- Implementing a culture of waste avoidance (e.g. some organisations have removed general waste bins from office and replaced with recyclable bins only).
- Working with suppliers to recover and re-use packaging and other materials consumed by business.
- Moving away from single use products in the workplace (coffee cups; plastic bags; plastic cutlery; take-away containers).
- Discouraging landfill disposal. Options may include
  - developing voluntary agreements for different industries and provide support in developing best practice waste management tailored in specific high waste volume industries (a potential expansion of the OEH sustainability advantage program);
  - look at opportunities to consolidate waste collection where there are spacial constraints to support additional waste infrastructure (e.g. food streets, commercial or industrial areas; intracity aggregation and compaction sites);
  - for high business density areas, working with industry to develop options to lower costs for all due to operational efficiencies;
  - banning landfilling of unsorted C&I waste.

Food waste

- The love food hate waste program has a number of initiatives to support waste avoidance. The 20-year waste strategy should examine the effectiveness of this program and the capacity to tailor initiatives on an industry specific basis. This may initially focus on high volume waste options. More direct strategies may be required where industry is not implementing waste avoidance strategies e.g. compulsory food donation and or food recycling if businesses exceed prescribed thresholds (tonnage of food waste generated etc. – see Section 7.3.3 of Volume III).
- Internationally, a wide range of programs have been adopted to tackle food waste (see for example Scotland, the EU and Singapore – Volume III).

Scotland

The Scottish government has recently pledged to reduce all food waste by 33% by 2025. The Scottish government introduced the 'Good to Go' scheme, which tackles the 53,500 tonnes of food that is wasted by Scottish restaurants each year. Through the scheme, restaurants are required to provide diners with their leftovers as a matter of course. This challenges the culture around leftovers and saves food from the bin.

European Union

The EU has established a target to halve per capita food waste at the retail and consumer level by 2030, and reduce food losses along the food production and supply chain. Key actions undertaken included implementing a multi-stakeholder platform (EU Platform on Food Losses and Food Waste) involving both EU countries and businesses in the food chain in order to help define measures needed to achieve the food waste SDG, facilitate inter-sector co-operation, and share best practice and results achieved.

The EU Platform:

- *aids the identification and prioritisation of actions to be taken to prevent food losses and food waste;*
- *aims to identify opportunities for food waste prevention across the food production and consumption chain and facilitate inter-sector cooperation.*

The platform initially focussed on:

- *implementation and application of EU legislation related to waste, food and feed to ensure the highest value use of food resources (in line with a "food use hierarchy");*
- *facilitation of food redistribution;*
- *examining ways to improve the use of date marking by producers in the food chain and its understanding by consumers, in particular "best before" labelling.*
- *awareness, information and education campaigns;*
- *technological and social innovation;*
- *clarify EU legislation related to waste, food and feed and facilitate food donation and use of food no longer intended for human consumption in animal feed, without compromising food and feed safety*

Recommendations on food waste prevention initiatives are expected in mid-2019.

Processing and recycling

a) Source separation

The 20-year waste strategy should review options for the source separation of recyclables. A comparable approach has been adopted in Scotland. Under the Waste Scotland Regulations (2012) all businesses are required to separate their waste for disposal and recycling or recovery. Businesses that keep or produces food over 5kg per week must also take all reasonable steps to ensure separate collection of food waste.

Such an approach would need to be implemented in consultation with councils, waste collection and waste processors and business. The implementation strategy would need to:

- Ensure sufficient waste collection options (bins sizes; collection methods) were available to deal with different business needs;
- Ensure a cost effective waste collection solution could be implemented by industry. SME's will be sensitive to any cost increases;
- Ensure local councils are supportive of additional collection schedules to avoid trucks on the road at peak periods;
- Assess whether additional processing facilities will be required to process the source separated waste, taking into account the new C&I facilities at Weatherill Park and Eastern Creek and Veolia's proposed facility at Camelia (see Section 4.4.5, Volume II);
- Assess the additional infrastructure required to collect; aggregate and transport (by road or rail) the collected materials to processing facilities;
- Consider whether time is required to develop end markets for the recovered materials (e.g. plastics).

Introducing extended producer responsibility schemes (including funding for collection and processing – See Key Finding 5), may also support increased source separation.

b) Incentivising appropriate behaviours

Collection of C&I waste is usually charged per bin collection (lift), based on the volume of the bin. Collections are planned and scheduled to optimise available capacity in trucks and to minimise transport costs. Service provision usually requires minimum waste volume and pricing usually reflects the operational efficiencies that can be realised by including additional sites into waste collection schedules. The structure of the industry (including being able to secure a steady stream of waste materials) and the pricing of the service delivery can be a significant inhibitor to an individual business electing to adopt improved recycling practices or for new waste service providers to enter the market.

The EPA could look at a phased transition to separation at source, with the commencement of a mandatory requirement to come in at the end of a transition period, during which the EPA could provide comprehensive support and guidance for businesses to reduce their waste generation and develop source separation strategies.

The 20-year waste strategy should include the analysis of options to implement a revised fee structure to incentivise C&I customers to reduce the volume of residual waste ending up in landfill. Such an initiative could be co-developed with industry or alternately, a pilot program could be trialled across a group of councils (as part of the implementation of source separation requirements).

Tariffs could be structured such that a higher tariff applies to the volume of residual waste with lower tariffs applied to source separated materials. This would provide a clear incentive for business to minimise its residual waste. Penalties may be imposed by waste collectors where businesses fail to consistently meet minimum requirements for source separation.

Industry may not be supportive of implementing a new tariff structure and will need to participate in a co-development strategy. As an incentive to participate in the program and as a means to ensure efficiencies in the future collection of waste C&I waste, the EPA may wish to examine the option to develop a coordinated procurement program, for source separated wastes. A similar concept was implemented in New York (see Appendix B).

Pursuing this type of program will:

- Minimise the number of trucks in a specific geography;
- Improve efficiency in service delivery and drive down costs;
- Allow volume to be leveraged to reduce the unit cost charged to businesses and allow for consistency of pricing across businesses (this will benefit smaller businesses who do not have the same purchasing power);
- Support new market entrants and ongoing contestability.

The capacity to implement would need to be examined in further detail to address any potential impediments.

As a risk mitigation strategy, the approach could be tested through a pilot program in a particular council.

c) Organics

With an estimated 51% of C&I waste comprising degradable organic materials, the EPA may wish to explore an organics-specific solution for C&I customers.

Larger customers are already likely to have organic recovery arrangements in place so additional analysis will be required to quantify the potential volume of organics that remains in the waste stream.

d) Innovation – Fines, Treated Timber, Pulp

18% of C&I waste comprises shredder floc and pulp. Shredder floc is a by-product of metal reprocessing, primarily from the recovery of end-of-life vehicles (ELVs) and white goods.

Shredder floc typically consists of a combination of plastics, rubber, textiles, metals and inert materials such as dirt and glass, and is generally contaminated with heavy metals, mineral oils and hydrocarbons.

ELV reprocessing in Australia has a recovery rate of approximately 65-75%. European Commission Directive 2000/53/EC, aims to reduce the hazardous componentry of vehicles and achieve a target of 85% for re-use and recycling (excluding energy recovery).

The key market barriers for use of shredder floc are cost and contamination (residual oil). Processes and technologies exist to extract the oil, however, this would incur additional cost which is unlikely to be recovered. Shredder floc may be a viable as an input to an Energy from Waste (EfW) facility. Uncertainty regarding contaminant levels and high processing costs, precludes shredder floc from being used in other products.

In Australia, fines are usually sent to landfill.

Markets exist for clean, untreated timber waste such as animal board, animal bedding and in landscaping. However, it is currently difficult to recycle treated or engineered timber due to the presence of preservatives and toxic chemicals. There is currently no good solution or diversion strategy for the treatment or recycling of treated wood.

The 20-year waste strategy way wish to support innovation (e.g. grant funding for research; pilot programs or commercialisation) in dealing with high volume and problem wastes in the C&I stream such fines, treated timber, shredder flock and pulp.

End markets

Most waste C&I materials that can be recycled have established end markets, however, as noted in Key Finding 10, the plastics market is under currently developed.

Research and innovation grant programs into recycling C&I waste streams may assist with reducing the volume of residual waste in C&I.

Industry should respond to the opportunities presented by increases in the supply of waste materials that can be recycled, as long as they have visibility and certainty of supply (with low contaminates). Additional processing capacity should evolve over time if the recycled materials are competitive in terms of cost and quality with virgin materials.

The 20-year waste strategy should consider whether the market should be allowed to respond to the new opportunities, or whether or a more prescriptive approach should be followed if new capacity can achieve other policy objectives (e.g. employment in regional areas).

Such an approach would need a clearly defined strategy for the relevant waste materials to support any decentralisation proposals developed by the NSW Government.

Interdependencies

Funding of source separation will be a sensitive issue for businesses. Incremental costs may be partially offset through producer responsibility schemes (e.g. changes to the Australian Packaging Covenant).

Additional processing capacity is likely to be required and sufficient time will be required for the Government to work with industry (as part of the Waste Infrastructure Plan) to agree on an appropriate locations for the new facility.

If a decision is made to prohibit unprocessed waste going to landfill, then the EPA will need to form a view on the preferred technology in light of the current issues with MBT plant output.

Key Finding 9

C&D diversion statistics are close to target, but further gains are possible particularly with improved source separation

9.1 Overview and context for change

C&D waste generated in FY18 totalled 12.77Mt, a 20% increase over FY17 (and 26% since FY16).

C&D was the largest contributor of waste going to landfill in FY18, 2.94Mt (39% of total landfill), an increase of 50% over FY17 (see Section 4.3 – Volume II).

90% of C&D waste in FY18 came from the MLA.

C&D volumes are driven by the level of residential and commercial building construction and demolition activities and large scale infrastructure projects. The significant growth in C&D waste volumes has been influenced by NSW's significant infrastructure program.

With a further $87 billion spend on infrastructure pipeline over the next four years, the NSW waste strategy will need to take into consideration the short and longer term impact these projects are likely to have on waste generation and transportation volumes; its immediate impact on C&D volumes and the flow on effects to C&I and MSW volumes.

The C&D recycling industry is considered to be mature and consistently delivers high diversion rates, ranging from 77% to 81% across FY16 to FY18 (Section 4.3.1 – Volume II).

C&D wastes are primarily metals and inert masonry materials (uncontaminated soil, bricks, aggregate, road base, ballast, bricks, concrete, ceramics and tiles) and non-inert masonry materials (timber, plasterboard and other organic materials). Lower volumes of ferrous metals and organics are also generated. The mix of C&D waste volumes is influenced by the nature of the projects and the extent which materials can be re-used.

Limited data is available on the composition of C&D waste to landfill. A 2000-2005 compositional study of the Sydney Metropolitan Area found C&D landfill by weight primarily comprised asbestos contaminated waste; contaminated soil, concrete and clean soils (Section 4.3.2 – Volume II).

9.2 Barriers to greater levels of recycling

The cost of landfill and the scrap value of certain materials (e.g. ferrous metals) provide strong incentives to recycle C&D waste, however, a number of barriers still remain that may impact on the ability to improve upon current rates:

- interstate leakage: approximately 830,000 tonnes of largely C&D waste was transported to Qld from NSW during 2016-2017 (Qld had no waste levy). Whilst the Qld Government has introduced a new waste disposal levy (commencing 1 July 2019), stakeholders have expressed the view that waste will continue to be transported to Queensland as long as it is cost effective to do so.

  Stakeholders estimated that up to two thirds of the volume currently being transported to Queensland will be seeking alternate landfill options in NSW post 1 July 2019.

  It will be important for the EPA to monitor the impact of Qld's new waste levy on the interstate transfer of waste, which may highlight other drivers of interstate transfer. It will also be important to consider how the price differences between the NSW and Queensland schemes will continue to influence rates of interstate transfer.

- difficulties in being able to source separate materials on site;
- a lack of markets for certain materials;

- contamination of materials through comingling;
- certain materials are unable to be recycled (e.g. contaminated soil; treated timber);
- a lack of knowledge and the cost of separating recyclable materials on smaller building sites;
- a lack of planning to optimise waste recovery from construction and demolition activities;
- low value and low volume products are landfilled rather than being stored for recycling as it is uneconomic; and
- challenges in collection and transporting wastes.

9.3 Considerations for the 20-year waste strategy

Mixed C&D waste represents the majority of C&D waste that is sent to landfill. Improving on-site separation and processing will support improved diversion rates and reduce contamination.

Improvements in waste diversion and re-use may also be realised through:

- designing products and structures for their eventual deconstruction to support resource recovery (the increased use of adhesives in construction is negatively impacting the ability to recycle certain materials);
- reducing the cross contamination of waste at point of capture and separation on-site;
- promotion of re-use of materials as part of construction and demolition planning;
- better up-front planning for construction and demolition activities to achieve minimum re-use and recycling targets; ongoing monitoring of compliance with plans and audits of actual outcomes;
- incorporation of re-use and recycling targets in contractual arrangements (the London 2012 Olympic Park demolition included an overall target of at least 90% by weight of demolition material to be re-used or recycled - see Appendix C);
- encourage the uptake of recovered materials through State and local government procurement;
- define quality standards and materials specifications to provide a framework for the use of recycled materials and overcoming market; and
- support research into technical barriers impacting the ability to re-use or recycle non-recycled materials (e.g. treated timber).

The EPA may also wish to investigate the merits of the EU's Construction & Demolition Waste Management Protocol (see Appendix D), which has a stronger focus on source separation and establishment of quality controls to ensure materials do not become contaminated.

Key Finding 10

Low levels of plastic are currently recycled.

10.1 Overview

Insufficient data is being captured by the EPA to quantify the volume of plastic waste being generated in the market and where these materials are ending up. The EPA relies on market studies to estimate plastic waste flows. Some information is gathered in relation to the volume of plastics recycled, but it is incomplete.

Total plastics consumption in NSW in 2017-18 was estimated to be approximately 1.09 million tonnes. 32% of plastic volumes is estimated to be generated by the packaging industry and 23% by the automotive and built environment sectors.

86,100 tonnes are estimated to have been diverted from landfill (7.9% recovery rate), a small increase over FY17 (85,200 tonnes - 9% recovery rate) and 94,600 tonnes in FY16 (10.1% recovery rate).

In 2017-18, 56% of recycled plastics were identified as being derived from the MSW waste stream and 37% from C&I. Of the 86,100 tonnes recovered, 26,100 tonnes (30%) were reprocessed locally in NSW, 56,800 tonnes were reported as exported for reprocessing and the remaining 3,200 tonnes were transported interstate for reprocessing.

Stakeholder feedback indicated that following China Sword, plastics were being exported to Thailand, Malaysia, Vietnam and Indonesia. Thailand, Malaysia and Vietnam have subsequently imposed tighter restrictions; revoked import licenses or banned certain wastes.

It is not clear whether plastics being sent overseas are being recycled. Plastics are primarily exported as mixed plastics. Industry feedback is that they believe a high portion of mixed plastics wastes sent overseas are likely to end up in landfill, incinerators or are being improperly disposed of.

Markets for recycled plastics are currently under developed. The primary concern for manufacturing businesses is the lack of reliable supply (with low contamination); a lack of end markets for recycled product and the cost competitiveness of recycled materials vs virgin product. Stakeholders consulted indicated a belief that growing pressure through social media may start to influence attitudes toward the greater use of recycled materials.

10.2 Barriers to recycling

The plastics stream suffers from a low recovery rate. This is a combination of multiple contributing factors that are interdependent (see Section 8.3.4, Volume II). Research and stakeholder consultations have identified the following impediments to higher use of recycled plastic:

- there is no positive obligations on industry to use recycled materials – aspirational targets by industry may not be effective or achieve the desired change in the timeframes required;
- plastics are not being consistently source separated across the MSW and C&I streams;
- households and businesses have a poor understanding of what plastics may be recycled (and therefore included in the dry recyclables bin) and which plastics are to be excluded;
- more than 200 recycling labels are used in Australian packaging, leading to confusion as to what plastics may be recycled, leading to contamination in the kerbside recycling and high processing costs or waste being sent landfill;

- there are high levels of contamination in the recovered plastics, leading to lower processing yields and higher costs of production. Recycled materials struggle to be cost competitive with virgin materials;
- implementation of the CDS is producing a higher yield of plastics through the CDS channel. A concern was raised that the quality and volume of residual plastics in dry recycling will decline and is likely to have comparatively higher contamination. Expansion in plastics processing capacity may not eventuate if contamination remains at current levels;
- domestic recycling capability is limited to certain plastic types (with the remaining mixed plastics being exported or land filled);
- a lack of certainty over the volume of recovered plastics (and underlying quality issues), has limited the level of scale investments in plastic recycling. This has had a negative flow on impact on the level of new product development using recycled plastics;
- large scale plastic sorting plants are required to improve sorting of plastics by grade and colour in a cost competitive manner;
- certain plastics are not being recycled either due to there being no end user of the recycled material (i.e. no domestic products or manufacturing requiring certain plastics) or certain products were not designed with recycling in mind (i.e. not recyclable through existing facilities or due to their combination with other materials (inks, adhesives and coatings) or non-recyclable plastics);
- certain plastics, such as food grade plastics films, cannot be recycled for re-use in the same or comparable products and therefore have limited application unless product innovation occurs (e.g. creation of new products utilising recycled plastic films);
- coloured PET (excluding light blue); used polystyrene (PS) packaging; and PVC materials are not currently being recycled in sufficient volumes (to recover the volume generated) as the cost of recycling is comparatively high and there is no end market;
- industry believes many MRFs are using less efficient sorting technology. Investment in modern technology (e.g. robotics) will improve processing yields, reduce contamination and increase recycling volumes (subject to there being an end market);
- Australia's higher cost structures (labour and electricity) reduce the competitiveness of domestic recycled plastics vs imported materials. This has resulted in domestic manufacturers importing recycled materials from south east Asia;
- certain plastic products currently do not have alternate uses, whilst other products can be processed into lower value products such as strapping. There is also a shift towards more organic based strapping materials. Not all plastic wastes will have an end market and consideration may need to be given to phasing out single use materials; and
- plastic is a challenge to recycle, due to the variety of additives and blends used to manufacture the significant variety of products that are tailored to the specific industries and regulatory regimes with which they must comply.

10.3 Considerations for the 20-year waste strategy

Gains being achieved in the UK and Europe in plastic recycling are the product of manufacturers, retailers and recyclers coming together to develop and implement strategies supported by clear policy direction and targets.

Avoidance

There has to date been an insufficient level of focus on the volume of plastic waste being generated.

There is no positive obligation on industry to use recycled materials and aspirational targets by industry may not be effective to achieve significant change in the timeframes required.

Industry feedback indicated there is a need to control the nature and volume of waste being generated and positive obligations are required to support the development of domestic markets and the innovation that will follow.

The 20-year waste strategy should consider setting appropriate policy targets, guided by the Australian Packaging Covenant targets and the Ellen MacArthur Foundation's New Plastics Economy Initiative.

A long-term strategy may give particular consideration to methods to improve the current rate of plastic recycling.

Re-use

Plastic makes up about half of the material found in consumer goods packaging.

Countries such as the UK and Singapore have introduced voluntary initiatives between government and industry to reduce packaging waste. Whilst these have been beneficial in focussing industry innovation to achieve reductions in waste (for example through reducing the size of packaging; thinning the plastic packaging; using alternate materials; use of air-filled cushions to replace low-density polyethylene foam cushions; creation of re-fillable containers; modifying product design e.g. concentrated dish washing liquid reduced the number of bottles that consumers used), industry achievements have remained subject to the cost-effectiveness of their implementation. Such schemes have also been criticised for their lack of annual targets, clearly defined material or product focus and their voluntary nature, which results in a lack of capacity to monitor and enforce commitments.

The 20-year waste strategy, should take on board the learnings from overseas jurisdictions, including:

- Use of extended product stewardship and producer responsibility schemes (see Key Finding 5) to:
  - reduce the volume of packaging (including plastics) used (through redesign, innovation, or new delivery models), with clearly defined targets;
  - eliminate problematic or unnecessary plastic packaging through redesign, innovation, or new delivery models;
  - application of re-use models to reduce the need for single-use packaging;
  - examine opportunities for producers to recover and re-use certain packaging materials from its customers;
  - reduce the volume of plastic waste (including through material substitution) in packaging materials;
  - phasing out the use of single use or problem waste streams;
  - improve product design to support re-use with minimal levels of reprocessing;
  - funding arrangements to contribute to the re-use, recovery and recycling of plastic wastes;
  - development of economic incentives to reward sustainable design choices.
- Implementation of actions to remove problem waste streams. Examples include:
  - the UK considered implementing a charge on disposable coffee cups to discourage their use (poly-coated paper cups are technically recyclable, but few UK facilities are capable of doing so);
  - the UK has introduced a ban on single-use plastics from the government estate;

  - a 5p plastic bag charge was introduced in the UK to small retailers (charge has seen a successful 85% reduction in England since its introduction in 2015). In Australia, recent plastic bag bans by the major supermarket chains have reduced a significant amount of high density polyethylene (HDPE) single use plastic in the environment but in the absence of regulation, a significant number of other retailers continue to provide single use shopping bags;
  - European parliament has implemented a wide-ranging ban on single use plastics (e.g. straws; swabs; plates and cutlery), with the UK to adopt similar measures.

- Programs to support consumer education and support of producers who have implemented waste reduction programs (e.g. in Singapore, consumers can support products which bear the Logo for Products with Reduced Packaging (LPRP) – a voluntary eco-label which identifies products which have undergone improvements by signatories to reduce the amount of packaging materials used);
- Better education of households and businesses on what materials can be recycled;
- Programs (research and grant programs) to support the chemical industry and plastics recyclers to develop and find wider and higher value applications for their output. Substances that hamper recycling processes may need to be replaced or phased out; and
- Use of taxes, bans and other deterrents (phased in over time) or funding programs to drive innovation in plastic materials and the development of alternative feedstock for plastic production that are more sustainable.

Collection and Transportation

Plastic recycling is held back by insufficient volumes of quality materials. Source separation is essential to avoiding contaminants in the recycling stream. This is evidenced by the significant improvement in quality of plastic waste through the CDS (see Section 10).

The State, local councils and waste management operators each have roles to play in raising public awareness and ensuring high-quality source separation and collection (see Key Finding 2). Education is a key component to improving source separation of plastics in the MSW stream. Extended Producer Responsibility schemes will also play a role in producing high quality waste streams (see Key Finding 5).

The transition to mandated source separation of waste (including plastics) will require industry to review and restructure waste collection programs and infrastructure (including the design of collection bins; frequency of collection; and options to address any impediments put forward by households and waste generators).

Additional waste transfer stations may be required to support the aggregation of recyclate for delivery to processing plants.

Further consultation is required with industry to understand the likely volumes of recyclate post the implementation of potential reforms to understand the need for additional infrastructure (and when). The State should consider whether industry should be left to respond to these needs or whether competition and regional development policy should support a new market entrant or direct investment in particular regional centres.

Plastics production and recycling

Stakeholder feedback indicated that improvement in the certainty of waste volumes; decreased contamination and cost competitive processing should increase the demand for recycled plastic content. A stronger focus on re-use, a reduction in the use of problematic plastics and production of source separated waste steams with lower contamination should improve the recyclability of plastics and reduce the volume of microplastics entering the environment.

With more plastic being collected, scaled up recycling facilities should be established using greater levels of automation for the sorting of plastic wastes. This should reduce the unit cost of production and support a more competitive plastics recycling industry.

If additional volumes are able to be captured through source separation, further investment in processing capacity and new technology will be required to cost effectively process waste, including addressing existing barriers with respect to inks, adhesives and other coatings currently being applied to plastic packaging (either through product redesign or research, potentially supported by grant funding).

In addition to the issues set out above, higher levels of plastic recycling can only be achieved by improving the way plastics are designed and used in production. It will require increased cooperation across the value chain: from plastics manufacturers and converters to consumers and waste management companies.

The emergence of degradable plastics and plastics with biodegradable properties brings new opportunities as well as risks. Plastics with biodegradable properties present potentially better environmental outcomes, however, they are unable to be processed within existing organics programs and present a level of potential contamination. The 20-year waste strategy will need to consider the role and opportunities for biodegradable plastics, their collection and subsequent processing.

The absence of clear labelling or marking for consumers, can lead to increased use of degradable plastics in the environment and the problem of microplastics. The 20-year waste strategy should consider the role of degradable materials in light of a focus on avoidance, re-use and recycling.

If additional types of plastics are collected from the various waste streams, additional processing capacity will be required to separate the different plastic components and process them into end products.

Producers presently have low incentives to take into account the needs of recycling or re-use when they design their products. Plastics comprise a range of polymers that can be customised, with specific additives to meet functional or other requirements, impacting the ability to recycle (or to do so in a cost effective manner) and the quality and value of recycled plastic. The 20-year waste strategy should consider:

- a program or works for government, producers, customers and recyclers to resolve issues or reduce (through product redesign) the volume of materials that are difficult to recycle. Design improvements may reduce up to half the cost of recycling plastic packaging waste;
- implement requirements that all plastics packaging placed on the NSW market is reusable or can be cost-effectively recycled by a defined date. This should preferably be undertaken as a national obligation coordinated by the Commonwealth;
- extended use of recycling labels to reduce confusion and provide clear on pack instructions on what can be recycled (through the kerbside); conditional recyclability (can be recycled if instructions are followed e.g. returned to the store) and what should be placed in the general waste bin;
- investigate the opportunities to recycle and the impact of additives (e.g. fire retardants) on plastics used in automotive, furniture and electronics and other significant (longer life) sectors;
- the need for some of the environmental considerations outlined in this section to be incorporated into design standards for products that contribute significant volumes of waste.

End markets

End markets have not fully developed due to uncertainties over the ability of recyclers to deliver a reliable supply of materials in sufficient volume and with constant quality specifications and no contamination. Concerns over the underlying long term viability or commitment of processors

also has contributed to a lack of development in end markets. The lack of positive obligations across industries to use recycled content has in part also led to a lack of a pull effect for recyclers.

The 20-year waste strategy should consider:

- stimulating the market for recycled products through measures such as mandatory government procurement of products using recycled plastic (including in road works and other government infrastructure);
- development of products standards and commitment to undertake the necessary research to address potential concerns over product quality and health considerations;
- obligations or incentive schemes for greater utilisation of recycled materials in domestically manufactured plastic products;
- grant funding to support new product development, pilot plants and commercialisation; and
- incentives for new products developed using recycled plastic materials (with a focus on those plastics materials that are currently being exported in an unprocessed state).

These policy levers should be considered in the context of whether they are to have broader, whole of market application or are targeted sectoral interventions.

Examples of these policies that have been adopted internationally include:

- food and drink companies will be taxed in the UK on plastic packaging that does not include at least 30% recycled content;
- Scotland has banned the manufacture and sale of plastic stemmed cotton buds and is taking steps to ban the sale of rinse-off personal care products containing microbeads;
- the UK has established a £20 million Plastic Research and Innovation fund; and
- Scotland has established an £18 million Circular Economy Investment Fund for small and medium sized enterprises who are helping to create a more circular economy.

Interdependencies

Obligations and strategies under product stewardship schemes may need to incorporate or be supported by other arrangements, for example:

- education programmes;
- bans or taxes on non-recyclable materials e.g. plastic bags, straws and cutlery;
- financial incentives (for households and business to source separate materials or funding support e.g. grant programs for new infrastructure and new technology investments to separate and recover waste materials from comingled wastes);
- support for development of a re-use industry; and
- phasing out the use of hazardous or single use materials in products.

Development of additional processing capacity needs to take into account contestability and regional development objectives and the resulting need to consider cost-effective waste transport options. It may also be appropriate to consider the opportunity for waste from Victoria to flow into NSW processing capacity.

Larger scale plants; increased automation and robotics and better quality feedstock (lower contamination to driver better yields) would improve the competitiveness of recycled materials. The State may need to influence industry to ensure new technology investments will sustain the plastics program into the future.

Key Finding 11

There is a viable end market for waste paper in NSW, but improvements in the recycling rate are required

11.1 Overview

NSW data from the 2016-17 financial year indicates that approximately 709kt of paper waste was sent to landfill (330kt from the MSW stream and 379kt was landfilled from the C&I waste stream). In the same period, approximately 741kt of used paper was reprocessed (177kt from the MSW stream and 564kt was reprocessed from the C&I stream).

Key Finding 7 and 8 identified that despite the use of a dry recyclables bin, significant levels of paper and cardboard remain in the MSW (19.6%) and C&I (c.15%).

With waste paper moving into and out of NSW, it is difficult to assess the current level of waste diversion. Analysis has estimated that recycled paper accounts for 50% of the paper (production) inputs used by NSW industry. However, industry estimates obtained during the Advisers' stakeholder engagement were higher.

Nonetheless, the NSW performance is lagging overseas jurisdictions. Research indicates that paper recycling in the US is approximately 67.7%. The EU has established a paper recycling target of 85% by 2030 (and 74% by 2020), achieving a rate of 72% in 2017.

There has been no significant improvement in NSW recycling volumes in recent years (c.1.1m tonnes per annum across FY16-18).

11.2 Barriers to recycling

There are physical and process limitations to paper recycling, including as a result of contamination. Paper production requires the infusions of new virgin fibres because recycled fibres fray and shorten from repeated use. Research indicates paper may be recycled up to 5-7 times before additional virgin material is required.

As noted in Section 8.2.3 (Volume II), contamination in the dry recyclate bin can negatively impact the recycling of paper. Certain contaminants can render the paper unusable for recyclable purposes or limit its use to lower grade papers. Research indicated that up to 20% of baled recycled paper is rejected on the basis of high levels of plastic contaminate.

The cost of disposal of contaminated bales contributes to the cost of recycling and threatens the economics of recycling. As a result, different prices are paid for used paper, determined by the quality of the bales. Generally, paper mills are permitted to reject poor quality bales. The price of recyclable paper is currently less than the cost of producing virgin fibres (i.e. from wood), meaning that cost is not presently a barrier to recycling.

Industry has also advised that fine glass shard contaminants in the paper recyclate is a growing problem due to the impact it has on machinery using the recycled product.

11.3 Considerations for the 20-year waste strategy

Paper is pointed to as a recycling success story. However, there is scope to improve recovery and recycling rates for paper in NSW. Some of the considerations discussed above in Key Finding 10 in respect of plastic hold true in respect of paper. Unlike plastic, however, the cost of producing recycled paper products is, generally, less than producing paper products from virgin materials. This assists the business case.

Factors which should improve the recycling rate include:

- improvements to MRF sorting processes to remove (or significantly reduce) contamination levels;
- separating the paper recyclate collection process from other recyclate; and
- improving demand for recycled paper products, as discussed above in Key Finding 3 (including mandating recycled packaging);

Key Finding 12

Organics: Significant reductions in the waste going to landfill can be achieved, by capturing organic materials in the MSW and C&I streams

12.1 Overview

Food wastes comprise c.35% of waste to landfill in the MWS stream (11% of total landfill volume) and 25% in C&I.

Overall, organics comprise approximately 54% of waste in the MWS stream and 29% of waste in the C&I stream.

Food and organic wastes are not being consistently captured across LGAs. As of 2016-17:

- 77 Councils (60%), offer an organic waste collection service (food and/or organics);
- 4 Councils (3%) offer a food and garden organics (FOGO) service;
- 73 Councils (57%) do not offer either an organics or FOGO waste collection service
- 51 Councils (40%) do not offer either a food or organics service.

LGAs offering a FOGO only (no separate garden organics) service had an average diversion rate of 54%, whilst those offering a garden vegetation service only (no separate food organics) had an average diversion rate of 44%. Four councils offer both a Garden Organics and FOGO service (at least to some of the residents) and have an average diversion rate of 41%.

There are four main methods currently used in NSW for the treatment of organic waste:

1. On-site composting by households and businesses (using worm farms and composting bins);

2. Green organics or mixed food and green organics processing plants (that produce a compost product for use, predominantly, in urban settings)

3. MBT (extracting organic material from mixed waste)

4. Anaerobic digestion.

There are 80 organic processing facilities in NSW, the majority (62) of which have an annual licensed capacity of 50,000 tonnes per annum. Research conducted for the EPA indicated that these facilities are at (or very near) their processing capacity (with current equipment).

Organics from mixed waste are currently being processed through mechanical biological treatment (MBT) facilities. The main output from an MBT process is mixed waste organic output (MWOO). In contrast to FOGO, MWOO is derived from organic outputs from mixed waste, rather than from food and organic waste only, meaning that there is a higher level of contamination (e.g. flecks of plastic) in MWOO. There are five MBT facilities in NSW processing over 500,000 tonnes of mixed waste per year. This has resulted in over 50% (by mass) diversion of the incoming waste from landfill through a combination of extraction of recyclables, moisture lost through the process and constructive use of MWOO.

Until October 2018, MWOO was used in NSW on mine sites, forestry and non-contact agriculture end uses, each with application rate limits, pursuant to the terms of a Resource Recovery Order (RRO). An independent research program commissioned by the EPA concluded that there are limited agricultural or soil benefits from applying MWOO at the regulated rates, but potential physical contaminant and environmental risks were identified. In October 2018, the EPA withdrew the RRO. Since then, organic outputs that might otherwise be applied to land are being sent to landfill as a result of these restrictions.

Anaerobic digestion (AD) is another method of treatment of organic waste. The end products of AD are gas for the production of energy and a by-product which is often applied to land as a soil

enhancer. Anaerobic digestion plants can vary in size and can be of a sufficiently small scale to use for on-site treatment of waste. Others (such as those installed a water treatment plants for the treatment of organic waste from the plant) are large enough to be able to also accept external sources of organic waste to mix with the treatment plant waste. Energy can either be utilised behind the meter, for the site where the AD plant is located, or transferred to the grid.

The extent of contamination in organics recycling bins can influence whether the organics is processed into materials for alternate use or landfilled.

12.2 Barriers to recycling

As noted in Key Findings 7 and 8, a significant portion of organic waste is not separated at the source and is therefore ending up in landfill. Presently, only 32 LGAs offer a FOGO service, with a further 50 offering a garden organics only service. A greater level of source separation would reduce the volume of waste going to landfill. MSW and C&I barriers are discussed in Key Findings 7 and 8.

Other issues relevant recycling volumes include:

- the provision of source separated organics may not be cost effective on a standalone LGA basis;
- some processing facilities are not licensed to receive compostable packaging;
- confusion exists as to products identified as "degradable" which do not 'compost', and will contaminate the end compost reducing its value or limiting its use;
- some compostable packaging products are sent to landfill as they cannot be processed by organics plants, using current technology and processes;
- research into household behaviours found residents with food and garden waste (FOGO) collection services are often unsure or incorrect about which items can be recycled in this stream, however, 88% agreed that a recycling bin for organic waste (i.e. food and garden waste) was a good idea.

12.3 Considerations for the 20-year waste strategy

The 20-year waste strategy needs to consider options to:

- support C&I specific programs tackling food waste (see Key Finding 8);
- improve education and other programs to increase the rate of organics recovery from existing garden organics and FOGO programs;
- assess whether there is a preference in terms of technology and collection programs, recognising that FOGO offers a higher organics recover relative to garden organics programs;
- increase the rollout of organics services (garden organics or FOGO) across LGAs (where cost effective to do so); and
- work with industry to develop programs (e.g. education; spot audits at point of collection) to reduce the volume of contaminants in the organics waste stream.

Waste avoidance and re-use

The 20-year waste strategy needs to provide an increased focus on options to reduce food and garden waste. Options include:

- education campaigns to promote increased source separation;
- packaging initiatives to improve shelf life;
- detailed examination (via waste audits) of the composition of residual organics in the MSW and the C&I waste streams; barriers to their recycling and whether tailored programs to improve diversion are required;
- increased participation and penetration in food waste reduction programs such as the Love Food Hate Waste Program;
- examine options for greater participation in food recovery programs e.g. compulsory food donation and or food recycling if businesses exceed prescribed thresholds (tonnage of food waste generated etc.);
- working with councils to promote low waste gardening, including reducing lawn areas and planting trees and shrubs that require less maintenance
- promotion of home composting, worm farms and other programs that encourage use of waste materials in the garden. Consideration may be given to the provisions of subsidised composting bins or other re-use infrastructure;
- examination of supplier take-back programs in respect of packaging or other organics in the C&I stream;
- repurposing aesthetically imperfect food, including for animal feed;
- supporting research into uses and processing for significant organic waste items in the MSW and C&I waste streams (e.g. treated timber and pulp);
- recognition that implementation of organics programs may result in an increase in organic waste volumes, as this becomes a preferable option to re-use (rather than domestic composting) in the household. LGAs must work with their service provider to implement strategies to mitigate this risk, including, household bin audits before and after the FOGO service is introduced.

Collection and Transportation

The potential transition to mandated source separation of wastes will require industry to review and restructure waste collection programs and infrastructure (including the design of collection bins; frequency of collection; and options to address any impediments put forward by households and waste generators).

Additional waste transfer stations may be required to support the aggregation of organics for delivery to processing plants.

Further consultation is required with industry to understand the likely volumes of recyclate post the implementation of potential reforms to understand the need for additional infrastructure (and when). The State should consider whether industry should be left to respond to these needs or whether competition and regional development policy should support a new market entrant or direct investment in particular regional centres.

Processing and recycling

There is scope for greater on-site treatment of organic waste, particularly by businesses. As described above, some sites have introduced on-site anaerobic digestion plants for processing of organic waste. In Singapore, for example, to try to reduce the high proportion of food waste in the general waste stream, with the support of a funding program, a number of site-based biological food waste technologies have been implemented, both at hotels and in apartment buildings.

In the MSW stream, the increase in the diversion rates between LGAs without an organics service and those that offer either a garden organics or FOGO service implies a level of organic materials continues to remain in the general waste stream.

Subject to the resolution of issues with respect to existing MWOO facilities and the suspension of resource recovery orders and related exemptions, the 20-year waste strategy should consider (in consultation with industry and local councils) analysis of the option to implement FOGO collection systems (or as a minimum garden vegetation collection systems) across the MLA and regional areas. Such an analysis should include:

- confirmation of organic waste volumes based on latest kerbside audit data;
- the capacity of existing waste processing facilities to process additional waste volumes;
- the likely capital cost of implementing such a program and funding options available (including state and Commonwealth funding options if required);
- infrastructure requirements (i.e. collection infrastructure, transfer station requirements and road and rail infrastructure requirements);
- geographic preferences for new organics processing facilities (if deemed necessary);
- ownership and competition considerations for any new waste infrastructure;
- technology preferences given the contamination issues being experienced with MWOO and existing MBT plants;
- phasing of the implementation of any new arrangements (taking into account existing council contractual arrangements; lead time for new infrastructure; council consultation and approval processes etc.)
- the capacity of such a service to be delivered under existing waste collection contracts or the need for separate tender processes for collection and processing services;
- the preferred approach to market for collection and processing services to ensure competition in any tender process and at the contract end;
- the existence of end markets for the additional materials produced.

Phasing for the roll out of any new programs needs to focus on maximising participation and the level of organic diversion including:

- community awareness of the availability of the new service, this requires effective community engagement and prompts to use the service;
- education on what may be placed in the organics bins and education of the avoidance of contamination and the consequences of such actions;
- ensuring ease of use;
- provision of kitchen caddies and if accepted by the processing contractor, compostable bags/bin liners to support use;
- the frequency of the garbage and organics collection services - weekly organics collection coupled with fortnightly residual waste collection has been shown to have the highest participation and diversion rates (councils in Victoria have found this collection combination to reduce residual waste by 30-50%). However, industry feedback indicated that increases in contamination in the vegetation bin is quite often due to the red bins being full; and
- the transition to a fortnightly general waste may need to be phased in where supported by appropriate sample bin utilisation audit data.

End markets

End markets exist for organics, however, further analysis may be required on the capacity of these markets to absorb additional volumes. Decisions on the location of new processing capacity, may lead to a need to develop new local area markets, including optimising the value realised from the end product and examination of options to increase its market value and utility.

Interdependencies

The 20-year waste strategy needs to be developed using more recent audit data on the volume of organics in the residual waste stream.

General strategies have been proposed with respect to the MSW and C&I waste streams. The organics strategy should be a subset of these overarching strategies and implemented over complementary timeframes.

The organics strategy remains subject to resolution of existing issues with MWOO. Industry will be reluctant to invest in new capacity unless there is regulatory certainty.

The strategy may need to consider options to transition existing programs to FOGO. This will need to be conducted in consultation with industry and will be impacted by cost-benefit analysis as well as transition and competition analysis (e.g. reducing the dependence on particular facilities).

Key Finding 13

Glass contamination is limiting the volume of cullet used in production

13.1 Overview

Glass has a potentially high recovery rate given the comparatively lower cost of recycled material vs virgin material.

It is estimated that Australia consumes approximately 1.36 million tonnes of glass packaging per annum, with NSW consuming 460,000, or just over one third of the national total.

In NSW, the majority of recyclable glass is collected through the Container Deposit Scheme and kerbside collections of MSW, and predominantly in metropolitan waste levy areas. From 2015 to 2018, glass recycling in NSW was an average of 260,000 tonnes per annum, with a high of 293,000 in 2016-17 and a low of 209,000 in 2017-18. According to the 2018 National Waste Report, the overall generation of glass fell by about 180,000 tonnes between 2006-07 and 2016-17, due in part to a loss of packaging market share to plastic (see Section 6.5, Volume II).

Domestic manufactured glass bottle volumes are subject to increasing competition from plastics and imported products. The decline in glass volumes has contributed to Owens-Illinois closing two of its four glass bottle furnaces in Sydney. Benedict Industries also closed its glass sand plant in Sydney leading to a number of MRFs to increase their glass sand production capacity, or to increase their stockpiling of glass.

Glass manufacturers are also under pressure from their global clients to increase the amount of recycled materials used in their containers. This pressure is being felt domestically through corporate customers with specific environmental policies.

Imported glass does not attract any minimum recycled content requirements or seem to be under the same level of pressure to use recycled content.

The lowest cost option for processing glass is to recycle it into new glass products. Approximately 64% of glass was diverted from landfill in 2016-17 (MSW: 72%; C&I: 45%), based on an industry consultant assessment.

Around 33%% of recovered glass waste was recycled into new glass products and c.46% was crushed into glass sand, with 8% stockpiled and 9% processed interstate and the balance exported (c.3%).

Glass sand is produced by crushing glass into fines which are then used as a substitute for sand (for use in road base, pipe embedment and asphalt). However, anecdotal evidence suggests that potential end users of glass sand have concerns around the long-term effectiveness of the material, as well as potential increased wear on capital equipment compared to natural sand. Other impediments to the greater use of glass sand include concerns over the risk of asbestos in the product, issues with odours, leachate and other perceived workplace health and safety concerns.

Whilst there is a limited end market for recycled glass products (both bottles and sand), the waste levy continues to ensure that it is more cost-effective for councils and MRFs to recycle glass than to dispose of it in landfill. This points to the importance of taking steps to facilitate the growth in demand from end markets for recycled glass products (e.g. beverage company Lion, has a policy that packaging materials will have 50% recycled content by 2025) . This could include consideration of procurement targets for the use of glass sand in government contracts, both to increase its uptake and demonstrate the long-term effectiveness of the material. Additional steps would also need to be undertaken to address any concerns end users have over the suitability of the product for end use in road and other projects.

Container Deposit Scheme

The NSW Government implemented a container deposit scheme in 2017, which has seen significant recyclable volumes shift from MSW and C&I collections to the CDS.

The volume of containers collected through the CDS is significantly greater than had initially been estimated. The CDS has created a significantly cleaner waste stream which is highly desirable to the waste recyclers (PET, glass and aluminium) and is creating new export opportunities with improvements in the value being realised. The removal of containers from the kerbside is reducing the volume of recyclables collected through this channel, with existing contamination in the dry recyclables bin increasing as a percentage of recycled waste.

13.2 Barriers to recycling

Research and stakeholder consultations have identified the following impediments to higher use of recycled glass:

Glass Sand

- reluctance to use crushed glass in road base and other commercial applications due to concerns over long term product effectiveness; increased wear on equipment and concerns with respect to asbestos, leachate and odours concerns;
- lack of enforcement of existing product standards for the utilisation of glass sand as a substitute in road base or other commercial application;
- local and State government procurement policies do not support the use of glass sand and enhance the reputation of the product;
- stockpile limits may be impacting on the ability to deliver product in sufficient volumes (to meet end customer's requirements for large volumes at specific times, recognising demand is not consistent over time).

Cullet

- inability for the glass manufacturers to process small pieces of cullet (as a result of compaction in the waste collection process);
- high levels of contamination in comingled kerbside (resulting in residual contamination that cannot be removed through processing);
- limits on the use of recycled materials to 50% in clear glass and 70% in brown glass;
- movement of materials across state borders (in part due to a lack of processing capacity in NSW);
- lack of glass washing infrastructure (CDS materials are currently being transported to SA and VIC for processing and then returned); and
- limitations of existing processing infrastructure (e.g. not all facilities have optical sorters).

13.3 Considerations for 20-year waste strategy

More glass containers enter the NSW system than are domestically produced.

Access to glass with lower levels of contamination would increase the volume of glass recycled. Whilst the CDS is delivering lower level of contaminants, kerbside glass is likely to have a higher level of contaminants.

Industry feedback indicated the implementation of a glass only recycling bin would eliminate the majority of contamination. Such an approach has already been adopted in international jurisdictions, including New Zealand, Scotland, the Netherlands, Slovenia, Ontario, Belgium, Finland and Luxembourg.

It would be prudent for the 20-year waste strategy to focus on methods to address the barriers to recycling. Successfully addressing the barriers will result in the demand for glass sands and cullet exceeding the current NSW production capacity (existing glass sand capacity is less than when Benedicts was in operation).

Avoidance and Re-use

Glass Sand

Glass sand is an effective substitute for sand in a wide range of applications. Potential buyers of glass sand have raised concerns which is limiting increased use (see Key Finding 13.2). The validity of these claims have not been substantiated through this report, but would likely need to be addressed as part of the 20-year waste strategy. This would need to be undertaken in conjunction with the strategies outlined below.

Glass bottles

Key Finding 3 discusses options for industry to decrease the volume of materials used in packaging. As an example, in the UK, Coca-Cola has committed to a program to:

- use less material for each product;
- use more recycled and renewable materials; and
- make sure that its own packs are recyclable.

Domestically, Lion and Woolworths have implemented similar programs to reduce the volume of materials used in their glass bottles and milk containers. Commitments such as these should examined as part of the revisions to the Packaging Covenant with clearly defined commitments and obligations; implementation plans with measurable targets and annual reporting of achievements.

Collection and Transportation

Existing collection and transportation networks already exist in respect of the MSW and C&I waste streams.

The implementation of the CDS is expected to divert up to 75% of relevant container volumes from kerbside collections.

The EPA will need consider the flow on consequences of:

- continued growth in the CDS and the demands placed on the CDS network operator and truck movements;
- modifications that will result from reduction in kerbside collections and the risks (e.g. contamination) and opportunities this may present; and
- the potential costs and benefits of source separating glass into separate bins in MSW and C&I waste collections (including an assessment of potential volumes and options to reduce costs frequency of collection);

Processing and recycling

Modelling undertaken on behalf of the EPA in 2018 indicated that:

- any increase in the volume of recovered glass will be processed into glass sand (46%) or sent interstate for processing (39%);
- any restrictions on glass moving into Victoria will end up in NSW landfill;
- failure to grow the market for glass sands will see the majority of any future growth sent to landfill (up to 95%).

Assuming initiatives to support greater use of glass sands are effective, additional processing capacity will be required.

Supporting the development of new processing capacity should consider:

- options to expand existing facilities;
- the location of end markets for products;
- transport infrastructure strategies;
- regional and remote investment strategies.

End markets

As long as the landfill levy is in place, it will be cheaper to recycle glass than to send it to landfill.

There is a need to focus on facilitating the market for glass sands. Glass as a substitute for sand could potentially utilise all diverted glass, however, existing impediments to the utilisation of glass sand will need to be addressed.

Glass containers

An estimated 274,000 tonnes of glass is produced by Owens-Illinois at its Penrith facility each year, of which 39% is produced from recycled material. Owens-Illinois has a global objective of using 50% recycled materials in its glass products.

Accessing sufficient cullet with low contamination levels has been a challenge despite obtaining the feedstock from MRFs who have separated the material. This position is improving following the implementation of the CDS (see Section 2.5.3, Volume II), which is not exposed to kerbside contaminants. While additional glass waste could be utilised by glass producers, this is dependent on the glass waste being well sorted and uncontaminated. Projected CDS volumes will not deliver the extra tonnage. Options to consider include:

- glass only recyclables bins for MSW and C&I (as noted above, this approach has already been adopted in overseas jurisdictions);
- based on the success of the CDS, the 20-year waste strategy may wish to include a review of the materials covered by the CDS and options to leverage the infrastructure investments already made to expand the volume of containers being captured (but not fall under the CDS scheme). Such an option would need extensive consultation with the CDS network operator. Such an option could have application in regional and remote locations to increase the volume of glass products captured and transported to centralised processing facilities;
- whether investments in modern process technology can address contamination issues.

Glass sands

Strategies to increase the volume of glass recycled include:

- developing clear product standards for the utilisation of glass sand as a substitute in road base or other commercial application;

- improving the quality of recycled material produced by addressing contamination in the waste stream (see below);
- increasing the use of recycled material in local, state and federal government procurement and key industries that could support the markets for recycled glass products;
- working with NSW Water and Roads and Maritime Services to address issues with respect to greater use of glass sand (quality; risks; appropriate standards and surety of supply and stock-piling limitations);
- review stockpiling limits to support the capacity to meet minimum delivery volumes for large projects; and
- reviewing license terms of processing facilities and clearly defining requirements to allow expansion of glass sand production.

Interdependencies

The interdependencies for glass is not inconsistent with MSW more broadly, see additional comments in Key Finding 7.

Key Finding 14

E-waste specific strategies are required to increase re-use and recycling

14.1 Overview

In NSW in 2016, approximately 36% of e-waste was recovered. 55% was sent directly to landfill without any processing, with a further 9% disposed by e-waste and metal recyclers as secondary waste.

E-waste is growing at three times the rate of general municipal waste. In 2016, e-waste generation in NSW was estimated to be about 150,000 tonnes. This is expected to grow to about 200,000 tonnes per annum by 2025. E-waste contains resources, including precious metals, which can have significant market values.

Large household appliances; small household tools and appliances; TVs, computers, and other IT; and Toys, leisure and sporting equipment make up more than 85% of e-waste by mass (see Section 6.11, Volume II). The fastest growing categories of e-waste are lighting equipment, PV panels and flat screen TVs.

Most councils have established hard waste collection services; community recycling centres and special e-waste collection programs that support the recovery of certain e-wastes, however, problem areas include batteries, cables, remote controls, mobile phones and other paraphernalia.

14.2 Barriers to recycling

Product design

Manufacturers are building devices (phones, laptops, desktops) that are becoming increasingly difficult to take apart, and harder to reassemble. New generations of technology are including modifications that make previous generations non compatible or obsolete, limiting useable product life and increasing waste volume. This is leading to a culture where prior generation technology, broken or malfunctioning electronics are no longer repaired or re-used but replaced.

Cost

Electronic assets can rapidly depreciate in value. Recyclers can find it costly to recycle assets relative to the value realised. Strategies are required to support re-use domestically or overseas and to reduce the costs of recycling.

Awareness

Research indicates a lack of awareness by householders and business on the toxic materials found in electronics and the damage they cause to the environment and therefore the need to remove e-waste from general waste streams.

14.3 Considerations for 20-year waste strategy

E-waste requires specialised treatment and disposal services that often incur high costs to process. Continued growth in e-waste volumes and demands for higher recycling rates will create pressure for additional funding and more sustainable arrangements will need to be considered across the full spectrum of e-waste materials.

National Television and Computer Recycling Scheme

The National Television and Computer Recycling Scheme was established in 2011 to provide industry-funded collection and recycling services for televisions and computers, including printers, computer parts and peripherals. The scheme is funded and run by industry. Any organisation that makes and/or imports televisions or computers in Australia is required to

contribute funds that are used by industry-run arrangements to deliver recycling to drop off points around Australia. Under the scheme, industry must fund the recycling of a proportion of waste televisions and computers each year, increasing to 80% in 2021–22. The State, through local governments, retains responsibility for waste volumes beyond these targets.

Amendments to the National Television and Computer Recycling Scheme are currently being explored as part of the Commonwealth Product Stewardship Act review. This should include opportunities to expand existing e-waste collection & recycling services and product stewardship arrangements beyond those products currently within the scope to capture emerging products and technologies without the need to adjust the regulation.

In amending and expanding the existing scheme, consideration may be given to the design and the effectives of comparable schemes in overseas jurisdictions, such as the EU's WEEE Directive (see Appendix E).

Re-use

There is a need for manufacturers to create equipment that can be repaired instead of having to be replaced. This is a complex cross-border issue and may be inconsistent with business operating models. Certain products suffer from short product life, due to an inability to replace basic componentry (e.g. batteries in mobile phones).

Options should be examined for manufacturers to support (financially) and promote schemes that re-use older generation technology (e.g. phones, televisions, computers; gaming equipment). There are examples of charities and businesses locally and internationally engaging in this, although careful consideration must be applied to the issue of data privacy and protection. Council collection programs may also differentiate between assets for re-use and assets for recycling.

The 20-year waste strategy should examine options for e-waste repair and refurbishment, to drive increases in re-use. Obligations should be also examined for new products to be designed with future re-use and repair in mind.

Recycling

In the absence of product redesign (to support repair and re-use), take-back options should be explored through the National Television and Computer Recycling Scheme or an expansion of obligations to fund collection and processing activities.

Other actions the 20-year waste strategy may wish to consider:

- strategies focused on raising the profile (through education and social media) of problem e-wastes; and the importance of their appropriate disposal and the environmental and economic benefits that will result;
- improved education on the appropriate treatment of e-wastes and the use of collection centres to support a reduction in inappropriate disposal;
- other actions to support reductions in volumes to landfill e.g. Victoria will ban electronic waste in landfill from July 2019, including all parts of a photovoltaic system, which will necessitate the implementation of recycling regimes for all e-waste types;
- reviewing the ease of accessibility for drop off points; and
- considering concerns about accessing old data on devices.

Key Finding 15

The cost efficiency of waste collection and transportation is being negatively impacted by transport challenges

15.1 Overview

a) Travel distance considerations (Section 7.4, Volume II)

Travel distances are a core component of the price of waste removal. Waste providers seek to maximise the volume of waste in a truck and minimise the total distance the truck has to travel. In higher density areas, commercial customers can benefit from using the same provider as a neighbouring business. Waste transporters endeavour to use data to optimise the routes they take to collect waste from different locations.

Isolated runs can be uneconomic. For example, it can be uneconomic for regional and rural councils to have kerbside recycling due to distance and lower volume considerations. It can be more economic to have one (or no) collections than for multiple trucks to collect source separated waste.

b) Rail Transportation (Sections 7.5 and 7.6, Volume II)

There are considerable benefits for the transfer of waste by rail. The most significant benefit (the removal of trucks from the road) is muted by the key disadvantage – namely congestion of the rail network and difficulty in obtaining rail slots or rail siding space for transfer of the waste

Some transport of aggregated waste is undertaken by rail. Veolia has rail transfer terminals at Banksmeadow and Clyde in Sydney, which consolidates waste for transfer to Veolia's putrescible landfill and MBT at Woodlawn in southern NSW (near Goulburn). Other waste operators also transport aggregated waste by rail to Queensland.

Access to rail transfer terminals (and capacity on rail lines) could support the development of processing capacity outside of the metropolitan area, however, industry feedback is that there are significant challenges in securing both suitable sites and capacity on rail lines relative to other higher value commodities.

c) Road transport challenges (Section 7.6, Volume II)

Transport of waste by road involves a number of challenges. Heavy machinery in the form of garbage trucks must traverse suburban and metropolitan streets to collect waste. This heightens risks to other people (pedestrians and those in other vehicles) and presents a challenge with respect to ensuring urban amenity (odour and noise pollution reduction) while ensuring an efficient waste collection.

Traffic, especially in metropolitan regions, presents additional challenges to collecting and transporting waste between locations. Industry advised streets and developments are often not constructed with waste collection requirements in mind. This is particularly the case with higher density housing. As a result:

- insufficient consideration is given to the efficiency of waste collection requirements (e.g. sufficient space for multiple small bins at kerbside; use of bulk bins to save space; location of bins and the need for manual intervention in order to empty; the safety of truck entry and egress; the need for bins to be manually moved into position for emptying);
- significant manual handling is required by drivers, increasing occupational health and safety risks;

- smaller waste trucks (which can carry less waste) are often required to be used in areas where larger trucks will not fit. This increases truck movements on roads and reduces the cost efficiency of services and potentially the need for additional transfer stations to combine loads; and
- there is a conflict between amenity considerations and efficient waste removal (many planning requirements ban collection of waste before daylight hours so as not to interfere with nearby resident amenity, but this results in increased truck movements in peak times).

It will be important for the 20-year waste strategy to incorporate transport and planning considerations, including opportunities to leverage the transportation of waste by rail.

d) Transfer stations

Stakeholder feedback and research indicated that a number of factors are constraining waste infrastructure investment:

- the high cost of land in metropolitan areas;
- the inability to secure project sites close to waste sources and transport infrastructure;
- the challenges of urban encroachment and public negativity towards waste infrastructure facilities in metropolitan areas.

15.2 Considerations for 20-year waste strategy

Strategies to reduce the volume of waste to landfill are all dependent upon access to collection, transportation and processing infrastructure. As noted in Key Finding 16, strategic planning needs to recognise the impediments caused by the lack of land availability and cost of land in metropolitan locations.

Strategic planning needs to identify and secure land for current and future waste needs, including the creation of waste precincts; and establishing buffer zones from residential encroachment.

In new and to the extent possible, existing developments, consideration should be given to the implementation of technology that reduces the volume of collection vehicles on roads. This might include vacuum transfer technology to support sufficient transfer of waste and precinct-style solutions, such as energy from waste facilities, where waste is treated on the site that it is generated.

Strategies that examine options in regional areas will be dependent on addressing the current challenges on accessing rail infrastructure.

Key Finding 16

Strategic infrastructure planning needs to be undertaken on a whole of Government basis, with reconsideration given to the application of the waste levy funds

16.1 Background and stakeholder feedback

Stakeholders consulted welcomed the development of a waste and resource recovery infrastructure strategy, particularly with respect to infrastructure development. Stakeholders consulted believe waste infrastructure needs to be treated as essential infrastructure with planning undertaken on a whole state basis in close consultation with industry and local council organisations.

Feedback indicated that many councils also saw a benefit in examining infrastructure needs from a regional perspective (rather than on a LGA basis), particularly with respect to identifying capacity constraints and presenting a consolidated view of waste flows on a geographic basis to the private sector when attempting to attract infrastructure investment.

Councils noted that the benefit of a regional approach did not currently extend to the procurement of waste services, with councils wishing to maintain their operational independence (through separate contracts) even though operational and financial benefits could be realised though optimising collection and transportation strategies (ignoring council boundaries).

Submissions to the NSW Parliamentary Inquiry into Energy from Waste and feedback received during stakeholder interviews were to the effect that the government has to date played a limited role in strategic planning for waste infrastructure, leading to industry-led, 'ad hoc' infrastructure planning and development driven by commercial imperatives rather than long-term, strategic waste management considerations.

Stakeholders also noted that a lack of up-to-date waste data undermined the ability of government and industry to assess the current demand for waste services and to systematically and pre-emptively identify and address any gaps in infrastructure.

There is a need to review the existing approach to waste infrastructure planning. Specific stakeholder observations included:

- the state needs to recognise waste as an essential service with essential infrastructure and a strategic future planning process;
- planning for an effective network of waste infrastructure needs to be coordinated with broader road and rail planning (e.g. access to transfer stations and intermodal facilities) as waste planning failures can manifest as more trucks on the road and bottlenecks in waste movements;
- there is a need for the state to drive the waste agenda by providing a more strategic view of waste management, including influencing where the next generation of waste infrastructure needs to be located;
- the NSW government would benefit from a waste infrastructure strategy that reflects the collective views and commitments of the various government department (Transport for NSW; Department of Environment and Energy; Department of Industry; EPA; Department of Planning and Environment, Department of Premier and Cabinet etc.);
- there is a need for greater coordination between the EPA and the Department of Planning;
- industry would benefit from more timely historical waste data and forward looking information to assist with planning (e.g. mega trends on population growth and

movements; state growth strategies; business and infrastructure investment and flow on factors relevant to waste considerations);

- strategic planning needs to recognise the impediment caused by the cost of land in metropolitan locations;
- strategic planning needs to identify and secure land for current and future waste needs, including the creation of waste precincts and establishing buffer zones from residential encroachment;
- stronger planning requirements for new housing and building developments are required to support waste infrastructure, including appropriate access and turning circles for waste transportation equipment;
- strategic planning needs to be undertaken on a whole of state basis, but recognising strategic priorities and approaches are not uniform across the state (e.g. regional vs metropolitan needs and issues are not uniform);
- concerns by the waste industry over a lack of certainty in the planning process, with a perceived lack of a dedicated approvals pathway for waste infrastructure; and
- the need for a greater proportion of the waste levy to be reinvested in the waste industry, including investment in waste programs and new infrastructure.

Local councils believe they are able to make a positive contribution to regional planning, which will support improved regional coordination and improved waste recycling outcomes. It was recognised that councils currently limit their planning to a shorter time horizon.

Contestability and competition

It was also recognised that strategic planning and policy development may need take into consideration contestability and competition objectives and the need to avoid monopoly or duopoly outcomes (see Key Finding 19).

Infrastructure needs

There is a gap between existing waste processing capacity and projected waste generation figures.

- the draft Waste and Resource Recovery Infrastructure Strategy 2017-2021 projected a total 2,024,000 tonne shortfall in available capacity across mixed waste treatment (note this work was undertaken prior to the mixed waste organic output ban); energy recovery facilities; MRFs, garden organics processing and putrescible organics processing;
- an Infrastructure Needs Assessment conducted by the Western Sydney Regional Organisation of Councils in 2015 identified that by 2021, there will be a 994,000 tonne gap between the capacity of processing facilities and the volume of waste generated in the Sydney metropolitan region;
- local Government NSW, in its submission to the NSW Parliamentary Inquiry into Energy from Waste, noted that many regional areas have limited access to adequate recycling facilities and that the focus was predominantly on the insufficient supply of waste services in the Sydney metropolitan area;
- limited recycling and resource recovery facilities for all types of waste and technologies;
- insufficient access to putrescible landfill, with the Suez facility at Lucas Heights the only active putrescible landfill in Sydney, and access to Veolia's Woodlawn facility constrained by a lack of conveniently located transfer stations and rail congestion;
- limited capacity of the two AWT facilities in metropolitan Sydney (Suez AWT at Kemps Creek and UR-3R at Eastern Creek).

Waste Outlook

Infrastructure needs assessment needs to take in account not only the current growth rates in waste volumes generated, but the consequences of:

- shifting to a circular economy model;
- the consequences of implementing potential policy levers (e.g. mandatory source separation; no waste to landfill without being processes; expansion of FOGO and organics waste collection programs).

The successful implementation of these policy options will reduce the volume of waste going to landfill but will accelerate the need for additional transfer stations; additional processing capacity; and access to rail infrastructure (depending on decisions on where to locate new infrastructure).

16.2 Barriers to investment

Stakeholders consulted believe challenges exist in being able to implement new infrastructure in a cost effective manner. Challenges highlighted included:

- the high cost of land in the Sydney metropolitan area;
- challenges in securing suitable properties close to transport infrastructure;
- reluctance of some councils or communities to have infrastructure located in their vicinity;
- a lack of timely data on waste flows and holistic information on the location and volume of waste generated ;
- transportation challenges, such as poor road networks, congestion; time restrictions; long travel times and lack of convenient aggregation points.

These challenges hinder their ability to undertake informed long term planning and are also an impediment when seeking financing to support projects.

Industry believe many new large scale property developments are not planned and approved with waste considerations in mind including the treatment of waste generated during construction, as well as waste separation and collection services, post completion.

Industry believe insufficient consideration is given to opportunities for circular economy or precinct style solutions, as well as truck movements and access to waste infrastructure post construction (both onsite considerations and more broadly).

Frustrations were also raised over the time and cost involved with existing government approval processes and the lack of alignment on project requirements across different agencies.

Policy and regulatory inconsistency between state and territory governments, and the Australian Government, creates additional challenges for long term waste management and resource recovery planning for both government and industry. Examples included:

- policy and regulatory inconsistency between jurisdictions reduces waste industry confidence, constraining future capital investment decisions;
- extended producer responsibility schemes not being applied uniformly across jurisdictions and compliance not being mandatory;
- the lack of a national government body bringing together all stakeholders to monitor progress against the National Waste Policy;
- inconsistency of landfill levies between jurisdictions, encouraging waste disposers to seek less costly disposal locations.

Landfill

Consultation with industry raised concerns around the lack of contingency planning for Sydney's putrescible landfills – noting that there are only two facilities in operation for the region (Veolia's Woodlawn and Suez's Lucas Heights), and uncertainty over what would happen if one was not available. It would be prudent for the 20-Year Waste Strategy to address contingency planning as, in some regional areas, landfills are approaching capacity.

16.3 Considerations for the 20-year waste strategy

An overarching waste infrastructure strategy would allow a coordinated approach to the key infrastructure challenges noted above.

As noted in the remaining Key Findings, there are a large number of interdependencies for new policy initiatives to be successful. Central to most of these policies is the need for access to essential infrastructure to collect, transport and process waste. Failure to prioritise infrastructure investment in the right regions, for particular waste materials or waste streams will increase the risk of failure and reduce business, household and investor confidence in the waste system.

The 20-year waste strategy needs to develop and assess options to address the existing barriers to investment and challenges discussed above.

The EPA has an opportunity to review the planning system with a view to developing a dedicated planning approvals pathway to help streamline approvals (across agencies) for necessary waste infrastructure. This could be in the form of a waste management infrastructure strategy to provide clear development pathways for waste infrastructure.

The EPA will need to consider the options available to fund not only the infrastructure strategy, but the broader move to a circular economy. Reinvesting a greater portion of the waste levy has been proposed by Industry and Local Government, however, this is a decision for the State. Areas for additional investment identified in this report include:

- development of the market for recyclables;
- creation of incentives for increased use of recyclables;
- investment in upgrading technology in problem waste areas;
- investment in waste infrastructure and innovation to support the collection, aggregation and transfer of greater volumes of source separated waste to processors;
- investment in expanded food and other organics collection and processing systems;
- analysis of the merits in expanding the categories of materials collected by the CRCs to address hazardous and problem wastes;
- the need for additional landfills; and
- examination of viable waste processing alternatives in regional and remote areas (e.g. micro factories).

Key Finding 17

Industry needs clearer guidance on the role of Energy from Waste in the NSW market

17.1 Background

Research of international practice has demonstrated that energy from waste facilities (excluding landfill gas capture) play a significant role in countries with high waste diversion rates. Many of these countries have a history of using incinerators to dispose of waste for the purposes or energy and heating. International experience has also demonstrated the challenges with reliance on energy from waste as a means of achieving diversion targets – including the risk that waste prevention and avoidance does not have sufficient policy focus.

While NSW has some operational energy from waste facilities (including landfill gas capture and anaerobic digestion), there are no licensed thermal energy from waste facilities in the state. The role of energy from waste technologies in NSW was the subject of a recent NSW Parliamentary Inquiry, where participants debated whether there was a place for energy from waste facilities in managing residual waste once higher order waste management techniques were exhausted.

17.2 Barriers & impediments

Stakeholder feedback to the inquiry and as part of the Situational Analysis was that energy from waste has a role to play in the future strategy for waste in NSW, but that there is significant uncertainty at present as to whether energy from waste facilities are a viable option and, in particular, how such infrastructure fits into a circular economy framework.

Stakeholder consultation undertaken by the Advisers indicated a willingness by industry to invest in energy from waste infrastructure (for processing of waste where alternate recovery options have been exhausted), however:

- industry felt that the EPA was not supportive of the option and therefore obtaining approval carries a significant level of risk at a potentially high cost;
- challenges existed with meeting some of the existing requirements of the *NSW Energy from Waste Policy Statement* or that there was uncertainty as to the statement's interpretation and how compliance could be demonstrated;
- industry requires regulatory certainty which they believe has been eroded by recent events in the organics industry (which will make financing of such infrastructure more uncertain).

Concerns were also raised in respect of the cost of land in metropolitan areas; the ability to secure project sites close to waste sources and transport infrastructure, whilst recognising the challenges of urban encroachment and public negativity towards energy from waste facilities.

International research indicates:

- the importance of policy levers, such as landfill bans, or high landfill levies, in facilitating the pathway to energy from waste;
- a shift away from the dependence on large scale thermal facilities, in part due to changes in environment and climate change policies and a shift towards circular economy policies;
- challenges exist in implementing circular economy policies where investments have already been made in large scale thermal facilities (e.g. this technology values high energy value waste streams such as plastics);
- challenges exist in reducing the volumes of waste being processed by thermal facilities due to increases in their unit cost of production and reductions in operating efficiencies from processing lower volumes;

- significant levels of capital are invested in energy from waste infrastructure and industry will compete to optimise their return on investment.

17.3 Considerations for the 20-year waste strategy

The long term use of energy from waste facilities is inconsistent with a true circular economy, as once a product is burnt it cannot be re-used. However, based on present technologies, there is likely to be a residual level of waste that cannot re-used or recycled (e.g. contaminants in recyclate streams; medical waste; certain hazardous wastes etc.). The 20-year waste strategy will need to consider whether such wastes are to be landfilled or processed by energy from waste facilities. Policy decisions in this area will influence the attractiveness of future investment opportunities and the willingness of industry to invest.

Under circular economy principles, the use of energy from waste facilities, should only be contemplated when all other options have been exhausted and the proposed treatment represents a better environmental outcome than landfilling.

In regional or remote areas where re-use or recycling options are not economically viable, there may be a need to consider the merit of small scale energy from waste facilities.

Industry would benefit from a better understanding of:

- the EPA's view of the role to be played by energy from waste, within the context of a Circular Economy policy and the waste hierarchy – for instance whether it may play an interim role in the transition to a circular economy or whether it has a place as a long term solution;
- what needs to be demonstrated in new investment proposals, or whether new proposals would only be considered where the EPA has specifically requested submissions;
- the EPA's comfort levels with the different types of technology;
- the direction and EPA's interpretation of the *NSW Energy from Waste Policy Statement*.

The EPA may want to undertake a review of the existing policy and assess the need to refine or clarify the application of the statement to new investment proposals.

The EPA may wish to consider issuing guidance to industry whether the EPA will be open to receiving new EfW submissions whilst it is in the process of implementing the 20-year waste strategy and transitioning to a circular economy approach.

Issues to Consider

In considering whether to support additional energy from waste infrastructure (even if under a very narrow remit), the EPA will need to consider:

- whether EfW has a role to play in regional or remote areas, where Circular Economy principles may be less effective in the re-use and recycling of waste materials;
- the likelihood of strong community resistance in the absence of appropriate educational campaigns;
- that EfW facilities need a stable source of waste and will target waste with a high energy value, which will compete against recyclers, unless addressed in licence terms; and
- that once a facility is built, it will be difficult to reduce the volume of waste being processed without significant financial penalties being applied, as waste volumes underpin the financial viability of these facilities.

Key Finding 18

A stable regulatory environment is needed to support investment

18.1 Background

Industry feedback indicated strong support for further investment in the NSW waste industry, however, the recent withdrawal of the mixed waste organic output exemption and the recent inquiry into energy from waste has created some unrest amongst industry participants. Concerns were raised that the lack of a strategic plan for waste infrastructure means that proposals are often developed in the absence of certainty as to how they will be perceived by government.

Industry advised that a stable regulatory environment was critical to securing capital within organisations for new investments. Capital allocations take into account a range of factors including the risk profile of projects. Financiers are also likely to be reluctant to support investment proposals (or attach a risk premium) in the absence of a stable regulatory environment.

The Advisers have not undertaken a formal review of the overall effectiveness of the combined NSW legislation, policies and strategies, but have made some observations in the course of undertaking the situational analysis. The existing system is compliance-focused with a core objective of protecting risk of harm to human health and the environment, but not so prescriptive as to influence improved waste recovery behaviour (although some of the recent changes to the C&D management regime is aimed at improving confidence in the quality of recycled products). As explored in the Benchmarking Review, overseas jurisdictions are more prescriptive with respect to supporting strategic directions of waste management.

Waste levies are consistently viewed, nationally and internationally, as an effective driver of increased diversions from landfill. A levy has been a stable presence in NSW since the early 1980s. While it should remain a driver, there is a need for further policy and regulatory action, as described in other parts of this report, to supplement this lever. There is a need for consideration as to whether a greater portion of revenues from the waste levy should be used to fund these initiatives.

18.2 Considerations for the 20-year waste strategy

Consideration should be given to:

- the EPA has roles with respect to the protection of air, waterways, land and human health and reducing the impact of waste on the environment – sometimes industry views these roles as being in conflict. The recent decision in respect of the MWOO (i.e. the ban on the application of MWOO to land) was made on the basis of evidence that there are limited agricultural or soil benefits from applying MWOO and physical contaminants in MWOO result in potential environmental risks. The practical impact of this ban is that more waste is now going to landfill. While often the different roles of the EPA are congruent with each other, decision-makers and industry will need to be clear about which considerations take precedence;
- ensuring draft policies are finalised;
- reviewing the need for certain policy decisions to be enshrined in regulation to reduce the likelihood of policy statements being removed at short notice; and
- developing a long term infrastructure strategy in consultation with local councils and industry to provide clear guidance on the states preference for particular types of infrastructure and their locations.

Key Finding 19

Further consolidation of the waste industry will impact on contestability

19.1 Background

Consolidation of the waste industry is impacting on the level of competition in the market and creating potential issues with access to waste infrastructure.

Concentration of the ownership of critical waste infrastructure and vertically integrated organisations may be reducing the level of competition in tender processes.

Concentration tends to be high in specific markets and regions (see Section 5.2.2- Volume II). It is generally uneconomical to transport waste for disposal across long distances and, therefore, proximity and access to infrastructure is critical to competition. As a result, the level of competition is not consistent across the state.

Stakeholders have advised that establishing new facilities can be difficult due to a lack of surety of supply of waste materials (which may be already contracted to other, less cost effective service providers). As a result, there are generally few large treatment and disposal facilities in a localised area within transport range. The existing facilities tend to account for a high proportion of industry revenue

The ACCC has raised competition concerns in respect of recent merger activity in the waste industry, observing that competition at the landfill level has flow on effects for competition at the processing and collections levels. Some concerns were raised that where critical waste infrastructure (including new purpose built facilities to meet a council's needs) is owned by the private sector and where there are no competing facilities in close proximity, pricing realised may not fully benefit from the impact of competition and this may also create incumbency issues if other waste service providers were unable to gain access to that infrastructure.

19.2 Considerations for the 20-year waste strategy

Concerns have been raised as to the future ownership of critical infrastructure, including new builds that may strengthen a service provider's competitive position relative to the rest of the market.

A shift to a circular economy and the resultant reduction in the reliance on landfill would disrupt the competitive landscape, however, ownership of processing capacity may replace landfill as a critical and controlling piece of infrastructure in the waste flow.

Consideration should be given to contestability requirements including the future ownership of critical infrastructure (including new builds); ongoing access to the assets by local councils and the wider market and whether alternate ownership models should be considered.

Some stakeholders were keen for a waste infrastructure strategy or the 20-year waste strategy to explore alternate infrastructure ownership and funding models for critical waste infrastructure to support increased contestability, including the potential creation of a government-held essential infrastructure fund (funded by the waste levy) to own critical waste infrastructure (which may be operated by councils or the private sector). An essential infrastructure fund could also be used to examine infrastructure solutions in regional and remote locations that might not otherwise attract investment.

Key Finding 20

Council contracting models need to be strengthened and streamlined

20.1 Background

Councils currently contract waste services under several different models (see Section 7.1 – Volume II), with different terms for collection or processing. In some council contracting arrangements, the council does not have a direct contractual arrangement with both service providers (waste collectors and waste processors) in the waste flow. Variations also exist as to whether title in the waste transfers to the contractor upon collection (or not).

Stakeholder feedback indicated existing contracts do not always provide the flexibility required to modify service approaches to match changing council or state policies and attitudes towards waste reduction and diversion. Where they do, there are often cost implications which are not manageable for Councils.

With a number of significant changes likely to come out of the 20-year waste strategy (and over varying time frames), Councils would benefit from contracts that provide a greater level of flexibility to modify service requirements. Failure to incorporate such terms may impact on the ability of Councils to fully adopted policies developed under the 20-year waste strategy and therefore undermine the transition to a circular economy.

Councils have also indicated a greater level of data reporting and consistency in performance measures across LGAs would be beneficial to monitoring MSW management practices.

Finally, stakeholders frequently commented on resourcing within Councils, both with respect to knowledge of the sector and/or dedication of a specific team to manage waste. It was suggested that some Councils lack the experience to procure and manage waste infrastructure development, hindering the progress that can be made in achieving waste-related improvements.

20.2 Considerations for the 20-year waste strategy

Stakeholders were keen for the EPA to work with councils to develop guidance on standard terms to be included in new waste services contracts (by all Councils). Subject to agreed actions set out in the 20-year waste strategy, this may extend to collection, processing and recycling contracts. This would help to ensure that those councils with contracts expiring in the near term do not enter into agreements that prevent them from modifying arrangements to benefit or support initiatives under the 20-year waste strategy.

Councils also expressed interest in working with the EPA to develop a standard set of KPIs or performance targets (across all waste services and different contracting models, aligned to the 20-year waste strategy) to be included in all new waste services contracts. Some councils felt their negotiating positions did not support the inclusion of such terms, but a whole of industry approach would be beneficial to achieving greater transparency.

Areas for potential improvement and consistency across council contracts include:

- a standard set of KPIs around meeting minimum recycling or diversion rates and treatment of specific wastes;
- visibility (through enhanced reporting) in respect of where waste is to be processed and the volume of waste that ends up in landfill;
- feedback and data from the service provider on the effectiveness of source separation and contamination levels in dry recyclables, organics and any other source separated wastes;

- receipt of timely and accurate data on waste collections, transportation, processing and diversion. Data currently received often only reflects the waste processing facility average rather council specific data;
- revenue sharing arrangements and gate fees across LGAs.

Subject to the specific strategies developed as part of the 20-Year Waste Strategy, there may also be a need to embed certain activities and requirements within the scopes of work under LGA waste collection contracts. These may include:

- monitoring and reporting householder and C&I waste separation practices;
- monitoring and reporting contamination levels in dry recycling waste;
- monitoring bin utilisation and the need to modify bin sizes or bin collection frequency;
- implementing additional waste collection services;
- undertaking mandatory post-collection (further) separation of certain waste streams;
- providing detailed data on end use of waste; and
- rise and fall fee arrangements should there be materials shifts in the waste volumes being delivered to landfill.

Waste collection and transportation charges

The transition to a circular economy is likely to result in a reduction in waste to landfill and an increase in the delivery of sourced separate materials in the MSW and C&I waste streams.

In the C&I sector, collection of waste is usually charged per bin collection (lift), based on the volume of the bin. Householders are generally charged a fixed fee by councils to cover their waste collection services. These arrangements do not provide a price signal to businesses or households. There are generally no financial penalties for failure to source separate, place wastes in the wrong bins or create contamination. There is also no financial benefit to reduce total waste; maximise waste sent for recycling; or to remove problem waste items from collection programs. Under existing contracting models, Councils may incur penalties if waste volumes fall below contracted levels.

As noted in Key Finding 7 and 8, incentive arrangements may need to be established to encourage greater levels of waste avoidance; re-use and source separation. New program initiatives may also see producers being responsible for the recovery and re-use of packaging wastes. These and other options that may be considered should:

- lead to reductions in the volume of waste being collected and transported;
- lead to a reduction in the landfill fees being incurred; and
- support higher recovery of materials sent for recycling.

To support business and householders with reducing the volume of waste going to landfill, alternate pricing models should be investigated.

Alternate pricing models

Models to be explored may include the options set out in Key Finding 7.3.

Waste collectors may resist any changes to existing fee arrangements as they have been long established and are well understood.

Any changes to existing fee arrangements will need to be developed in consultation with industry, with an initial pilot program to confirm proof of concept.

Key Finding 21

Bespoke solutions are required for regional and rural areas

21.1 Background

Although 91% of households in NSW have a red bin and 89% have a recycling bin, recovery rates in regional areas are lower than in metropolitan areas.

Organics collections are far less prevalent in regional and rural areas – only 60% of NSW has an organics bin, although waste audit data substantiates that there is likely to sufficient organic volumes in waste to warrant a GO or FOGO service. Kerbside organics collections are uneconomic in regional and rural councils.

Community Recycling Centres have had high take-up rates amongst regional and rural councils but lesser take-up rates by metropolitan councils.

Long travel distances can create a challenge for regional Councils. Trucks must travel a significantly longer distance to collect a smaller amount of waste. This often means that in many regional areas there is a lack of competition within the contracting industry. This does not give councils realistic price competition for the provision of waste management services (resulting in the payment of a cost premium for waste management service compared to metropolitan councils).

This cost environment is further compounded by many regional councils not having the financial capacity to provide best practice waste management services to their communities. Regional and remote locations have demonstrated a much higher level of sensitivity to the impact on ratepayers of any strategies that, whilst beneficial to waste outcomes (e.g. recycling rates), would negatively impact on council rates.

Regional areas are also underrepresented in terms of infrastructure investment, in part due to the prioritisation of the metropolitan area by industry. Many small facilities have been established in regional and remote areas where local communities without waste collection services can consolidate waste for bulk collection. However, larger facilities tend to have technological capability to use a greater level of automation in the waste sorting process in comparison to smaller facilities.

Regional facilities tend to be smaller in capacity (often less than 10,000 tonnes per annum), and more reliant on manual sorting processes. This likely impacts on the efficiency and effectiveness of waste recovery rates and the level of contamination in recovered materials. Differences in terms of size, location, technical sophistication and processing capabilities impacts on the efficiency of the waste industry in a number of ways:

- Some facilities forward certain waste materials to other MRFs for processing, incurring additional transportation charges;
- The transportation costs for certain MRFs to deliver recyclables to end markets makes it less economical to recycle particular waste streams under current market conditions;
- Some facilities do not have the capacity to produce recycled materials in sufficient quantities to secure arrangements with the end market and so they need to stockpile the materials or landfill them;
- Some locations do not have a MRF. Waste is delivered to the local landfill where only limited recovery is undertaken of recyclables.

Lower volumes and financial constraints impact on the extent to which investment in waste infrastructure is made. There has been a focus within government agencies to support regional areas in the development of waste infrastructure that supports metropolitan waste needs.

While the Veolia Woodlawn facility is an example of this model, replication of this requires identifying an efficient way to get waste to the facility.

21.2 Considerations for the 20-year waste strategy

Strategies in respect of regional and remote locations need to take into account the volume of waste being generated; the cost vs the potential returns from source separation or the efficiency of manual separation at the local landfill or a regional MRF.

Consideration should be given to:

- The use of transfer stations/community recycling centres for depositing of recyclate instead of kerbside collections, where it is more economic (this allows for better source separation and use of the money spent on kerbside collections to instead be invested in circular economy solutions relevant to the specific regional area or enabling for greater economies of scale for transport of materials to other locations);
- Supporting or funding community organic solutions (such as anaerobic digestion plants or other on-site food waste treatment plants that use microorganisms to convert food waste into non-potable water);
- The use of anaerobic digestion, which may have a key role to play in regional or rural areas given the proximity to sources of organic waste derived from agricultural areas;
- Trialling of other (thermal) energy from waste technology targeting specific problematic waste streams;
- Development of infrastructure near major rail lines that can support metropolitan areas as well as regional areas;
- Infrastructure planning on a regional basis (extending beyond individual LGAs);
- Modifying frequency of waste collection of recyclate to improve yields and limiting general waste collection services to defined areas surrounding the town centre;
- Examine options to bundle services e.g. service providers are generally interested in larger regional centres but have limited interest in surrounding areas. Services may be contracted on a bundled basis (hub and spoke model) covering multiple LGAs (larger regional centre and surrounding townships). Such a model may create issues with respect to cross subsidisation, which would need to be managed;
- Examining options to leverage infrastructure investment or service arrangements that have already been implemented (for example the CDS has had a significant take up and collection services have already been established across the state. This may provide an opportunity to collect a larger number of recyclable containers under a fee for service model (e.g. wine bottles; spirit bottles; compacted milk and juice cartons; paper and cardboard etc.) that are not captured by the CDS).
- Adoption of alternate technologies that support re-use and recycling activities (e.g. UTS micro-factory technology; ANZRP e-waste plastic micro-factory);
- Incentivising industry to develop service solutions: industry consultations indicated a willingness of some participants to explore options to address service needs to regional locations and to examine options to locate new processing capability outside of the metropolitan areas. The 20-year waste strategy should consider a consultation process on the needs and opportunities in regional and remote areas and seek input from industry. Such an approach allows industry to demonstrated innovation and creativity in service delivery and potentially provides a first mover advantage for those organisations prepared to invest in the new circular economy.

Other considerations

22.1 Overview

A number of other observations were made as part of the Situational Analysis. These observations are included on the basis of items that may be considered as part of a future program of work to undertaken under the 20-year waste strategy.

22.2 Considerations for 20-year waste strategy

a) Review of the waste levy

It has been suggested that the waste levy should be attached to the generation of waste, rather than disposal, to recognise the environmental costs of waste generation and to help encourage waste avoidance. Imposition of the levy at the point of generation would assist with levelling the playing field in terms of imported waste materials vs domestic waste.

Research indicated that further reductions in the volume of waste being generated may not be achieved until there was a transparent environmental cost attached to packaging and other waste materials.

b) Alignment of regulatory frameworks and strategies

National and state legislation and policies set the framework that state, local and regional government activities must reflect. Any inconsistencies between national and state and interstate requirements may result in market distortions than can have negative consequences (e.g. inconsistent waste levies has resulted in NSW waste being transported to Qld).

Certain waste strategies may only be effective if undertaken on a national or a multi-state basis (e.g. adoption of circular economy principles and the development of end markets).

The waste issues being encountered in NSW are likely to be similar to other states. The National Waste Strategy should there be reflective of state based policies, objectives and priorities.

The 20-year waste strategy may need to incorporate a program of work to:

- align with key areas for action under the National Waste Policy, as well as any targets, specific actions and funding arrangements agreed to with the Commonwealth.
- work with the Commonwealth to develop and implement action plans in respect of the key strategies and waste priorities as set out in the 2018 National waste policy:
  i. actions to support a 'circular economy' framework, including:
     - changes to product design (to reduce material generation);
     - strategies to increase waste re-use and recycling and reduce disposal;
     - accounting for the full cost and life-cycle of materials;
     - approaches that will help to minimise reliance on virgin materials and maximise the economic value of resources.
  ii. avoiding waste generation by:
     - prioritising waste avoidance, encourage efficient use, re-use and repair;
     - designing products so waste is minimised, they are made to last and materials can be more easily recovered;
  iii. a national approach to waste policy and regulation, which may include a unified approach to the cross-border transportation of waste, consideration of proximity principles and a coordinated approach to waste levies;

iv. further development of product stewardship and extended producer responsibility schemes (see Key Finding 5);
v. better managing material flows across state borders (to reduce contamination, leakage and improved yields);
vi. improving the timeliness, consistency and accuracy of waste information to guide future investment;
vii. improving product labelling and information to support informed consumer decision making;
viii. national approaches to reducing key waste streams (e.g. plastic pollution);
ix. national strategies to support waste avoidance and re-use, waste industry development and innovation;
x. national strategies to support product innovation and infrastructure investment; and
xi. increasing the demand for recycled materials through Commonwealth, State and local government procurement and programs that support the use of recycled materials.

c) Climate Change

The 20-year waste strategy will need to consider the current and likely future policy settings with respect to climate change and the risks or opportunities this may present e.g.:

- Emission Reduction Fund includes support for alternate waste treatment and landfill gas capture;
- CEFC funding for new waste infrastructure (the CEFC supports the 'reduce, re-use, recycle' recommendations of the international waste hierarchy and focuses on projects that seek to make a material reduction to Australia's waste-related carbon emissions);
- consequences of climate change policy on infrastructure, environment and strategic planning decisions (e.g. new landfill or energy from waste infrastructure).

d) Changes in Technology

Changes in technology, innovations in the materials used in production and changes in consumer behaviour will influence not only waste generation but the mix of waste. This will impact the efficiency and effectiveness of existing waste collection and recovery practices, the contamination levels in waste streams and ultimately the tonnage and type of waste that ends up in landfill.

Emerging issues to be monitored (and strategies developed) include:

- Growth in e-waste (e.g. mobile phones, portable electronic devices, laptops; televisions, lighting equipment, and other electronic equipment);
- Waste from the energy generation sector e.g. solar panels and associated photovoltaic system equipment;
- Shifts away from fibres and metals to complex plastics;
- Growth in battery usage - for household energy storage systems.

Options to manage the increasing influence of technology may include increased controls over the use of non-recyclable materials in the development of new technologies, and increased producer responsibility or stewardship obligations (see Section 3.9.4 – Volume II).

e) Social change

Waste and related issues are experiencing significant coverage in social media and local council forums. Consumer attitudes are expected to exert greater influence over business

and purchasing decisions. The power of social media in effecting change and impacting decision-making was raised in interviews of stakeholders undertaken by the Advisers.

The 20-year waste strategy should consider the importance of social media in influencing behaviours and to generate support for circular economy principles and other strategies where changes in behaviour will be necessary to effect improved waste outcomes.

f) Hazardous waste

Management of hazardous waste, both legacy and emerging, is an important issue, especially from the perspective of potential health and environmental impacts. The 20-year waste strategy may consider the following issues associated with hazardous waste:

- existing hazardous waste treatment infrastructure is aging, but no suitable replacement sites have been identified in planning legislation for future infrastructure that takes into consideration the importance of a facility being situated near appropriate sewer infrastructure as well as suitable from a transportation and urban amenity perspective;
- the benefits of implementing an end to end hazardous waste tracking system, to replace the inadequate system currently in place;
- there is a requirement for the strategy to be agile enough to adapt to information about emerging waste types. At the same time, stakeholders have highlighted the need for targeted strategies for known problematic wastes like tyres, asbestos and PFAS (including, for example, amnesty periods for disposal of asbestos waste to combat dumping);
- there is a need for hazardous waste initiatives to be regulated (stakeholders commented that schemes such as the proposed battery stewardship scheme are insufficient); and
- there is a need for national enforceable standards and guidelines that industry can adopt and implement. The current landscape of hazardous waste management is characterised by a number of inconsistent state guidelines, which stakeholders claimed created perverse incentives for disposal.

g) Despite being an essential service, communities tend to remain resistant to waste infrastructure in their local areas

There is a recognised need to develop waste infrastructure close to waste sources and transport infrastructure. This is challenged by urban encroachment and public negativity towards waste facilities.

It would be prudent for the 20-year waste strategy to address a program for community engagement regarding the need for and impacts of waste infrastructure, particularly in built up areas.

h) Data strategy

The EPA has recognised a number of areas where improvements may be made in data collection (see Appendix A: Volume II).

As part of the situational analysis, we have not undertaken a comprehensive assessment of what data is currently being collected, however, a number of observations are made where data was not available (see Appendix A: Volume II).

There is currently no comprehensive data strategy in place that supports the timely collection of data in a standard format that can be used for planning as well as reporting purposes.

As NSW moves towards a more circular economy, the EPA will need complete and accurate data to understand the volume of waste generated, its movement through the waste stream,

how it is ultimately managed (i.e. whether by re-use, recycled domestically or offshore, landfilled or disposed through some other method such as waste to energy) and, ultimately, what proportion of materials are going back into the circular economy.

The nature of the data required will be influenced by the relevant policy levers and objectives being set. Data will be required to monitor the effectiveness of the policies being implemented (both in relation to the point of generation as well as in respect of the efficiency and effectiveness of processing activities) and the progress being made towards achieving specific targets. It should also be used to identify emerging waste trends; potential areas of underperformance; areas for additional investment; or service providers that are failing to support the realisation of the waste policy objectives that might require additional support or other responses. The transition to a circular economy will occur over an extended period and therefore the data strategy will need to consider immediate as well as longer term data needs.

A number of international jurisdictions have implemented comprehensive data strategies. Appendix A of Volume II provides a summary of the approach adopted by Scotland.

i) State and local government resourcing

A frequently raised issue during the Advisers' consultations with stakeholders was the resourcing of various initiatives or strategies and the impact that constraints on resourcing had on the successful implementation of programs.

Examples were given of situations where funding money had to be given back because of insufficient resources being available in local councils to carry out the funded program or departmental resources being stretched and impacting the ability to carry out sufficiently detailed assessments of programs.

Resourcing will need to be a key consideration of any program undertaken by the EPA or the NSW Government pursuant to the 20-year waste strategy, as both domestic and international experience has demonstrated that well intentioned plans will not succeed if there are inadequate resources to implement them.

Appendix A – Glossary

Advisers	PricewaterhouseCoopers and Sphere Infrastructure Partners
C&D	Construction & demolition
C&I	Commercial & industrial
EPA	Environment Protection Authority
FOGO	Food organics garden organics
HH	Household
Kg	Kilogram
Kt	Thousand tonnes
MLA	Metropolitan levy area
MRF	Materials recovery facility
MSW	Municipal Solid Waste
Mt	Million tonnes
MUD	Multi-unit dwelling
NLA	Non levy area
NSW	New South Wales
NTCRS	National Television and Computer Recycling Scheme
PSA	*Product Stewardship Act*
RDF	Refuse derived fuel
RLA	Regional levy area
PwC	PricewaterhouseCoopers
SMEs	Small to medium enterprises
Sphere	Sphere Infrastructure Partners
SUD	Single unit dwelling
t	Tonnes
tpa	Tonnes per annum
VENM	Virgin extracted natural material
WARR	Waste Avoidance and Resource Recovery
WARRP	Waste Avoidance and Resource Recovery Portal
WCMR	Waste Contribution Monthly Report
Wk	Week

Appendix B – Coordinated Procurement

New York Commercial Waste Zones[11]

A network of more than 90 private waste collectors, collected waste from businesses across NYC. The collectors operated in a disorganized, competitive market plagued by inefficiency. Individual commercial blocks saw dozens of private waste collection trucks on a given night. Waste collectors competed for customers, willing to drive further for an extra load. These market forces lead to an unsafe, inefficient, and unsustainable environment.

Establishing Commercial Waste Zones in NYC was a key strategy from the NYC Department of Sanitation to bring efficiencies to C&I waste collection in NYC.

The plan envisioned 20 zones with 68 contract awards. The majority of zones would have a maximum of three waste collectors (select Manhattan districts may have up to four or five). Waste collectors would be allowed to compete for any zone, but no company could win contracts in more than 15 zones.

Pricing would be negotiated directly with customers under a rate cap structure. Recycling and organics service are a requirement for any contract, and rates must be lower than refuse (residual waste) service.

Tender processes are to commence in 2020, post the consultation period and pass of relevant regulations.

Commonwealth Property Program

A similar principle was applied by the Commonwealth Department of Finance in respect of property services (including waste collection). Under the program, the Commonwealth property portfolio was divided into portfolios, with a single facilities management service provider contracted to each portfolio. The facilities manager was responsible for contracting a single provider for services such as waste collection to avoid multiple providers travelling to the same locations. The approach created significant efficiencies for industry.

[11] New York City Department of Sanitation. (2018). *Commercial Waste Zones*. Sourced from: https://dsny.cityofnewyork.us/wp-content/uploads/2018/11/CWZ_Plan-1.pdf

Appendix C – Re-use of construction materials: London 2012 Olympic Park

The Olympic Delivery Authority (ODA) set demanding sustainability targets for the Olympic Park demolition, including an overall target of at least 90% by weight of demolition material to be re-used or recycled.[12]

The ODA's overall target was exceeded by 8.5%, with less than 7,000 tonnes landfilled.

The key lessons learned from this project include:

1) The use of pre-demolition audits and reclamation surveys are valuable to improve planning for material recovery.
2) Use audits and reclamation surveys, together with consultations with reclamation specialists, to set headline targets for re-use and reclamation for materials before issuing tenders.
3) Include clear reclamation and re-use targets as separate and additional to the overall recycling target and state them clearly in the tendering process and in contracts. Make explicit the responsibility for demolition.
4) Incentivise use of specialist contractors and achieving of re-use targets.
5) Require re-use to be entered into a materials database and included in Site Waste Management Plans.
6) Design team workshops and communication with other local regeneration projects are recommended; regular site visits are vital.
7) Include use of site-won re-used materials in the design and construction contracts for the new build.
8) Sufficient storage space is vital to enable re-use of construction products.[13]

[12] Deloitte. (2016). *Resource efficient use of mixed waste*. Sourced from: https://ec.europa.eu/environment/waste/studies/cdw/CDW_Task%202_Case%20studies_Olympic.pdf

[13] Ibid

Appendix D – EU Construction & Demolition Waste Management Protocol

In 2016, the EU issued a Construction & Demolition Waste Management Protocol, to support the EU's realisation of 70% recovery of C&D materials by 2020. Some countries have been able to achieve 90%.[14]

The overall aim of this Protocol is to increase confidence in the C&D waste management process and the trust in the quality of C&D recycled materials. Some of the policy levers implemented have relevance to the NSW market.

Protocols

a) **Improved waste identification, source separation and collection** - key strategies include: the preparation and execution of quality pre-demolition audits and waste management plans to clearly identify:

- materials that can be re-used and recycled and therefore separated at source to optimise recoveries;
- hazardous waste, and other materials that hamper recycling (e.g. fixation materials) that should be separated and removed from site.

The protocol promotes improved collection of goods for re-use and recycling through selective demolition and appropriate on-site operations.

The better inert C&D waste is separated, the more effective recycling will be and the higher the quality of recycled aggregates and materials. The protocol recognises the degree of separation depends strongly on the options available at the site (e.g. space and labour) and on the costs and revenues of separated materials.

b) **Improved waste logistics**: the protocol promotes the importance of tracking waste to build confidence to guarantee the integrity of the materials from dismantling to recycling. Recognise that certain wastes cannot be comingled e.g. if glass comes into contact with concrete, stone or brick residues, it is no longer suitable for recycling in a circular economy (re-melting).

c) **Improved waste processing:** the waste management option (re-use; recycle; energy from waste) differs from case to case, depending on regulatory requirements, as well as economic, environmental, technical, public health and other considerations.

Non-inert materials and products need to be sorted depending on their economic value. Metal has an established resale value, and there is significant demand for materials such as bricks and tiles as well.

Hazardous waste should not be mixed with nonhazardous waste. Some types of C&D waste are not hazardous in their original form, but during the demolition stage can become hazardous through their mixing, processing or disposal.

Preparing for re-use is to be promoted as it involves application with little or no processing.

In order to create demand for C&D materials proof of satisfying quality is required. Usually it is the contractor that is responsible for the quality confirmation.

[14] Information for this appendix has been sourced from the EU Construction and Demolition Waste Protocol and Guidelines. Sourced from: https://ec.europa.eu/growth/content/eu-construction-and-demolition-waste-protocol-0_en

d) **Quality management**: A systematic and sequenced quality management system reduces the environmental risks and potential negative perceptions.

The risks of hazardous substances passing to the final product should be reduced from step to step (demolition; sorting and temporary stockpiling; processing production control) final testing if the process functions as intended.

National product standards with industry agree specifications should be established. Testing of construction products and testing methods should be set out in harmonised products standards.

Sound planning of construction activities and related waste management activities on construction sites are a prerequisite for high recycling rates and high-quality recycling products.

C&D waste recycling needs to be promoted particularly in densely populated areas, where supply and demand are geographically close,

e) **Appropriate policy and framework conditions:**

- waste management requires that ownership of the waste is clear through all stages of the project and across all parties, and that responsibilities are clearly defined;
- post-demolition follow-up and evaluation processes allows government to monitor whether such waste management plans are being implemented effectively;
- landfill restrictions are a prerequisite for developing a market for C&D recycled materials. Landfill bans and high landfill taxes provide the necessary incentives, however, landfill restrictions always need to be accompanied by other measures e.g. alternative processing facilities need to be available;
- Taxes on virgin materials may be an option, to provide price incentives to use recycled materials;
- Allow space for recycling: the feasibility of recycling is highest in densely populated and urbanised areas. However, this requires that space is reserved and that permits are issued to build such facilities in appropriate locations close to the urban areas – but this is not always the case;
- Temporary recycling installations and onsite recycling can help: higher value materials (plastics, ceramics, glass, gypsum, wood and metal) can be transported further away. Building waiting systems can be part of the solution.

Appendix E – EU waste electrical and electronic equipment directive

The WEEE Directive sets collection, recycling and recovery targets for a broad range of electrical goods. The scheme initially targeted 10 large product groups but has recently been expanded to cover all electrical and electronic equipment (EEE) unless explicitly excluded.[15]

The WEEE Directive requires member states to implement regulation to facilitate and encourage the separate collection, treatment, re-use, recycling and ultimately sound disposal of electrical and electronic equipment. Requirements include specific producer obligations:

- provide free take back in store (or on delivery) to enable purchasers to return their WEEE. Businesses must accept it even if it is a different type or brand;
- establish convenient facilities for the return of WEEE, including public collection points,
- encourage cooperation between producers and recyclers to promote inclusion in the design and production of EEE, elements to facilitate the re-use, dismantling and recovery of WEEE, its components and materials;
- prohibit the disposal of separately collected WEEE which has not yet undergone proper treatment (as defined in the directive);
- minimum collection rates are to be achieved annually (65 % of the average weight of EEE placed on the market in the three preceding years in the Member State concerned, or alternatively 85 % of WEEE generated on the territory of that Member State);
- producers or third parties acting on their behalf are to set up systems (reuse, repair, recycling) and are to provide for the recovery of WEEE using best available techniques.
- producers must provide at least for the financing of the collection, treatment, recovery and environmentally sound disposal of WEEE from private households and all other products that has been deposited at collection facilities.
- producers have registration, information and reporting obligations.
- penalties are applicable to infringements.

[15] Information in this section has been sourced from the European Commission's Waste Electrical & Electronic Equipment (WEEE) website. Sourced from: https://ec.europa.eu/environment/waste/weee/index_en.htm

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