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Waste Strategy Options

Final Report

CESSNOCK
CITY COUNCIL

Prepared for Cessnock City Council

November 2019

Project Number: TW19035

DOCUMENT CONTROL

Version	Description	Date	Author	Reviewer
0a	Draft report (partial) released to Client	27/06/19	TA/KM	AU
1a	Draft Report Released to Client	10/09/19	TA/KM	AU
1b	Amended following client review	20/09/19	TA	AU
1c	Amended following client review	14/10/19	TA	AU
1d	Final Report	26/11/19	TA	AU

Approval for Release

Name	Position	File Reference
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Table of Contents

Tables

Diagrams

Plates

Figures

Appendices

Appendix A : Service Extension modelling assumptions

Appendix B : Mapping Figures

1 Introduction

Cessnock City Council (Council) is located within the Hunter Region of New South Wales and covers an area of approximately 1,950km^2. Council's jurisdiction is a mixture of urban and rural dwellings. The majority of the Council's population is found around, and between, the townships of Cessnock and Kurri Kurri. Whilst mining has, historically, been the main industry in the area, more recently viticulture and the resulting tourism industry have significantly increased.

The Council previously developed and adopted a Waste Management Strategy 2014-2019 and is currently in the process of developing its next five-year Waste Management Strategy (2020-2025). Cessnock is eager to ensure its new Waste Management Strategy is innovative, sustainable and feasible within a local government environment. As such, Talis Consultants Pty Ltd (Talis) has been engaged to undertake a review of Cessnock's waste management services and to deliver a Waste Strategy Options Report (the Project). The Project will include a high-level review of Cessnock's waste services and infrastructure including a comparison of key services with comparable local governments.

The review will consider Council's current waste management systems and identify a range of strategic options and recommendations that may assist Council in continuing to move towards a more sustainable waste management system.

1.1 Objectives

The key objectives of the Project are to:

- Provide a review of the waste services delivered to customers with a view to matching these services against the community's expectations and Council's vision;
- Identify short, medium and long-term opportunities for Council to improve its waste services;
- Determine how these services can be delivered at the right level, at what cost and in the best way possible to meet community expectations;
- Ensure value for money and operational efficiency;
- Assess opportunities for better waste service delivery by comparing key services with other comparable local government authorities (LGAs); and
- Ultimately, facilitate the development of the 2020-2025 Waste Management Strategy in the near future.

1.2 Scope

To achieve the objectives of the Project, this report contains the following sections:

- Section 2 – Legislative and Policy Drivers;
- Section 3 – Waste Management Concepts;
- Section 4 – Emerging Waste Streams and Technologies;
- Section 5 – Current Services and Delivery Models;
- Section 6 – Comparison with other Council Systems;
- Section 7 – Waste Management Options – Identification and Evaluation;
- Section 8 – Discussion;
- Section 9 – Preferred Options; and
- Section 10 – Performance Improvement.

2 Key Legislative and Policy Drivers

There are a number of regulations, policies and guidelines, at the local, regional, State and Federal level, relevant to waste management, which may have an impact on Council either currently or in the future. These documents have been reviewed and assessed in terms of their potential implications on Council's current and future waste management operations.

2.1 Local

2.1.1 Waste Management Strategy 2014-2019

Council's five year waste management strategy was published in 2014. It outlines Council's vision and objectives for waste management across the LGA. It also summarised Council's position in relation to waste services and waste infrastructure and the key changes anticipated to achieve their objectives by 2019. A strategies and implementation plan included actions covering MSW, C&I and C&D waste along with litter and illegal dumping and data collection & monitoring. The strategies and implementation plan will assist Council in measuring their success when preparing its new waste management strategy (2020-2025).

2.1.2 Cessnock 2027 Community Strategic Plan

The Cessnock 2027 Community Strategic Plan was published in 2017 and identifies the community's desired outcomes and aspirations up to 2027. The five desired outcomes were identified as:

- A connected, safe and creative community;
- A sustainable and prosperous economy;
- A sustainable and healthy environment;
- Accessible infrastructure, services and facilities; and
- Civic leadership and effective governance.

Under the sustainable and healthy environment outcome, the objective specifically relating to waste management is "*Better waste management and recycling"* (Objective 3.3). The strategic direction relating to this objective is "*We divert more of our waste for recycling or reprocessing*".

2.1.3 Cessnock City Council's Delivery Program 2017-21

Cessnock City Council's Delivery Program 2017-21 outlines how Council will achieve the five outcomes identified in the Cessnock 2027 Community Strategic Plan. This includes specific actions in relation to waste management and recycling including a new waste transfer station at Council's Cessnock Waste Management Centre (CWMC), construction of the landfill extension project and continuing to implement litter and illegal dumping prevention programs.

2.2 Regional

2.2.1 Hunter/Central Coast Waste Avoidance and Resource Recovery Strategy 2017-2021

The Hunter/Central Coast Waste Avoidance and Resource Recovery Strategy 2017-2021 (Hunter WARR Strategy 2017-2021) provides a framework for regional waste management activities and service delivery towards meeting specific targets across eight themes. These are outlined in Table 2-1.

Table 2-1: Hunter WARR Strategy 2017-2021 themes, objectives and targets

Theme	Objective	Target
1: Avoidance and waste reduction	1a Reduce the generation of waste by supporting and enabling waste avoidance and reuse behaviours through community education, engagement and involvement.	Reduce waste generation per capita consistently to achieve a 4% reduction by 2021-22 from the 2011-12 baseline (KPI: kg/capita/year).
2: Increased recycling	2a Maximise the volume and quality of material inputs in kerbside and drop-off collection systems. 2b Improve understanding of waste stream composition. 2c Recover maximum levels of food and garden organics. 2d Increase the range of options and support available to community and businesses to recycle waste materials.	Achieve a regional resource recovery rate for MSW of 70% by 2021-22 from a 2011-12 Baseline.
3: Diversion of waste from landfill	3a Maximise the volume and quality of material inputs in kerbside and drop-off collection systems. 3b Improve understanding of waste stream composition. 3c Recover maximum levels of food and garden organics. 3d Increase the range of options and support available to community and businesses to recycle waste materials.	Achieve a landfill diversion rate of 75% by 2021-22 from a 2011-12 Baseline.
4: Managing problem household wastes	4a Ensure adequate community access to the regional network of facilities that accept and manage problem wastes. 4b To have an educated community on problem wastes and their management.	Provide facilities for core problem waste in all council areas by 2021-22.
5: Reducing litter	5a Minimise the environmental, social and economic impacts of littering through community education, enforcement, deterrents and installation of appropriate infrastructure. 5b Move towards a more strategic and integrated approach to litter prevention and management.	Reduce the volume of litter by 40% by 2020.
6: Reducing illegal dumping	6a Minimise the social, environmental and economic impacts of illegal dumping through community education, enforcement, installation of deterrents and clean-up activities. 6b Support state initiatives and programs on illegal dumping.	Reduce illegal dumping incidents by 30% of the 2010-11 levels by 2020-21. RID targets: • 30% increase in clean-up costs paid for by offender • 30% decrease in problem waste incidents • 15% increase in PINs issued

Theme	Objective	Target
7: Governance and leading by example	7a Consistent, regular and timely implementation of the Hunter WARR Strategy that facilitates ongoing collaboration and adaptive management. 7b Enhance a long-term and integrated planning, reporting and governance approach to waste management. 7c Councils in the region show leadership through internal and external waste management strategies. 7d Extend regional and sub-regional collaboration in procurement opportunities. 7e Collect, collate and analyse data to support decision making. 7f Manage overarching regional approaches to education and communications activities. 7g Provide a regional branding platform for education and communication initiatives.	Formally review the Regional Waste Strategy in 2021-22 Formally review Action Plan every year until 30 June 2021 Incorporate waste management into council Integrated Planning and Reporting Processes
8: Infrastructure and planning	8a Best practice management of new and existing services and facilities. 8b Optimise the long-term efficiency and capacity of waste management infrastructure and services across Hunter/Central Coast Councils. 8c Land use planning integrates best practice resource recovery principles.	N/A

The Regional Action Plan outlines the activities that will help to achieve these targets.

2.2.2 Disaster Waste Technical Guidelines

The Hunter Joint Organisation developed Disaster Waste Technical Guidelines - 'Is Your Council Disaster Ready? A Guide to the Management of Natural Disaster Waste by Local Government in NSW' in 2018, along with a more detailed guide focussed on Waste Management.

The document recommends that Councils undertake a number of actions including the preparation of a Disaster Waste Strategy and Disaster Waste Management Plan.

2.3 State

There are several NSW State legislative, policy, strategy, educational and economic tools relating to waste management in NSW. Key state legislation that impacts waste management includes the *Protection of the Environment Operations (POEO) Act 1997*, the *Waste Avoidance and Resource Recovery (WARR) Act 2001*, the *Protection of the Environment Operations (Waste) Regulation 2005* and the *Protection of the Environment Operations (Waste) Regulation 2018*. These legislative documents describe the requirements for transporting, storing, processing, managing, recovering and disposing of waste and recyclable materials.

2.3.1 NSW 2021: A Plan to make NSW Number One

NSW 2021: A Plan to make NSW Number One was published by the State Government in 2011. The strategic plan outlines a number of goals and targets across the economy. There are several waste management related aspects within the following goals:

- Goal 22 - Protect our Natural Environment:
  - Target illegal dumping;
- Goal 23 - Increase opportunities for people to look after their own neighbourhoods and environments:
  - Reduce litter;
  - Achieve recycling targets; and
  - Supports community recycling drop-off centres to provide locations for recycling and/or disposal of household hazardous wastes.

2.3.2 NSW Waste Avoidance and Resource Recovery Strategy 2014-2021

The NSW Waste Avoidance and Resource Recovery Strategy 2014-2021 (WARR Strategy) provides a framework for waste management up to 2021 and aligns with the NSW Government's waste reforms in *NSW 2021: A Plan to make NSW Number One.* The NSW WARR Strategy aims to avoid and reduce waste generation, increase recycling, alter public behaviour through education and increase investment, innovation and improvement of environmental practices and divert more waste from landfill. In doing so, the WARR Strategy includes a specific waste diversion from landfill targets to achieve its objectives, as outlined in Table 2-2**.**

Table 2-2: NSW WARR Strategy diversion targets

Waste Type	2022 Diversion Target
Municipal Solid Waste (MSW)	70%
Commercial and Industrial (C&I)	70%
Construction and Demolition (C&D)	80%
Overall Diversion from Landfill	75%

The *WARR Amendment (Container Deposit Scheme) Act 2016* established the Container Deposit Scheme (CDS) to reduce litter and recover, reuse and recycle drink containers. The CDS "Return and Earn" program was introduced in late 2017 facilitating a 10-cent refund for eligible containers when presented to a collection point. In NSW, eligible containers in kerbside recycling bins are also redeemable by Councils through an agreement with the relevant Materials Recovery Facility (MRF) operator providing Councils with a source of revenue.

Talis understands that NSW Environment Protection Authority (EPA) are currently in the process of developing a 20-year Waste Strategy for NSW in partnership with Infrastructure NSW, which is due for release at the end of 2019.

2.3.3 Waste Less, Recycling More Program

The Waste Less, Recycle More Program is a NSW Government initiative that provides funding for business recycling, organics collections, market development, managing problem wastes, new waste infrastructure, along with local councils and programs to tackle illegal dumping and litter. The program was recently extended up to 2021. Council has received funding through the program for the new Community Recycling Centre and waste transfer station.

2.4 National

2.4.1 National Waste Policy

The National Waste Policy – Less Waste More Resources (National Waste Policy) was released by the Department of Environment and Energy in 2018. The National Waste Policy provides a new direction for waste management in Australia up to 2030, with a view to reducing waste generation and promoting the management of waste as a resource by applying circular economy principles. The National Waste Policy outlines five key principles, namely:

1. Avoid waste.
2. Improve resource recovery.
3. Increased use of recycled material and build demand and markets for recycled products.
4. Better manage material flows to benefit human health, the environment and the economy.
5. Improve information to support innovation, guide investment and enable informed consumer decisions.

The above five principles are underpinned by 14 strategies that help to identify a means of achieving more desirable waste management outcomes.

The National Waste Policy recognises the important role of Councils in providing waste management services and infrastructure such as household waste and recycling collection services and delivering education and awareness programs. It also notes the relevance of regional bodies, such as the Hunter Joint Organisation of Councils to "*address waste management issues of regional significance and they can manage compliance and enforcement for littering and illegal waste disposal*."

3 Waste Management Concepts

3.1 Circular Economy

The circular economy concept has recently been obtaining significant media attention across Australia and internationally. The circular economy is considered to be an alternative to the traditional, linear economy (take, make, use, dispose) which refers to taking resources, making goods that are then bought and used to then be disposed of as waste. Given there is a finite supply of natural resources which are getting increasingly harder and costlier to extract, these traditional processes result in unnecessary waste. A circular economy aims to 'close the loop' by recovering and reusing items that would otherwise have been disposed of and returning them to the economy – considering them as a valuable resource rather than waste (Diagram 3-1). Benefits of implementing the circular economy concept include job creation, reduction in carbon emissions and improved resource efficiency.

Diagram 3-1: A simple circular economy representation

3.2 Waste Management Hierarchy

The Waste Management Hierarchy (Diagram 3-2), is an internationally adopted principle and concept which lists waste management options in order of preference according to their sustainability and environmental impacts.

The Waste Management Hierarchy has been adopted within this report as the basis for classifying and assessing the various resource recovery options which are being considered to assist Council to improve its waste management system. As shown in Diagram 3-2, options which achieve outcomes higher up the Waste Management Hierarchy are preferred over those located further down the Hierarchy. Notwithstanding this, options from each level of the Waste Management Hierarchy have been identified and assessed.

The following sections provide a description of the various levels of the Waste Management Hierarchy.

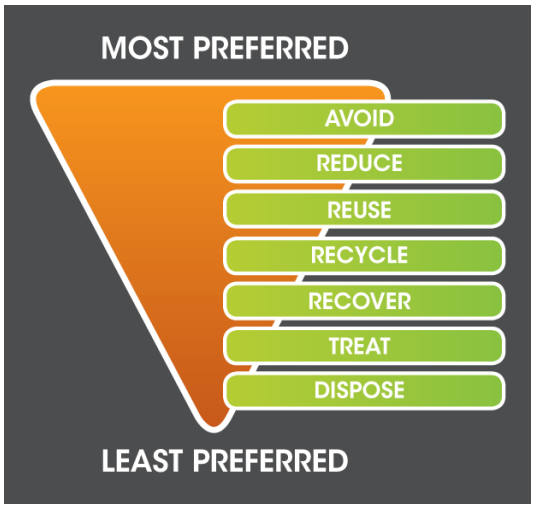


Diagram 3-2: Waste Management Hierarchy

For the purposes of this project, the levels of the Hierarchy which are similar and/or complementary have been grouped.

3.2.1 Avoid and Reduce, Reuse

Waste avoidance is the highest priority in the hierarchy and is closely associated with sustainable design, production and consumption. After waste generation the next stage is minimisation. Waste avoidance and reduction are the most challenging aspects of waste management.

Reuse is considered to be the recovery of value from a discarded resource in its original state without reprocessing or remanufacturing. Reuse can be achieved by an individual generator, or through the transfer of items or materials from a generator to another user through second hand sales.

3.3 Recycle

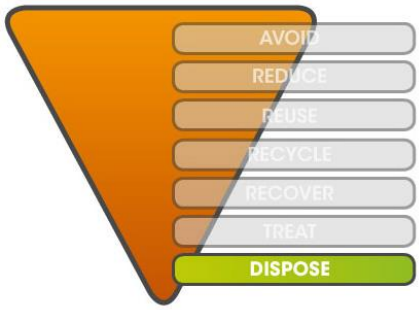
Utilising recycled products in manufacturing is environmentally beneficial as it reduces the demand for raw materials. In NSW, recycling has been widely adopted at a household level for packaging materials and household hazardous wastes. There are significant opportunities to increase recycling in the C&I and C&D sectors including organic mulching, inert waste crushing and screening.

Local governments have a significant role to play in the implementation of recycling practices including the collection, sorting and sale of materials, as well as education to encourage waste generators to utilise recycling systems.

3.4 Recover and Treat

Recovery of materials involves the physical, chemical or biological processing of waste to generate embedded products or energy. In contrast to recycling, the products generated from recovery processes are not necessarily like the original waste materials. Recovery often reduces the hazardous properties of the waste. The process is commonly undertaken at AWT facility which generate products and/or electricity or heat from sorted or mixed waste streams.

3.5 Dispose of waste



Disposal typically involves landfilling and thus is the least preferred level of the hierarchy. In addition, it can include incineration without any energy or heat recovery such as thermal destruction of hazardous wastes. While it is inevitable that a small portion of waste will require disposal, it should be used as a last resort.

Waste disposal to landfill is the predominant method of managing waste within NSW and although the potential environmental impacts such as soil and water pollution and greenhouse gas generation may be minimised through the construction of best practice landfill facilities, landfilling inevitably results in a loss of materials and energy.

4 Emerging Waste Streams and Technologies

This section provides an overview of emerging waste streams and waste management treatment technologies that Council may wish to consider when planning for its future waste management services and infrastructure.

4.1 Emerging Waste Streams

4.1.1 E-waste

E-waste (electronic waste) is any item with a battery or plug that is considered waste and requires disposal or recycling. Common forms of e-waste include:

- Computers and their associated parts (including monitors, printers and keyboards);
- Televisions;
- DVD and CD players;
- Mobile phones;
- Power tools;
- Hi-fi systems; and
- Kitchen appliances.

E-waste is considered one of the fastest growing waste materials being generated in Australia (DELWP Victoria, 2017). The issues with e-waste being landfilled are considered to be two-fold. Firstly, there is the missed opportunity to recover valuable recyclable material components and, secondly, there is the potential for hazardous substances from some of these materials to be released if e-waste is landfilled, which can have adverse environmental and human health impacts.

To date, two Australian states have introduced legislation to ban e-waste from disposal into landfill. Most recently, Victoria enacted a state-wide ban effective from 1st July 2019. This follows South Australia who enacted a ban in 2013. The Victorian Government has pledged $16.5 million to upgrade e-waste collection and storage facilities across the state along with an education campaign to help support the ban.

Council currently accepts e-waste at the CWMC such as TVs, DVDs, computers, laptops, monitors, printers, cables, hard drives etc. Domestic customers can drop off electronic equipment for free. The recycling of e-waste is undertaken by TechCollect who is a not for profit e-waste recycling service provider. In general, e-waste is firstly dismantled to recover the valuable resources which are then processed to manufacture new products.

4.1.2 Photovoltaic Systems

In 2015, Sustainability Victoria recognised that photovoltaic systems (PV systems) as the most rapidly growing e-waste stream. PV systems can include PV panels, inverter equipment and accessories from domestic, commercial and industrial generators. Globally, Australia has the highest uptake of solar power with 20% of homes installing PV systems. As of April 2019, an estimated 2.1 million PV systems had been installed on the rooftops of homes across Australia (DotEE, n.d.). More locally, there were 3,872 small-scale solar panel installations in Cessnock City Council in 2017 (ABS, 2018).

The lifespan of PV systems in Australia is approximately 15 to 35 years. By 2050, a Griffith University study (Salim, et al, 2018) estimates that Australia will have generated 1.5 million tonnes of solar PV waste. About 90% (by weight) of solar panels can be recovered including glass (90%), aluminium and other valuable metals. PV systems also contain hazardous materials such as lead and cadmium presenting environmental risks if disposed to landfill. PV systems are considered particularly challenging to recycle as the components are held together with hardened layers of ethyl vinyl acetate (EVA) or silicon. Additionally, there are limited facilities in Australia for

recycling this problematic waste. Currently, there is one PV recycler in Australia, Reclaim PV Recycling, who are based in South Australia. They work with PV manufacturers to facilitate collections of PV modules from across Australia.

In addition to solar panels, a common component of PV systems are lead acid and lithium-ion batteries that act as energy storage systems. This type of battery waste is predicted to increase significantly as these products approach their end of useful life. The Griffith University study estimates approximately 100,000 tonnes of battery energy storage waste will be generated by 2050.

Recognising this emerging waste stream, solar panels were added to a priority list in 2016/2017 by the Federal Minster for Environment under Section 108A of the *Product Stewardship Act 2011* with the purpose to establish a Product Stewardship Scheme. The aim of the scheme is to ensure environmental and social responsibility for the manufacturers, seller and consumers of these products. At the time of writing, a product stewardship scheme was planned for design and implementation in 2020.

4.1.3 Furniture

A NSW EPA illegal dumping report (2015) found that household furniture was the "*most common type of waste dumped*" making up an estimated 20% of all recorded illegally dumped waste. However, the Report Illegal Dumping (RID) reporting system used by Council indicated that, in 2018-19 (nine month period to March 2019), nearly half (48%) of reported illegally dumped waste in the LGA was household waste totalling 100 tonnes. There is anecdotal evidence to suggest that the increased availability of cheap, low quality furniture has exacerbated the incidence of illegally dumping this waste, with it often being perceived as cheaper to buy new furniture than repair existing items resulting in an increase in waste.

4.1.4 Fibreglass

Fibreglass is a type of synthetic material, often used for insulation in buildings (such as fibreglass batts) or as a reinforcement material for pools or boats. In Europe, there are examples of fibreglass being recycled. The materials are processed and subsequently used in cement production. Cement production requires large quantities of sand, of which glass is a main component. The fibreglass is fed into a crusher and sent to a cement manufacturer as a substitute to sand, saving an estimated 200 tonnes of sand for every 1,000 tonnes of fibreglass recycled. The recycling of fibreglass in this way reduces fossil fuel usage, along with other resources including sand and aluminium oxide (Fibreline, n.d.).

Exposure to fibreglass without appropriate personal protection can "*cause irritation to the eyes, nose, throat and skin*" (DoMIRS, 2014). The City of Newcastle has published guidance on the disposal of synthetic mineral fibre waste (CoN, 2018), including fibreglass. The City of Newcastle's waste facility at Summerhill limits the acceptance of synthetic fibre waste to a pre-arranged date, requiring the materials to be dropped off before midday and does not accept this waste on weekends or public holidays. When booking, information must be provided on the type of waste, the number and size of the load(s), the source of the waste and contact details of the transporter. This allows them to plan and effectively manage these materials that are brought to site. If Council does not currently have a safe work practices policy for handling hazardous materials, Talis would recommend that it consider developing one.

4.1.5 Engineered Stone Benchtops

The use of engineered stone benchtops has increased significantly in recent years. However, correlating with this increase, some health concerns have been reported. In 2018, there was a health warning issued by Safe Work Australia regarding the risk of exposure to respirable crystalline silica (RCS) from the cutting and processing

of engineered stone benchtops. A number of people working in the stonemason industry have been diagnosed with silicosis, emphysema and lung cancer all of which can be fatal (SWA, 2019).

These materials are expected to be brought to Council's waste management facilities in future years in growing quantities. The main health risks associated with stone benchtops are when the products are being cut and producing dust. This is not likely to be a direct concern for staff at Council's facilities unless the materials are being crushed on site or being brought to site crushed or partially processed. In future, these materials could be recoverable resources that are suitable for reuse. There are currently limited markets available for recycling these materials, specifically. However, as this product becomes increasing prevalent as a waste stream, markets may emerge.

4.2 Emerging Waste Management Technologies

There are numerous technologies that are emerging in the waste management industry to treat waste. This section focusses predominantly on those technologies that are now operating, or in the planning stages, in Australia including:

- Thermal Energy from Waste;
  - Conventional combustion;
  - Plasma Gasification;
  - Pyrolysis;
- Torrefaction;
- Mechanical Heat Treatment;
- Mixed waste processing (Bioelektra);
- Waste tracking system innovation; and
- 'Green' tyre recycling.

The suitability of each of these emerging technologies for Council were also assessed and are discussed within the relevant sections.

4.3 Thermal Energy from Waste (EfW)

Thermal waste treatment processes are able to process all wastes except for non-combustible materials such as inert wastes and some forms of hazardous wastes. Thermal processes can be used to recover the energy content of the waste stream to produce electricity, heat or fuel however, they also generate air emissions and a solid residue. Thermal treatment is able to reduce the volume of waste by up to 90%-95%, thereby significantly reducing the quantity of waste disposed of to landfill. Disposal of the facility residues needs to occur in appropriate landfill facilities.

There are four different types of thermal waste treatment processes used by EfW facilities. The combustion of waste materials involves the complete burning of organic materials in an oxygen-rich environment to create ash, flue gas and heat. Gasification and plasma gasification differ from combustion as these treatments occur in a low oxygen environment and involve a longer residence time. Finally, pyrolysis is similar to gasification, but is undertaken in an oxygen free environment and at lower temperatures.

Whilst not new, there has been increasing interest in recent years in EfW as a means of diverting waste from landfill, with disposal being the least preferred option of the Waste Hierarchy. The NSW EPA released a Policy Statement on EfW in 2018. The Policy Statement cites that energy recovery from waste "*must represent the most efficient use of the resource, and be achieved with no increase in the risk of harm to human health or the environment*".

It is important to note that the establishment of many thermal EfW technologies require high capital costs and, generally, a significant (at least 50,000 tonnes per annum) minimum throughput of materials in order to be considered economical. Therefore, most, if not all, of the technologies discussed below would require a regional approach in order to make them viable technologies to be adopted by Council in the longer-term.

4.3.1 Conventional Combustion

Conventional combustion facilities recover energy from heat released from waste being burned in a combustion chamber with an oxygen-rich environment. This heat converts water into steam, which is then sent to a turbine generator to produce electricity. This process generally has a high cost for flue gas cleaning and thus tends to be only economical on a large scale. Both the East Rockingham and Kwinana EfW facilities in Western Australia have proposed this technology, with a capacity of 300,000 to 400,000 tonnes per annum respectively. These facilities cost between an estimated $400 and $680 million, equating to a capital cost per tonne of capacity of between $650 and $1350 (MWRRG, 2018).

Due to the throughput capacity likely to be required to make a conventional combustion facility financially viable along with the high capital costs, Council would need to collaborate with other Councils in the region to establish such a facility.

4.3.2 Gasification

Gasification occurs in a low oxygen environment and involves a long residence time which results in less complex chemicals being generated by the process. This is done through the presence of heat at temperatures of 760°C to 1,370 °C without combustion and a controlled amount of oxygen and/or steam. The synthesis gas (syngas), which is a mixture of carbon monoxide, carbon dioxide and hydrogen (Biofuel UK, 2010), produced in the process is used as a fuel to generate energy. It is mostly used to generate steam, which in turn drives steam turbines to generate electricity.

Gasification has an estimated capital cost per tonne of between $600 and $850 (MWRRG, 2018). Due to the high capital costs associated with this technology, it would only be a viable option if considered as part of a regional approach to waste management.

4.3.3 Plasma Gasification

Plasma gasification is a variation of gasification, which uses plasma to generate ultra-high (1,200˚C up to 10,000˚C) temperatures resulting in the breakdown of organic waste into simple compounds. Supporters of this technology claim that the high temperatures result in a very clean syngas of hydrogen and carbon monoxide. However, it requires a relatively high capital investment and limited net energy production. To date, plasma gasification has had limited commercial success, with no proven track record for large scale mixed waste streams. A plasma arc facility has been operating in Victoria since 1992, focussed on treating chlorinated pesticide waste. However, there is some evidence to suggest that dioxins have been detected in the facility's emissions (Zero Waste Oz).

Plasma gasification has an estimated capital cost per tonne of capacity of between $1,150 and $2,000 (MWRRG, 2018). Due to the high capital costs associated with this technology, it would only be a viable option if considered as part of a regional approach to waste management.

4.3.4 Pyrolysis

Pyrolysis is the process of converting waste materials, with the application of heat in a low oxygen environment, to produce two by-products – namely gas and a residual char (or biochar). The gas, or syngas, produced is a combination of hydrogen, methane, carbon monoxide, carbon dioxide and nitrogen. This can be used as a fuel

to generate electricity. The biochar is a carbon-rich form of charcoal comprised of predominantly carbon and mineral ash. There is evidence to suggest that biochar can be applied to soil as a soil enhancer with potential benefits including improved soil health, increased crop yields along with carbon sequestration (Hussain et al, 2017). However, there are also a number of potential risks documented including introduction of contaminants such as heavy metals to soils and impacts on microbial and faunal communities (Hussain et al, 2017).

Pearl Global operates a tyre pyrolysis facility in Queensland with three production lines. The shredded tyres are fed into a hopper followed by a belt screw conveyor, which feeds the tyres into the reactor. The shredded tyres are heated for over an hour. This treatment process results in four end products namely, char, oil, syngas and scrap steel. After heating, the char is cooled on a water-cooled conveyor, the steel is extracted using a magnetic separator and the resulting oil is captured in barrels.

Pyrolysis has an estimated capital cost per tonne of capacity of between $750 and $2,000. Due to the high capital costs associated with this technology, it would only be considered a viable option if it was adopted as part of a regional approach to waste management.

4.4 Torrefaction

Torrefaction is a technology usually applied to biomass but could be used for some single-stream organic waste materials such as waste wood, some organics and forestry or agricultural residues. The process works similarly to a low temperature version of pyrolysis, operating between 200˚C and 400˚C without oxygen present. The carbonaceous biomass is slowly cooked so that the mass is reduced (estimated to be around 70% of original mass) however, 90% of the energy content is retained. The end product is a brittle, charcoal or coal-like solid fuel, sometimes called bio-coal, which is potentially suitable as a substitute for coal.

At the time of writing, there were no torrefaction plants operating in Australia nor are any known to be in the planning stages. However, there are a number of torrefaction plants in construction or operating internationally including several countries in Europe and Canada.

There is limited information available on the costs of processing material by torrefaction in Australia. However, as with the other EfW technologies discussed in this section, it is likely that, due to the high capital costs associated with these types of technologies, it would only be a viable option if considered as part of a regional approach to waste management.

4.5 Mechanical Heat Treatment

Mechanical Heat Treatment (MHT) includes two systems/processes, which work to separate a mixed waste stream into several component parts in order to give further options for recycling and recovery. The processes also sanitise the waste by destroying pathogens and reducing its moisture content using steam and/or heat.

The most common MHT system that is increasingly being promoted for the treatment of waste is the autoclaving process. Autoclaving uses steam and pressurises the waste to break it down into a fibre volume that is sanitised, leaving a clean stream of recyclable material. This product then undergoes a post-heat mechanical sorting process. To generate a high level of quality plastics, glass and metal product, labels are removed from dense plastics, glass bottles and tins during the process.

The second MHT system is a non-pressurised heat treatment system, where waste is heated in a rotating vessel prior to mechanical separation.

There is a MHT plant operating in Coffs Harbour City Council. The Biomass Facility integrates an autoclaving MHT system. The facility accepts source separated mixed waste and food organics that are collected under a regional

kerbside collection contract, as well as commercial waste and biosolids (Netwaste, 2013). It is understood that approximately 60,000 tonnes of waste is received for processing comprising of:

- 30,000 tonnes – Organics;
- 25,000 tonnes – Mixed waste; and
- 6,000 tonnes – Biosolids.

However, in 2018 the NSW EPA retracted an exemption on the 'red bin compost' (residue) from the facility, which had been on-sold for agricultural use due to contaminants found in the residue. This has resulted in Councils utilising the facility, having to landfill this material, dramatically reducing their waste diversion rates (Nambucca Guardian, 2018).

Council already has its garden organics waste collected and processed by a contractor and has future plans to introduce Food Organics & Garden Organics (FOGO). As such, the expected future tonnages of organics would be unlikely to be sufficient to make an MHT facility viable at the local scale. In addition, the recent decision by the NSW EPA to retract the exemption on the application of the processed materials from this technology has resulted in significant adverse impacts on those Councils affected.

4.6 Mixed Waste Processing (Bioelektra, Shoalhaven)

Shoalhaven City Council (Shoalhaven) recently appointed Bioelektra Australia to construct and operate a 'first of its kind' mixed waste processing facility. The facility has a capacity to process up to 100,000 tonnes initially per year however, the development approval for the site is set to 130,000 tonnes.

The facility uses a sterilisation process, similar to autoclaving. The main difference to 'standard' autoclaving (or MHT) is that there is no injection of steam during treatment. Instead, the process uses the steam generated within the waste to assist with the sterilisation process. The facility's control systems adjust pressures and temperatures during the process as required to ensure full sterilisation takes place (Shoalhaven City Council, 2019).

The remainder of the process consists of traditional sorting equipment that is used in most MRF's throughout Australia. The benefits of the new technology include:

- A very high recovery rate;
- Little to no odour once the material is sterilised, resulting in minimal environmental impact; and
- Householders don't have to change their current waste management practices reducing the need for re-education.

The output products from the process will include metals, plastics, glass, inert aggregates, cellulose, fabrics and biomass:

- Plastics are separated and sent for recycling. The process removes labels, paint and caps;
- Fine fraction of glass and aggregate minerals will be used in cement, bricks, render or glass wool;
- Coarse aggregate minerals will be used as construction aggregate;
- Metals are sent for recycling. The process completely removes labels and paint;
- Cellulose and fabrics will be used as a refuse derived fuel; and
- It is proposed that biomass will be used in brick and render manufacture.

A key difference between Council and Shoalhaven is that Shoalhaven have a two bin system with no plans to expand to a three bin system. The mixed waste processing facility aims to capture waste from the red lid bin. As

Council has a three bin system, and anticipates the introduction of FOGO in coming years, further reducing the volume of waste in the red lid bin, it is unlikely that a facility similar to Shoalhaven's would suit Council.

4.7 Waste Tracking System Innovation

The Town of Bassendean (Bassendean) in Western Australia is planning to undertake a three year trial, in partnership with its waste collection contractor, Suez and Curtin University to track and monitor waste material flows within Bassendean. Bassendean has a population of approximately 15,000 people and is located approximately 12km north-east of Perth covering an area of approximately 10km^2. A mobile application will be developed to collect data and better understand consumption practices in a sample of Australian households. The use of technology including video, still cameras, radio frequency identification (RFID) and volumetric sensors will help the project partners to establish a data baseline from the trial households and gather a complete household waste profile. Information will be fed back to trial households so they can understand their waste habits. The trial aims to improve waste data, identify problematic packaging, reduce contamination where it occurs and minimise landfill costs and associated greenhouse gas emissions. This will be the first trial of its kind undertaken by a local government in Australia.

Council could consider undertaking a similar trial, potentially with funding from NSW EPA and/or in partnership with a university or waste management company.

4.8 'Green' Tyre Recycling

A green tyre recycling company, Green Distillation Technologies, was recently approved by the NSW EPA to operate a tyre recycling plant in Warren, in central-west NSW. The plant will recycle car and truck tyres back to three raw products, namely oil, carbon and steel using heat to catalyse chemical reactions. The oil produced can be used as a heating fuel and the carbon is a high grade product that can replace those sourced from fossil fuels. The steel can be returned directly to tyre manufacturers for reuse.

Alternatively, tyres can be recycled to produce a variety of new products. Council currently accept tyres for recycling at the CWMC. Tyres are recycled through Tyre Stewardship Australia (TSA) to produce a range of products including new rubber products (artificial turf, conveyor belts brake pads etc), alternative fuel sources and for road construction.

5 Current Services and Delivery Models

A review of Council's current waste management services and infrastructure were undertaken to obtain a thorough understanding of the waste services provided. These were categorised as:

1. Kerbside Collection Services;
2. Waste Infrastructure;
3. Waste Management Personnel;
4. Bulk Waste Management;
5. Waste Education and Community Engagement;
6. Waste Data and Treatment;
7. Illegal dumping;
8. Alternate Waste Management; and
9. Public Place Bins.

Each aspect of Council's waste service offering and infrastructure are discussed in the following subsections.

5.1 Kerbside Collection Services

Council currently has a three bin kerbside collection system, comprised of the following:

- General waste;
- Comingled recycling; and
- Garden organics.

5.1.1 General Waste

Domestic general waste collections are currently undertaken in-house by Council staff on a weekly basis. The general waste bins are 240L and Council is gradually phasing out dark green lidded bins for red lidded bins, in compliance with Australian Standard (AS 4123.7-2006). There are an estimated 22,083 services within Council's waste collection area. A total of 15,041 tonnes of general waste was collected in 2018 (March 2018-February 2019). Council is currently considering reducing the size of the general waste bins to 140L or maintaining the 240L bin and providing a fortnightly collection once the FOGO service is established (see Section 5.1.3).

5.1.2 Comingled Recycling

A fortnightly collection service for comingled recyclables is undertaken for residents with a domestic waste service by a contractor, Hunter Resource Recovery. Hunter Resource Recovery is an initiative between Cessnock, Lake Macquarie, Maitland and Singleton Councils. The recycling collection contract is a joint contract with Council along with the partner councils. The initial term of the contract is 10 years, which is due to expire in mid-2023. The recycling bins are generally 240L yellow lidded bins. Ratepayers have the option to upgrade to a larger 360L bin for recyclables for a one-off charge ($25) or request an additional bin for an annual fee.

5.1.3 Garden Organics

A fortnightly garden organics collection service is also run in the Council. This service is also outsourced to a contractor, Solo Resource Recovery. The garden organics bin is a 240L lime-green lidded bin. Once collected, the contractor takes the materials to another contractor, Australian Native Landscape's (ANL) transfer station for screening prior to hauling the materials to the processing facility in Tea Gardens, also operated by ANL. The materials are then processed into mulch and compost.

The organics collection and processing contracts are joint contracts, with Singleton and Maitland Councils. These contracts have provision for the introduction of a weekly FOGO service by March 2024.

5.1.4 Kerbside Collection Summary

A summary of Council's kerbside collections services along with estimated tonnages collected during 2018 (the most recent 12 month period data available, March 2018-February 2019), are shown in Table 5-1 below.

Table 5-1: Summary of Council's kerbside collection services – current and future

Service	Bin size	Frequency	Bin lid	Serviced by	Tonnes collected (2018)	Average weight of bin collected
General Waste	240L	Weekly	Red (some dark green being phased out)	In-house by Council staff	15,041	13kg
Comingled recycling	240L / 360L	Fortnightly	Yellow	Contractor – Hunter Resource Recovery	4,031	9.5kg
Garden Organics (GO)	240L	Fortnightly	Lime-green	Contractor – Solo Resource Recovery	5,424	7kg
Food Organics, Garden Organics (FOGO)	Future Planned Service - by 2024				-	-
Total Tonnages					**24,496**	**-**

As summarised above, there were 24,496 tonnes of waste materials collected in 2018 across Council's kerbside collection three bin system.

5.2 Waste Infrastructure

Council has two waste facilities, namely the CWMC and the Greta Waste Transfer Station (Greta WTS) both of which are discussed in more detail below.

5.2.1 Cessnock Waste Management Centre (CWMC)

The CWMC is operated by Council. It is located on Old Maitland Road, north-east of Cessnock township and has been in operation since 1974. The site is currently licensed to accept up to 60,000 tonnes per annum and includes a waste transfer station and a landfill.

The waste transfer station has been in operation at the CWMC since late 2017. The addition of the waste transfer station at the site provides the opportunity for the diversion of materials away from landfill and, ultimately, their resource recovery. The waste transfer station includes a Community Recycling Centre (CRC) that diverts problem

wastes such as paints, oils and batteries from landfill. The waste transfer station was designed to maximise resource recovery by:

- Directing users past numerous material drop-off points with the final drop-off point for mixed waste destined from landfill;
- Adopting a differential pricing strategy, aimed at encouraging the source separation of materials for recycling and recovery; and
- The use of an internal weighbridge, which is connected to a dual weighbridge system to accurately account for resource recovery drop-off and reward this behaviour with a significant price reduction for the user.

Council has approval for its proposed landfill extension project at the CWMC which will include four new landfill cells with an expected 20 year lifespan once completed.

5.2.2 Greta Waste Transfer Station (WTS)

The Greta WTS is located in the north of the LGA on Hollingshed Street, Greta approximately 21km north of Cessnock. The site is located on Crown land. The Greta WTS is open five half days per week (Monday, Thursday, Friday 14:00-17:00, Saturday 08:00-12:00 and Sunday 13:00-17:00) and is operated by a contractor. The Greta WTS costs Council approximately $133,000 per annum. The waste materials accepted are limited to household waste, with no bulk waste, mattresses or commercial goods allowed. Waste is transferred from Greta WTS to the CWMC once per week. Waste vouchers cannot be used at the Greta WTS and it is understood that no resource recovery is carried out on site. Talis understands that waste acceptance data is not recorded at the site. Therefore, there is limited information available to indicate the waste volumes or frequency of usage of the Greta WTS.

5.2.3 Waste Fleet

Council owns six side-load single-person waste collection vehicles (Waste Management Strategy 2014-19). These vehicles are operated five days per week (Monday-Friday). The waste collection vehicles are fitted with Global Positioning Systems (GPS) systems, which records both the coordinates of each vehicle and provides real time data including what services have been delivered and touch screen tabs for non-presentation, along with bins that have been overfilled or damaged.

5.3 Waste Management Personnel

Council's waste management staff includes a team of three in strategy and program development, and a further 26 staff for delivery. Delivery staff includes one coordinator and two supervisor roles (split between collections and landfill management) and 23 Waste Service Operators that work in collections, at the CWMC or rotate between to two aspects of the service. The CWMC operational staff work on a seven day roster system.

5.4 Bulk Waste Management

In terms of bulk kerbside collections, Council has not provided a regular bulk and green waste bulk kerbside collection service since 1997. Instead, ratepayers are issued with four waste vouchers per year that enable them to self-haul waste and other materials to the CWMC, with up to 500kg accepted per voucher.

In addition, Council holds free drop off days for household waste, such as mattresses (see Plate 5-1) and chemicals ('Chemical CleanOut') at various locations within the LGA. Mattresses normally attract a charge at the CWMC and, once collected, are sent for recycling through the social enterprise, Soft Landing.

Plate 5-1: Example of Mattress Drop-off Day in Council

5.5 Waste Education and Community Engagement

Council undertakes a number of waste education and community engagement initiatives as an individual Council, with neighbouring councils and as part of its regional collaboration through the Hunter Joint Organisation of Councils. The initiatives focus on resource recovery, waste disposal and combating illegal dumping, including:

- Community waste survey (Cessnock);
- Your Organics Bin (Cessnock, Maitland and Singleton Councils);
- Better not mess with Cessnock (Cessnock);
- Report Illegal Dumping (RID) Online (through NSW EPA);
- Report Illegal Dumping (RID) Squads (Cessnock);
- Illegal Dumping on Charities (Cessnock);
- Recycle Right (Cessnock, Lake Macquarie, Maitland City and Singleton Councils);
- Your Waste Service Guide (Cessnock); and
- CWMC and CRC Education (Cessnock).

Council provides these education and community engagement initiatives with the support of funding programs, without which, most would not be possible. The sporadic approach to waste education results in less consistency in the messages delivered to the community and hence, less positive engagement and behaviour change. The key waste education initiatives that Council participates in are discussed briefly below.

5.5.1 Community Waste Survey – Don't Waste Your Opinion

Council recently undertook a community consultation exercise with a community waste survey, Don't Waste Your Opinion. The aim of the survey was to gather feedback on proposed waste management initiatives and options to help inform the 2020-2025 Waste Strategy. In addition, community drop-in sessions were held in Millfield, Cessnock, Branxton and Kurri Kurri.

Council were focussed on the following key points for the community consultation:

- Household waste collection – in relation to a potential change to frequency or bin size;
- Bulky waste services – in relation to a proposed change to the voucher and potential for bulk kerbside collection;

- Food in the garden organics bin;
- Cessnock Waste Management Centre (CWMC); and
- Illegal dumping.

5.5.2 Your Organics Bin

Your Organics Bin is a joint initiative between Cessnock, Maitland and Singleton Councils. It aims to provide information to the community on the garden organics collection service such as collection scheduling, material acceptance and details on what happens to the organics after it is collected.

5.5.3 Better Not Mess with Cessnock

Recognising that illegal dumping is a significant problem, Council received funding from the Waste Less, Recycle More initiative from the NSW EPA to launch a 'Better not mess with Cessnock' campaign. The campaign used local personalities in advertisements that send clear and direct messages to illegal dumpers.

5.5.4 Report Illegal Dumping (RID) Online

Report Illegal Dumping (RID) online is a NSW EPA initiative to encourage people to report information regarding suspected or observed illegal dumping. Council provides the contact number and RID Online link on its website. Further to this the Council list other ways the community can assist as well as reporting illegal dumping online.

5.5.5 Report Illegal Dumping (RID) Squads

To further reduce the occurrences and costs of illegal dumping within the region, the Hunter/Central Coast Regional Illegal Dumping (RID) squad was established in 2014. The squad utilise surveillance techniques to identify (and penalise) people illegally dumping waste.

5.5.6 Illegal Dumping on Charities

Charities within the Council's LGA receive significant donations from the community however, unfortunately only 10% of what is received is of a good quality and suitable for resale. The remainder of the unsaleable items often end up in landfill and the costs of disposal is subsidised by Council. Illegal dumping and unsuitable donations also puts pressure on staff and volunteers to manage these materials and their capacity to help others. In an effort to minimise the illegal dumping of waste materials Council, along with local charities, have created an educational campaign. The campaign aims to inform people about donations (i.e. what items are accepted, the quality of items, cleanliness etc). A variety of mediums such as social media and print will be used to communicate the key messages of the educational campaign.

5.5.7 Recycle Right

Council, in collaboration with Lake Macquarie, Maitland City and Singleton Councils established the Hunter Resource Recovery (HRR) initiative to manage the kerbside recycling service across the four councils. The HRR website educates the community on how to 'Recycle Right' to encourage the correct use of the service and minimise contamination. The Recycle Right information includes six key aspects including 'how recycling impacts you', 'what can be recycled', e-waste, recycling tips, Frequently Asked Questions (FAQS) and links to further information.

5.5.8 Your Waste Service Guide

To educate and promote current waste services to the community, Council provide a user friendly, colourful and clear guide to outline the Council's waste management services. The guide was delivered to every household in

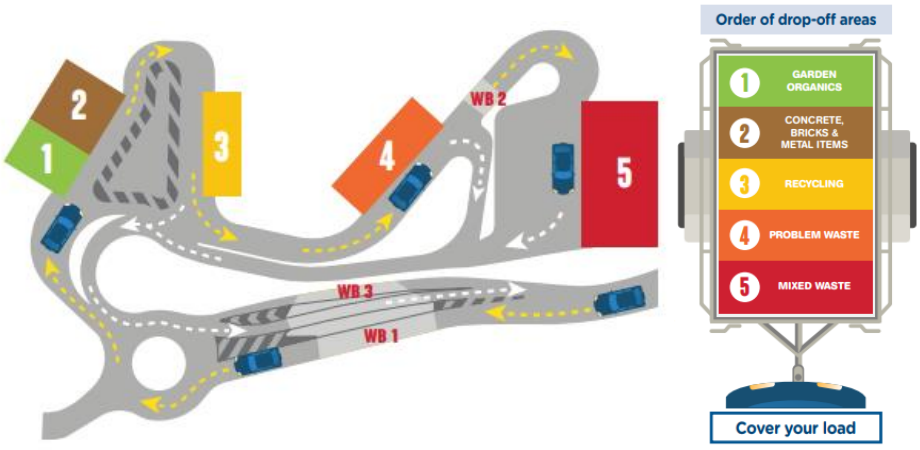
February 2019 and is now delivered with all new waste services. The guide covers, but is not limited to, the waste types that are accepted, tips and hints, waste management infrastructure, illegal dumping, litter, problematic waste, community recycling stations and sharps management.

5.5.9 CWMC and CRC Education

Information on the CWMC and CRC is provided on Council's website. The information outlined for the CWMC includes the location, opening hours, how to pack your waste load, how to get there, costs and safety. A list of materials accepted at the CRC are also listed on the website.

Council recently published a colour coded site map for inclusion within the Your Waste Service Guide, which is posted to all ratepayers. The guide is also available on Council's website, advertised in the newspaper and handed out to users at the CWMC (see Figure 5-1). The site map includes a colour coded guide of where to drop waste types including garden organics, recycling and problem waste.

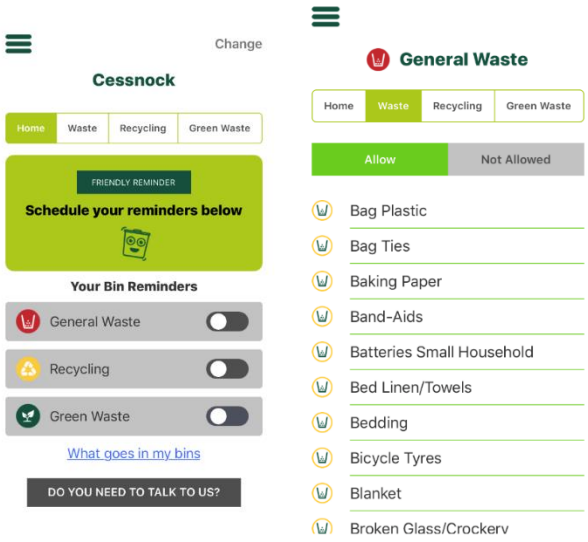
Figure 5-1: Site map – CWMC



5.5.10 Waste Mobile Device Application

Council has recently introduced a waste mobile device application, the Solo Bin App to its community. The free app provides residents with features such as bin reminders and a guide of acceptable materials for each bin type (see Figure 5-2).

Figure 5-2: Council's new Solo Bin mobile application



5.5.11 External or Contracted Waste Education

Through various contracts and regional partnerships, Council obtains additional waste education as outlined in Table 5-2.

Table 5-2: External or Contracted Waste Education

Source	Description
Kerbside Comingled Recycling Contract	The kerbside comingled recycling contractor (Hunter Resource Recovery) is required to provide recycling education as part of the contract. The service is shared with Maitland, Lake Macquarie and Singleton Councils therefore providing a consistent message across all areas. However, during the course of the contract the effectiveness of the dedicated waste education officer has reduced with a greater focus placed on bin inspections and not community education.
Kerbside Garden Organics Contract	The kerbside garden organics (GO) collection service, provided in partnership by ANL and Solo, has provision for education included the contract. This contract is shared with Maitland and Singleton Councils. A full-time education officer is employed by Solo, which shares the waste education responsibility between the contractor and Council. The dedicated waste education officer associated with this contract is proactive however, their time is split between three Councils resulting in reduced effectiveness.
Hunter Joint Organisation of Councils	The Environment Division of the Hunter Joint Organisation of Councils oversees the Hunter WARR Strategy 2017-2021. A part-time education project officer is employed to deliver projects associated with the Hunter WARR Strategy 2017-2021 to the 11 member councils. Again, the effectiveness of a part time education officer split across 11 councils is significantly reduced.

5.6 Waste Data and Treatment

The key waste materials that are generated and accepted at the CWMC are summarised in Table 5-3. Waste data is for the most recent 12 month period available at the time of writing.

Table 5-3: Council's waste materials and their treatment (March 2018 – February 2019)

Material	Tonnes	Source	Treatment method	Location
Resource Recovery				
Comingled recycling	4,031	Kerbside collection	Recycling	Sorting – Materials Recovery Facility (MRF), Gateshead; Recycling – exported overseas
Comingled recycling	117	Drop off		
Garden organics	5,424	Kerbside collection	Reprocessing (Composting)	ANL's Tea Garden facility
Vegetation or garden organics	1,053	Drop off		
Bricks and concrete	130	Drop off	Recycling	Central Waste
Cardboard	64	Drop off	Recycling	Suez
Tyres	3	Drop off	Recycling	Tyrecycle
Problem waste	80	Drop off	Recycling	Cleanaway
Mattresses	29	Drop off	Recycling	Soft Landing
E-waste	74	Drop off	Recycling	Matthews Metals
Scrap metal	1,980	Drop off	Recycling	Matthews Metals
Resource Recovery Total	**12,985**			
Disposal				
General waste	7,799	Drop off	Disposal	Landfill
Asbestos	49	Drop off	Disposal	Landfill
Soil	3,089	Drop off	Disposal	Landfill
Dredging spoil	1,321	Drop off	Disposal	Landfill
General waste	15,041	Kerbside collection	Disposal	Landfill
Disposal Total	**27,299**			
Total waste	**40,284**			

The comingled recycling is transported to the MRF in Gateshead for sorting. Separated materials suitable for recycling are subsequently sent overseas for processing. Any unsuitable materials or those that are considered contaminated are sent to landfill.

As previously outlined, garden organics collected from the kerbside collections are transferred to ANL's organics processing facility in Tea Gardens outside of the LGA. These materials are composted and on-sold by the contractor.

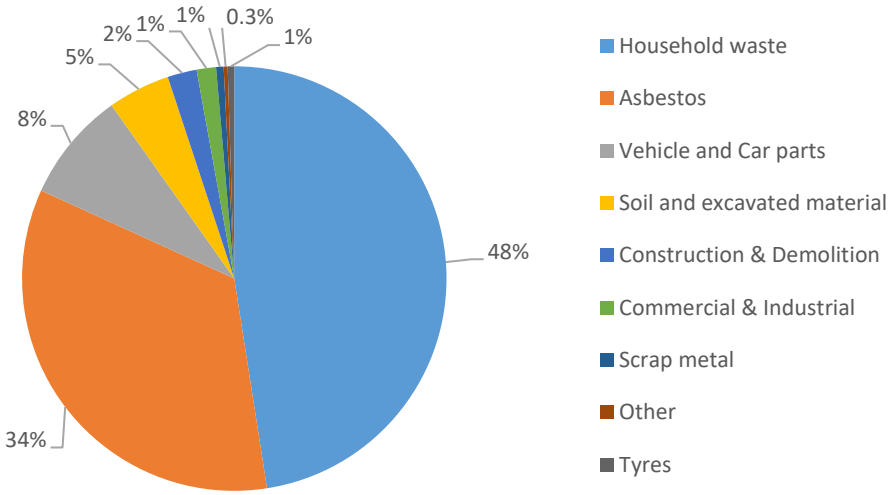
All general waste collected in the kerbside collection service is taken to the CWMC's on site landfill for disposal. In addition, asbestos, soil and dredging spoil is disposed of at the CWMC's landfill.

5.7 Illegal Dumping

As mentioned previously, illegal dumping in Cessnock is a major issue. Illegal dumping is a common problem for many LGAs. The causes of illegal dumping are complex with multiple drivers. Whilst there is no clear monetary figure on the cost of tackling illegally dumped waste, during 2018-19 Council reported a total of 612 incidents, averaging more than one incident per day. To help manage this, Council have a number of initiatives in place including a RID Officer, community education campaigns (as detailed in Section 5.5) and other prevention strategies. The in-house RID Officer investigates large illegal dumping offences and those relating to the transport of waste.

A breakdown of the reported illegally dumped waste in 2018-19* from Council's RID reporting system is shown in Figure 5-3.

Figure 5-3: Reported Illegal dumping by waste type in Cessnock (2018-19*)



** Nine month period from July 2018 to March 2019*

A total of 211 tonnes of illegally dumped waste was reported in the 2018-19 period, with almost half (100 tonnes or 48%) of this being categorised as household waste. This was followed by asbestos (34%) and vehicle car parts (8%). The most common incidents were household waste, with 84 incidents in 2017-18, followed by tyres (11 incidents), asbestos (8 incidents) and commercial and industrial (8 incidents).

In addition, there are reportedly issues with illegal fill and/or soil being dumped on private properties. Other common illegally dumped materials include:

- Mattresses;
- Tyres;
- White goods; and
- Green waste.

It should be noted however, that illegal dumping within the Council LGA, is not Council's issue alone. Illegal dumping quite frequently occurs on crown or state government land where Council is not the responsible authority and, therefore, has limited capability or capacity to deter or pursue offenders who illegally dump waste

in those areas. Council is often called upon to clean-up these areas at its own cost. The authorities responsible for the crown or state-owned land should provide leadership and greater support to Council to firstly deter illegal dumping and secondly undertake clean-up if, and when, required.

In addition, with the RID officer only targeting large illegal dumping offences and those relating to the transport of waste, Council is left to clean-up the more frequent but smaller loads of illegally dumped waste. This waste is still illegally dumped and, therefore, should still fall under the responsibility of the RID officer, which suggests that the priorities and subsequent effectiveness of the RID officer should be reviewed to ensure that the service is all encompassing.

5.8 Alternate Waste Management

As discussed earlier in the report, Council provides services to the majority of its residents. However, due the large area of the LGA and the low density, rural nature of some properties, it is not feasible or economically viable to provide a waste collection service to all residents. According to Council data, there are an estimated 3,397 freehold lots or just over 1 in 10 freehold lots (11.8%) that are not provided with a collection service. Instead, these residents are offered an alternate service voucher to self-haul their waste – both general waste and recyclables to the CWMC. These lots are generally located on the outskirts of the LGA (see map Figure 4). Some residents must drive significant distances to dispose of their waste at the closest Council waste management facility, with 3.5% of residents having to drive more than 30 minutes (one way) to access the CWMC. It is possible that the significant travel time required to access a waste facility could be contributing to illegal dumping activities.

5.9 Public Place Bins

There are approximately 317 public place (240L) bins currently located across the LGA. These are predominantly general waste bins however, there are two public place recycling bins located at the Visitor Information Centre in Pokolbin. The public place bins are generally collected once a week, with some high traffic bins in the Cessnock area collected twice a week.

There have been issues with vandalism, particularly fires with these bins. Subsequently, some metal bins have been installed as a preventative measure. Public place bins have also been mined for eligible CDS containers which results in increased occurrences of litter and untidiness from emptied bins. There have also been issues reported with contamination in the recycling bins. Public place recycling is discussed further in Section 7.3.2.

5.10 Internal Waste Management Practices

It is estimated that Council generates approximately 5,000-6,000 tonnes of waste per annum from internal works and infrastructure service projects and ongoing maintenance activities. However, this has reportedly been substantially reduced over the past few years from an estimated 10,000 tonnes per annum due to improvements in the Works and Infrastructure team's work.
The main sources of waste generated from Council's Works and Infrastructure team can be broadly categorised as:

- Road construction waste;
- Drain clean up waste; and
- Street sweeping waste.

The waste materials generated from these operations are believed to be a mix of soils with some vegetation and litter, although detailed analysis of its composition has not been undertaken. Some of these materials, due to their source, would be considered contaminated, which would limit their reuse potential. However, there are opportunities to reuse or recycle some of this material.

6 Comparison with Other Council Systems

A comparison of waste management services and initiatives was undertaken in relation to key issues identified in discussions with the Council, namely:

- Food Organics and Garden Organics (FOGO) collections;
- Reuse and Tip Shops;
- Fees and Charges;
- Waste Education;
- Waste Vouchers vs bulk waste services; and
- Illegal dumping.

6.1 FOGO

Council already has a garden organics (GO) kerbside collection service but plans to introduce a FOGO service by 2024 as part of its existing contracts with waste collection service provider, Solo Resource Recovery, and organics processor Australian Native Landscape. A comparison between a number of other LGAs that have already implemented FOGO was undertaken. These include other Councils in NSW as well as examples in Victoria, South Australia and Western Australia, namely:

- Albury City, NSW;
- Barossa Council, South Australia (SA);
- City of Bunbury, WA;
- Shire of Byron, NSW;
- Lake Macquarie, NSW;
- Moira Shire, VIC; and
- City of Shellharbour, NSW.

6.1.1 Albury City, NSW

Albury City is located in the Riverina region of NSW with a population of approximately 52,165 people. The City implemented a FOGO collection service in 2015 with surrounding LGAs, City of Wodonga, Federation Council and Greater Hume and Indigo Shire Council. The Councils in the region formed an initiative “Halve Waste” (Halve Waste Councils) to reduce waste to landfill by 50% by 2020 and implemented a FOGO service to assist in reaching this target. Albury received $278,106 in funding from the NSW Environmental Trust in partnership with EPA NSW Waste Less Recycle More initiative for the implementation of the service. The introduction of the service initially increased costs to ratepayers by $13 per household per annum, a subsidised rate, as an incentive for residents to utilise the service. The actual costs to implement the system is unpublished but is suggested to be approximately $60 per ratepayer. The Halve Waste Councils used ‘community-based social marketing’ to develop and deliver a waste education and behaviour change program. The program’s methodology included a number of steps such as selecting behaviours, identifying barriers and piloting strategies to address the barriers (Sustainability Victoria, 2017).

As part of the implementation, residents received a 140L refuse and 240L recycling collection fortnightly and a 240L weekly FOGO collection. The introduction of the third bin resulted in the refuse bin collection changing to a fortnightly collection from weekly collections. Residents also received a kitchen caddy with compostable liners. Additional liners were made available from Albury City Council for a small fee, and a user guide to the new bin system was also provided to all participants. The compostable liners were supplied by the processing contractor. This was faced with some public resistance as residents were not permitted to use alternative biodegradable bags.

Albury undertook sufficient education and marketing prior to the implementation of the FOGO system, achieving a contamination rate less than 1%. They utilised local celebrity, Ms Julie Goodwin, to promote organic recycling through TV commercials. The education strategy focused on how to manage specific items such as nappies and a community assistance team dealt with complaints and issues the public raised during roll out of the system.

As the region does not currently have an organics processing plant, collected waste from Albury and the surrounding Councils is currently hauled to Albury Waste Management Centre for sorting, shredding and then transported by Cleanaway to temporary organics waste facility sites in Wagga Wagga and Shepparton. An estimated 22,500 tonnes of waste from LGAs completes this journey on an annual basis. The LGAs in the region are hopeful to be able to have a site developed closer in the near future and produce high quality compost (AS4454 – 2012 standard) that can be utilised by the community.

6.1.2 Armidale Regional Council, NSW

Armidale Regional Council (ARC), situated in the New England and Northern Tablelands regions of NSW originally introduced their organic waste collection program, 'City to Soil' to 10,000 households back in 2012 (KAB, 2013). The program involves the collection and processing of organic waste materials including food waste, green waste along with paper towel and food-contaminated cardboard, such as takeaway containers. As part of the original roll out, eligible households that received a kerbside collection were provided with a 240L green lidded bin for organic waste. ARC provided residents with a kitchen caddy (MaxAir food scraps bin – see Plate 6-1) and also supplied free compostable biobags (ARC, 2019). The program was extended to residents in Guyra, in the north of the LGA, which amalgamated with ARC in 2016, in mid-2019.

Plate 6-1: Example of ARC's 'MaxAir' kitchen caddy

The City to Soil (FOGO) bins are collected fortnightly with general waste (140L bins) collected weekly. ARC operates a hybrid contract delivery model for its organic waste program. It utilises an external contractor for organics collections. However, organic materials are then transported to ARC's Armidale Waste Management Facility for processing in-house. ARC utilises a form of aerobic windrow composting that requires no mechanical turning, known as static fermentation or fermentative composting. The materials are initially screened for contaminants such as glass, metals and plastics, which are then removed. The organic materials are then sorted to ensure there is a suitable ratio of carbon to nitrogen before being watered down and inoculated with specialised microbes. The materials are arranged into windrows, covered and left to decompose, whilst having their temperature monitored to ensure suitable conditions. The process takes approximately 12 weeks, after which time the materials are put through mechanical screens. At this stage, any materials requiring further treatment, such as large objects not broken down sufficiently, are further processed to produce 'B' grade compost, whilst suitably processed materials are considered 'A' grade. The processed material is generally available for sale between \$50-\$70/m^3 depending on whether it is classified as 'A' grade or 'B' grade.

The ARC's program is considered to be one of the more successful organics recycling programs in Australia with low contamination rates and community buy-in. This is, in part, credited to the ongoing education, and focus on working in partnership, with the community. The launch of the program included an extensive media and education campaign (KAB, 2013). The community is encouraged to source separate their organic waste at home with prizes awarded for compliance, such as fruit and vegetable hampers. In addition, ARC provides access to compost at a much-reduced rate of $25/m^3. ARC estimates that 3,500 tonnes of organic materials are diverted from landfill each year (Northern Daily Leader, 2013).

6.1.3 Barossa Council, SA

The Barossa Council is located in the south-east of South Australia, with an estimated population of approximately 23,000 people. Barossa previously offered a voluntary GO system however, in early 2017, Barossa undertook a community consultation exercise to gather views on its proposed waste collection options. The purpose of the proposed waste collection options was to improve resource recovery rates as a result of the rising costs of waste disposal to landfill and to minimise environment impacts. As a result of the consultation, Barossa decided to implement a three bin kerbside collection service with FOGO system. The FOGO system is now offered to residents that live within the designated waste collection area, which covers Barossa's main townships. The green bin, along with a kitchen caddy for food waste, is offered to residents on a voluntary basis. Ratepayers are able to opt-in to the services for $59 per year.

The 240L FOGO bin is collected fortnightly, alternating with a 240L recyclables collections, with the 140L general refuse bin continuing to be collected on a weekly basis. Outside of the townships, the green bin is not offered with only the refuse and recycling bin collection service being maintained.

The roll out of the three bin system coincided with the appointment of a new waste collection contractor. New bins with unique bin identification codes were rolled out. As part of its community education campaign, Barossa provided communications about the changes via social media, its website and by post. An education kit including a reusable coffee cup, biodegradable pen, tote bag, fact sheets and a colouring in competition were included with the new bins.

Barossa undertook a tender process in partnership with a number of regional councils and appointed a contractor on a seven year contract. The materials are mulched before being transported to a regional composting facility, which use a mobile aerated floor (MAF) system.

6.1.4 City of Bunbury, WA

The City of Bunbury is located 160km south of Perth in Western Australia with a population of approximately 31,000 people. In 2012, the City of Bunbury committed to introducing an organic bin collection service, following a survey that showed overwhelming support from the community. In 2011, Bunbury conducted a survey in Local Government Areas (LGA) in the Wellington Regional Group of Councils (now referred to as Bunbury Harvey Regional Council), of which the City of Bunbury is a member to help guide the decision making process. Subsequently, several other members of the group have successfully rolled out the three bin system including Shires of Capel, Collie and Donnybrook-Balingup.

The Western Australia State Government's Better Bins Kerbside Collection Program provided a grant of $177,000. Additionally, prior to roll out, charges for the third bin were included on rates notices for the 2012/13 financial year. Rates increases due to the roll out of the three-bin system have continued with a $4.50 increase being applied between the 2016/2017 and 2017/2018 financial years.

Combined organic bins were implemented for the collection of FOGO. The roll out included a 7 litre kitchen caddy and green compostable bags as part of the service. The City of Bunbury offers residents two general waste

bin size options (140L, 240L), three co-mingled recycling bin size options (140L, 240L, 360L) and two organic bin size options (140L, 240L). Organic bins are collected weekly while recycling and general waste bins are collected on a fortnightly basis on alternating weeks.

To create awareness of the three bin system Bunbury developed a logo and rebranded the waste collection trucks prior to roll out to advertise the pending three bin system. A waste education strategy was developed to outline the methods and timeframes for the implementation of the third bin. Methods included face-to-face communication, printed media, websites, social media, phone apps, radio and television, informal workshops and presentations, community events, static displays and signage. Organisational staff found the use of local radio, extremely effective, particularly in regional areas.

During its implementation, organic processing facility staff and City of Bunbury staff monitored contamination to ensure effective use of the system. Prizes for non-contamination were given to residents as incentives. Additionally, The City of Bunbury continued to commission independent audits annually to assess the habits of households. Contamination rates were initially low, 1-5%, during the 6 week roll out period. In the months after this period contamination rates increased to 8-9%. To combat this, bins were regularly checked in areas where contamination was higher. In incidences of minor contamination, a letter was placed in the letter box detailing the contamination issue and how it can be resolved. For high levels of contamination, a similar process was followed however a notice was left on the bin indicating to the driver not to empty the bin, and a refuse collection truck would retrieve it within a few days.

Organic material from kerbside collection is treated at the Banksia Road Organics Processing Facility (BROPF) located in Dardanup and is managed by the WRGC. The BROPF was established to facilitate the new organic collection in these areas. A composting system is used, whereby organic waste is deposited in large windrows and is mixed with mulched green waste high in carbon, to offset the high levels of nitrogen in the material collected. During the process the windrows are also aerated using a forced aeration system and pasteurised. In response to complaints by the community in Dardanup regarding odours generated by composting activity at the facility, Bunbury installed wind monitoring equipment to determine the wind direction during processing to avoid odour impacts.

At the commencement of the new organic system, there was a demand for high grade soil amendments to improve the carbon depleted soils in the surrounding area. As of April 2017, the compost produced at BROPF has been certified as Australian Certified Organic. Additionally, Intuit Earth, a specialist consulting company, endorsed the compost manufactured at the facility to be used by farmers. The compost is primarily used by farmers in the surrounding areas such as Capel and Binningup. Compost was initially trialled on public areas in Bunbury however, this received backlash from the community due to an incident in which glass was dispersed over a public oval in Bunbury as a result of contamination in the organic bins.

6.1.5 Shire of Byron, NSW

The Shire of Byron is an urban regional metropolitan area, 165km south of Brisbane. Byron is considered to have an aging population of 32,790 people. Byron implemented a FOGO system to urban households, upgrading to a three bin system in 2015, the implementation of which was largely community supported. Rural households remained with a two bin service but are offered subsidised compost bins ($47) and worm farms ($70) for sale at the Second Hand Shop at the Byron Resource Recovery Centre. In 2014, the Shire received $735,759 from the NSW Environmental Trust in partnership with the NSW EPA Waste Less Recycle More initiative for the new organics collection system.

Residents in urban regions within Byron receive 240L weekly FOGO collections and fortnightly refuse and recycling collections. Rural residents receive 240L refuse and recycling collections fortnightly but can opt for a 140L refuse bin for a reduced waste collection charge. Residents receiving a FOGO collection were provided

with a kitchen caddy, educational waste information and a 6 month supply of caddy liners. Byron implemented waste education through retrofitting all mobile garbage bins (MGB) with stickers showing a visual representation of what is to be placed in each bin providing consistent and clear education for residents. During the implementation phase, contamination was declared as "low", although no numerical rate was publicly available. The success of the services implementation was attributed to waste education and community driven desire for an organics collection service.

Collected organic waste was originally treated at a facility within Lismore City Council, 56km south, but is now treated within Byron, at Byron Resource Recovery Centre (BRRC) after receiving NSW Government funding. The newly developed Centre produces 3,000 tonnes of compost annually, processing both kerbside and drop-off FOGO waste. BRRC utilises a Mobile Aerated Floor (MAF) system and aims to sell compost to the Byron community and farmers in the near future as an alternative to farmers sourcing compost from Lismore.

Byron is reported to divert 3,000 tonnes of organic waste annually into high quality compost. The FOGO service has enabled them to achieve 63% diversion rate, which is an increase from the 38% diversion achieved with the two bin system.

Figure 6-1: Shire of Byron's bin stickers

6.1.6 Lake Macquarie, NSW

Lake Macquarie City Council implemented a full FOGO recycling program in mid-2018. The planning process for the full roll out spanned eight years following Lake Macquarie's decision to endorse the program. This included extensive community engagement and consultation. A draft waste strategy summary was prepared and published in 2010, outlining the issues and potential options for future waste management across Lake Macquarie and inviting submissions from the community. The document included a FAQs and calendar of consultation events (Lake Macquarie, 2010).

The program was implemented in two phases. Phase 1, in 2013, saw the introduction of the third, green bin accepting garden waste, collected on a fortnightly basis across the LGA. This was followed by further community consultation and a community nappy trial in 2014. In 2016, Lake Macquarie undertook a trial (the Food+Garden=Green trial) with a select number of households for a full FOGO service over a two month period.

The full FOGO recycling program was rolled out in July 2018 including a weekly FOGO service and an alternating fortnightly recycling and refuse service. Starter kits including kitchen caddies, compostable bin liners and promotional materials were delivered to approximately 82,000 households in the two months leading up to commencement of the service.

During the planning stages, the construction of a new organics processing facility was underway. Organic materials collected are now processed at the Lake Macquarie Organics Resource Recovery Facility, which was financed, designed, constructed and is operated by the contractor, Remondis. The facility is a hybrid model with both in-vessel and mobile aerated floor (MAF) systems.

Lake Macquarie experienced a number of challenges during the first few months of implementation including unexpected high seasonal tonnages, contamination issues and waste facility expansion delays. To address contamination issues, Lake Macquarie undertook bin checks and monitoring, offered assistance to households where required and offered prizes for correct use of the bins.

6.1.7 Moira Shire, VIC

In 2014, Moira Shire was the first LGA in the Goulburn Valley region of Victoria to introduce a FOGO collection service. This full program roll out followed a trial in 2012. There was a nine month lead in period from Moira Shire's Council approval to service commencement in order to allow sufficient time for the tender process and budget/rates planning. Moira undertook widespread community education initiatives including media promotion with TV ads and newspaper articles, community meetings and site tours to promote the new service.

The FOGO collection service included a mandatory, fortnightly FOGO collection from 240L bins. There were an estimated 7,800 service initially rolled out across four main towns in the Shire. A kitchen caddy (8L) along with purple, compostable bags and information packs were included in the roll out. Moira Shire was supported in implementing the service with $145,000 funding for some of the roll out materials. Moira worked in partnership with Goulburn Valley Waste and Resource Recovery Group, the collection contractor and processor, which resulted in the service achieving low contamination (0.3%) and high presentation (75%) rates with over 2,000 tonnes of waste, or the equivalent of approximately 2.5kg of waste per bin per fortnight, diverted from landfill in the first year. The service cost an estimated $92 per household (NEWRRG, 2015).

Moira staff worked closely with the collection contractor to monitor services and enforce compliance. The collection vehicles utilised cameras installed at the back of the vehicle. If contaminants were identified from a receptacle, these were removed from the truck into a clear contamination bag left beside the offending bin with a bin sticker used to explain that their services have been suspended until they contact the Council. Repeat offenders were followed up with phone calls. Moira's tips for implementing a FOGO service included engaging service contractors who share your objectives, engaging the community and listening to feedback, engaging the media and enlisting councillors to advocate for the service (NEWRRG, 2015 & MWRRG, 2018).

6.1.8 City of Shellharbour, NSW

The City of Shellharbour is a regional council located 147km south of Sydney with a population of 68,462. The City of Shellharbour set a good precedent for the implementation of its FOGO service with 10 years of planning, consultation and communication campaigns to maximise the likelihood of success of its program. Community surveys were conducted in 2007, a master plan and business case for an organics processing facility was developed over subsequent years and the scheme was officially launched in 2016.

Shellharbour was strategic in their aim to achieve a FOGO collection service with residents firstly receiving a GO service in 2008 introducing the residents to the concept of a three bin system. Currently residents receive a 240L weekly FOGO collection and a 140L/240L refuse and recycling collection on alternate fortnights. Residents within

Shellharbour were considered to be environmentally focused with 88% supporting a reduction in refuse collections to a fortnightly basis and the introduction of a FOGO collection service. Residents were not forced to downsize refuse bins but it was found that a large number did so voluntarily. Residents were provided with a 7L kitchen caddy and user guide. Clear instructions were given not to use bin liners, aiming to avoid contamination of non-biodegradable plastics and instructions were given how to make liners from newspaper.

Shellharbour received $370,866 in funding provided by the NSW Environmental Trust in partnership with EPA NSW Waste Less Recycle More initiative. The implementation of FOGO saw a reduced levy payment to rate payers as FOGO processing costs were cheaper than landfill.

The implementation of the FOGO system had a large focus ensuring the community was educated. Shellharbour did marketing through cinema ads, doorknocking, TV commercials and the local newspaper. Free courses were provided to residents, FOGO education was conducted in schools and residents were invited to community BBQs, all aiming to educate the community on the benefits of FOGO. Shellharbour noted hard to reach target groups (24-35 year males) and specifically targeted this group through marketing during aired cricket games on TV and local news programs. In July 2016, 28 community events held where community members were asked about challenges and benefits they saw in separating food waste. Shellharbour did research, speaking with behavioural and industry experts and other LGAs. Shellharbour ensured they utilised the phrase “FOGO” in all forms of marketing to ensure the community wasn’t deterred by the phrase and it became a part of conversation.

The large marketing and education phase of the implementation was extremely successful evident by a low contamination rate of 0.82% (NSW state average is 6%) during the initial stages of FOGO implementation. Shellharbour staff conducted approximately 400 visual audits whereby audited bins were tagged and as an incentive, residents with low contamination could return the tags to City of Shellharbour to enter draws for prizes and $200 EFTPOS gift card. Shellharbour found through utilising these incentives, the community continued to practice what they had learnt through the education program.

Collected FOGO bins are treated at a newly developed facility operated by Re. Group at Dunmore Waste and Recycling Depot. At this facility, the FOGO material is treated with forced windrow processing in an enclosed facility. The facility’s capital costs totalled $14.6 million. Although FOGO waste is currently treated at Dunmore, in the initial stages of Shellharbour’s GO system, waste was treated at a Soilco facility at Kembla Grange within a neighbouring LGA, Wollongong City Council.

Although the implementation of Shellharbour’s FOGO system involved a long lead in time, Shellharbour’s focus on education and voluntary downsizing of refuse bins ensured community engagement in the process.

6.1.9 Summary

In terms of collection frequency, most local governments reviewed opted for a FOGO collection service collected on a weekly basis. Refuse collections were split between weekly and fortnightly collections. Most LGAs reviewed included kitchen caddies and bin liners as part of the FOGO starter packs during roll out, although Shellharbour opted to avoid using bin liners altogether recommending residents use newspaper or similar materials to line their bins. The inclusion of bin liners in a program roll out should be considered, first and foremost, on whether the organics processor is able to accept them as part of its feedstock. Other considerations include the estimated costs of supplying the bags, whether the caddies and bags will be offered on a mandatory or opt-in basis and the likely service frequency. Liners can assist in facilitating a fortnightly service by containing odours (MWRRG, 2018), which would result in significant collection cost savings. Caddies and liners could be provided to residents on an ‘opt in’ basis to reduce the financial and environmental costs of supplying unwanted materials however, this could increase the risk of contamination from the use of unsuitable liners.

All LGAs reviewed offered a 240L FOGO bin with one offering an optional 140L FOGO in addition to the 240L for low organics generating households (i.e. small or no garden, singles and avid composters). All LGAs reviewed collected refuse in 140L with two offering an optional larger, 240L refuse bin.

The preferred processing method was composting, which included open and enclosed windrow systems along with static fermentation. Of the eight LGAs examined, only one local government (Albury) is looking to adopt anaerobic digestion in the future.

A key message from all of the LGAs reviewed was the importance of effective planning and implementation of comprehensive community engagement and education programs at all stages of the program from planning to post-implementation, in making a success of the FOGO collection service. One LGA adopted specific branding for their service entitling it 'City to Soil', rather than FOGO.

In order for Council to effectively plan for the implementation of a future FOGO collection service, including preferred service frequencies and receptacle size for the general waste bin, Talis would recommend that Council undertakes a compositional waste audit. This will help Council to effectively plan for the expanded green bin service to minimise capacity issues when the service is rolled out. If refuse collections were reduced from weekly to fortnightly collections there could be capacity issues, particularly for residents with young children or ongoing medical issues, that can result in additional refuse generation and resultant bin overflows.

A comparison summary of the key aspects of FOGO services implemented by the LGAs reviewed are shown in Table 6-1. The contract delivery model (In-house or outsourced) summarised in the table refers to the FOGO collections arrangement.

Table 6-1: Comparison of LGAs – Existing FOGO collection services

LGA	Population	Materials accepted (GO/FOGO)	Mandatory or voluntary	Processing	Refuse collection frequency	Refuse Bin Size	Organics Collection frequency	Organics Bin Size	Kitchen caddy supplied	Caddy liners supplied	Contract delivery model (In-house or Outsourced)
Albury, NSW	53,767	FOGO	Mandatory	Aim to do Gore Cover and AD in future	Fortnightly	140L	Weekly	240L	✓	✓	Outsourced
Armidale, NSW	29,449	FOGO	Mandatory	Composting	Weekly	140L	Fortnightly	240L	✓	✓	Hybrid
Barossa, SA	24,808	FOGO	Voluntary, only provided in townships	Composting	Weekly (required by SA law)	140L/240L	Fortnightly	240L	✓	×	Outsourced
Bunbury, WA	41,574	FOGO	Assume mandatory	Composting	Fortnightly	140L/240L	Weekly	140/ 240L	✓	✓	In-house
Byron, NSW	34,574	FOGO	Mandatory	MAF composting	Fortnightly	140L	Weekly	240L	✓	✓	In-house
Lake Macquarie, NSW	197,371	FOGO	Mandatory	Composting (hybrid in-vessel and MAF)	Fortnightly	240L	Weekly	240L	✓	✓	Outsourced
Moira, VIC	29,000	FOGO	Mandatory	Composting (in-vessel)	Weekly	120L	Fortnightly	240L	✓	✓	Outsourced
Shellharbour, NSW	73,101	FOGO	Mandatory	Composting (Re: Group)	Fortnightly	140L	Weekly	240L	✓	×	Outsourced

6.2 Reuse Shops

Reuse Shops are where small quantities of reusable materials such as furniture, electrical goods and other household items are collected, stored, sometimes given minor improvements and presented for sale. These items can then be made available to the community for a small charge. Council does not currently operate any Reuse Shops at either of its waste facilities. However, there was a reuse centre operating at the CWMC previously, which was operated by a private contractor. Feedback from the community suggests that this was a well-regarded service when it was in operation. Council has looked at establishing a new Reuse Shop as part of the redevelopment of the CWMC. However, Talis understands that this was considered by Council through a tender process in 2016 in which it was considered not economically viable.

Presentation is a key factor in the success of a Reuse Shop, with attractive and well organised shops more likely to encourage use and improve the quality of the items received. Reuse Shops generally include a shed for the storage of items that need to be held indoors, as well as a forecourt area for larger, outdoor items. A consistent approach to the layout, signage and receptacles at the Reuse Shop would ensure a greater uptake of the service and increase the reuse of materials that may have been traditionally sent to landfill. This would ultimately assist in increasing the longevity of landfill sites through waste diversion. Additionally, this can provide beneficial community waste education practices whilst it may create a revenue stream for Council.

There are a number of successful Reuse Shops operating, both within the Hunter Region and further afield. There are various models available for operating a Reuse Shop. Some examples and service delivery models utilised by other local governments are shown in Table 6-2.

Table 6-2: Reuse Shops operations at other Councils

Name and LGA	Location	In-house or Outsourced	Operating hours	Further information
Burragan Recycle Shop, Singleton, NSW	Co-located with Community Recycling Centre	In-house	Daily 10:00-14:00	Funds raised through the Recycle Shop assist with Council's disposal of expensive recyclables and problem wastes such as chemicals and e-waste.
Eaglehawk Recycle Shop, City of Greater Bendigo, Vic	Eaglehawk Eco-Centre	Outsourced – Future Employment Opportunities Inc.	Daily (hours vary)	Includes an ERS Bazaar with clothes, shoes and homewares.
Revolve Tip Shop, Shellharbour, NSW	Dunmore Recycling and Waste Disposal Depot	Outsourced – Resource Recovery Australia	Daily 07:30-16:00	Council runs a community initiative with RRA called Tinkerage for workshops and learning. Admittance for a gold coin donation.
Logan Recycling Market, QLD	Adjacent to the Browns Plains Waste and Recycling Facility	In-house	Friday-Monday 10:00-17:00	Donated goods can be dropped off at any of Council's waste facilities. These are then transported to the market. Offers a limited collection service.

Name and LGA	Location	In-house or Outsourced	Operating hours	Further information
Cockburn Reuse Shop, WA	Co-located with Henderson Waste Recovery Park	In-house	Fri, Sat and Sun 08:00-16:00	Users can drop off items for cost of a trailer pass or standard entry fee.
Tuncurry Community Recycling Centre, (The Green Shop), NSW	Co-located on Tuncurry Waste Management Centre	Outsourced – Resource Recovery Australia	Wed – Sun 08:00-16:00	The site includes a Green Community Garden, Green Bikes and the Green Shop and local Men's Shed.
Fossicker's Tip Shop, Albany, WA	Co-located at Hanrahan Road Waste Facility	Outsourced	Daily 08:30-16:15	If users donate items they receive a discount voucher to deposit rubbish at the landfill on the same day.

As can be seen above, a number of other LGAs operate Reuse Shops in-house. However, a common approach is for Councils to partner with a social enterprise. The social enterprise could secure government funding and utilise council land and/or buildings with a peppercorn lease (i.e. nominal rent). The revenue from the Reuse Shop may help to offset operating costs to minimise costs to Council.

Based on some of the feedback from the recent community survey, there appears to be a desire to re-establish a Reuse Shop for the community. This would also provide an opportunity for Council to demonstrate to the community its commitment to sustainable solutions and diverting materials from landfill, while also offering Council another opportunity to engage with and educate the community regarding better practice waste management.

One 2012 case study of Reuse Shops (Social Traders), found that the best business model was to sell items 'as is' without further value being added. The study reported that "*customers want the basic product at the lowest price so that they can value-add themselves*" and the business model was focussed on achieving a high sales volume rather than higher price yields. All Reuse Shops in the case study were profitable and self-funded their operations without relying on financial assistance.

The waste management options relating to Reuse Shops are discussed further in Section 7.1.5.

6.3 Fees and Charges

Even though the majority of customers to the CWMC pay using a voucher, feedback from the community through the recent Don't Waste Your Opinion survey indicated that there is concern that the fees charged at the CWMC are higher than other LGAs. Talis undertook a comparison of Council's fees and charges against neighbouring Maitland, Singleton and Port Stephens Councils and summarised the results in Table 6-3.

Table 6-3: Comparison of Fees and Charges 2018-19 (per tonne unless otherwise specified)

Material	Cessnock	Maitland	Singleton	Port Stephens
	Cost per tonne (where relevant)			
Garden organics – including grass clippings	$140	$189	$236 (uncontaminated) $337 (contaminated)	$195

Material	Cessnock	Maitland	Singleton	Port Stephens
	Cost per tonne (where relevant)			
Oversized trees and stumps	$360	-	-	-
Metal items	$140	No charge (scrap metal, lead acid batteries)	-	No charge
Concrete and bricks – domestic	$140	$248 (uncontaminated only)	$180	$150 (min fee $25)
Concrete and bricks – commercial	$410	$248 (uncontaminated only) $385 (mixed C&D waste)	$182 (C&D clean bricks and concrete)	$150 (not differentiated)
Cardboard and comingled recyclables	$140	No charge (uncontaminated and separated)	No charge	No charge
Mattresses	$32 each	$31 each	$29 each	$30
Electronic waste – domestic	No charge	No charge (up to 17 items)	No charge	No charge
Electronic waste – commercial	$140	$385	-	$850
Motor oil	No charge	No charge	No charge	No charge
Mixed waste	$360	$385	$337	$305
Special waste – including asbestos	$410	$520 (asbestos) $500 (other)	$372 (asbestos)	Not accepted at facility
Tyres (per unit)	$7 to $51	$7.60 to $87	$18	$10 to $15
Deceased animals	$12 to $97 each	$500 (classified as special waste)	$33 (each, small) $101 (per tonne, large)	Unknown

Most fees and charges are similar across the LGAs reviewed. One notable exception is cardboard and comingled recyclables, which attracts no charge in Maitland, Singleton or Port Stephens Council facilities for domestic users but is charged at $140 per tonne at the CWMC. Scrap metal charges were also higher for Council at $140 per tonne, which does not attract a charge at Maitland or Port Stephens waste facilities, no information was available for Singleton Council regarding these charges. Council has this $140 per tonne charge to cover the cost of the waste levy which applies to all material onsite. If a material is not recycled for any reason, it is subsequently landfilled, and Council is required to pay the levy. This ensures that Council is not left with any unpayable liability relating to the landfill levy.

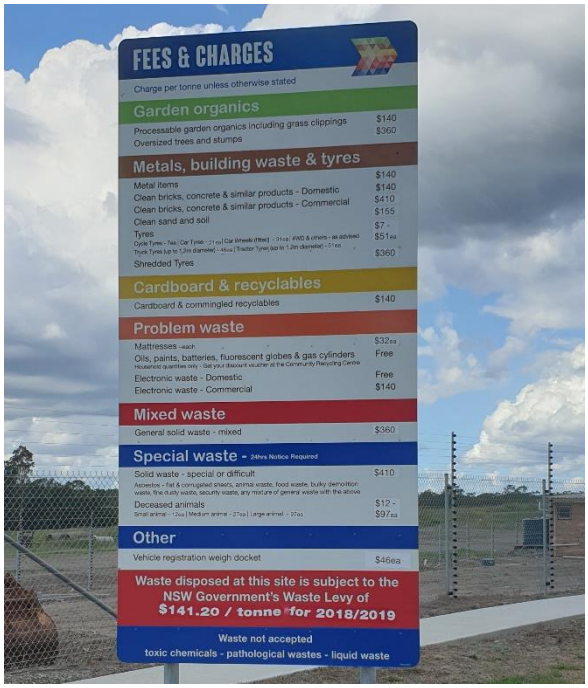


Plate 6-2: Current Fees and Charges sign at CWMC

There appears to be a perception amongst the local community that Council's waste fees are high, including feedback on social media and the recent waste survey. Outlining fees on a 'cost per tonne' basis is a useful means of presenting information in a consistent manner, particularly for commercial waste users (see Plate 6-2). However, most members of the community aren't necessarily aware of what a tonne of materials looks like, nor would they necessarily know the weight of the materials they are wanting to offload.

	DOMESTIC/ COMMERCIAL	BUILDING	GREEN
Waste Bin (240 litre)	$11.00		
Car boot	$19.40		$6.50
Station Wagon/SUV	$19.40		$6.50
Ute/Van	$74.00	$255.00	$28.00
Large Ute/Van	$92.50	$318.75	$35.00
SINGLE AXLE TRAILER UP TO 6 X 4			
Level	$74.00	$255.00	$28.00
Heaped	$92.50	$318.75	$35.00
Full	$111.00	$382.50	$42.00

Plate 6-3: Example of representative charges based on vehicle/trailer size (Shoalhaven City Council)

In order to provide more clarity for domestic users, Council could consider including indicative costs for waste that is brought to the CWMC in a box trailer or car boot, similar to the information provided by Shoalhaven City

Council (Plate 6-3). This could be provided as representative costs with a disclaimer to highlight that actual costs may vary. For example, a box trailer (6m x 4m) would have a capacity of approximately 2.5m^3. If a member of the community brought a box trailer full of garden organics (standard conversion rate for unprocessed garden organics of 0.15 tonnes/m^3), charged at a rate of $140 per tonne they would have approximately 375kg and pay in the region of $50. However, some people could be 'scared off' by the prospect of paying $140 for their load if they're unaware of their capacity. Another way of presenting fees is in cubic metres (m^3). Depending on the material, presenting fees in this way can give the appearance of lower fees. Some examples of this are shown in Table 6-4.

Table 6-4: Council waste Fees and Charges presented as cost per tonne and cost per cubic metre (m^3)

Material	Cessnock current Cost per tonne	Equivalent Cost per m^3	Conversion factor (tonnes per m^3)
Garden organics – including grass clippings	$140	$21	0.15
Scrap metal (ferrous)	$140	$70	0.5
Cardboard	$140	$14	0.1

6.4 Waste Education

Council has a lot of waste resources and education initiatives to encourage behaviour change in relation to resource recovery, waste disposal and combating illegal dumping. These include 'Better not mess with Cessnock' and 'Recycle Right'.

Council's website has a lot of useful information relating to waste and recycling however, it is found across numerous webpages and members of the community may not know where to find the information they are seeking. Some Councils have consolidated all the information on waste materials into a user-friendly 'one stop shop'. Whilst there is currently a PDF on the Council's website providing a limited list of materials and where to dispose of them, a number of local governments have developed a Waste and Recycling 'A to Z' on their website (for example City of Newcastle) where users can search by material type to find out how to dispose of it. In addition, Council could include waste management events, such as drop off days in the Council's 'What's On' calendar.

A number of LGAs have established waste education centres at their waste management facilities and offer tours and classes to the community. In Western Australia, the City of Rockingham has established a Waste Education Centre at its Millar Road Landfill Facility. The City of Rockingham's waste education officer holds regular tours of the facility and provides community members with an overview of what happens to their waste and recycling.

In Queensland, Sunshine Coast Council runs a 'Waste 2 Resource Education Program', which offers free tours of their Recycling and Resource Recovery Centre along with presentations to the community. Brisbane City Council has a 'Towards Zero Waste Centre' co-located at its Rochedale landfill offering information on waste minimisation practices and other sustainability initiatives. Closer to home, the Lake Macquarie Organics Resource Recovery Facility has a purpose-built education centre for community and schools groups. The establishment of an education centre at the CWMC is discussed further in Section 7.1.4.

Along with these services and infrastructure, Council could consider employment of a dedicated waste education officer similar to what other Councils like Newcastle, Lake Macquarie and Port Stephens have done, to facilitate and deliver regional and local waste education initiatives effectively and efficiently for the community.

Potential actions to increase community engagement and waste education include:

- Review and consolidate waste management information on the Council's website into a 'one stop shop' for waste and recycling;
- Employ a dedicated waste education officer;
- Review of existing program and implementation of a dedicated community Waste Education and Behavioural Change Program;
- Establish a waste education centre at the CWMC and consider introducing community waste education centre visits and tours of the CWMC.

These potential actions are discussed further in Section 7.

6.5 Waste Voucher vs Bulk Kerbside collections

Bulk kerbside collections were ceased at the same time as the Council introduced single person side-load waste collection vehicles to its fleet. This change in fleet meant that a bulk kerbside collection service could no longer be provided in-house. In addition, there were concerns that bulk kerbside collections posed occupational, health and safety risks to its workers, increased Council's exposure to public liability issues and the perception that bulky wastes on the kerbside are considered aesthetically unappealing, particularly as the area is frequented by tourists, and does not encourage sustainable waste management practices (Waste Management Strategy, 2014).

In 2015, Council undertook a tender process for an on-call kerbside collection service of bulk waste as part of a regional contract, with Maitland and Singleton Councils. The service was included as a discretionary service along with organics collection and processing services. Upon consideration of the waste voucher system, the tendered costs indicated that the provision of a new bulky waste kerbside collection service would result in a significant cost impact to the domestic waste management charge. As such, Council was given the recommendation not to proceed with the service at that time.

However, some of the issues identified with current system of waste vouchers are:

- Rental properties are reportedly not always receiving waste vouchers from landlords;
- Evidence that some residents were profiting from the sale of their allocated waste vouchers; and
- Some residents have no means of self-hauling their waste.

As waste vouchers are distributed with rates notices each year, some tenants of rental properties are reportedly not receiving waste vouchers from their landlords. According to Council Profile i.d., 26% of the 20,627 households in the LGA are renters. This equates to approximately 5,466, or one in four households, who may not have access to waste vouchers.

In order to combat issues with on-selling of waste vouchers by a small number of the community, Council have included the relevant address onto each waste voucher in the hope that this will reduce this practice.

In addition, some feedback from the community survey suggested that some Council residents do not have any means of self-hauling their waste to the CWMC. This could be as a result of no, or limited, access to a suitable vehicle or trailer or for elderly or disabled residents who are physically unable to load and self-haul their waste. The key messages from the survey are broadly in line with the feedback from the consultation undertaken in 2013, as part of the consultation on the draft Waste Management Strategy 2014-2019. That is, the majority of residents are content with the current service offering but some residents would prefer an on-call bulk kerbside collection.

A comparison of other Councils' bulk waste management was undertaken and is shown in Table 6-5.

Table 6-5: Council Comparison: Waste voucher vs bulk kerbside collection

Local Government	Waste voucher	Bulk kerbside collection	Alternative / Hybrid	Further detail
Cessnock City Council	✓	-	-	4 vouchers per rate paying household per year.
Lake Macquarie City Council	-	✓	-	Six monthly collections.
Maitland City Council	✓	-	-	1 voucher per household per year.
Newcastle City Council	-	-	✓	Hybrid model – Up to two self-haul vouchers (on request) or up to two on-call bulk kerbside collections per year. Ratepayers can also request one of each.
Singleton Council	-	✓		One bulk kerbside collection per year.
Lismore City Council	✓	-	-	On request up to three waste vouchers (households) and two waste vouchers (commercial).
Shoalhaven City Council	-	-	✓	Two waste disposal vouchers issued to ratepayers – option to use voucher for on-call garden organics or bulk waste collections (subsidised fee applies).
City of Albany, WA	-	✓	-	Green waste – one per year. Bulk waste – every two years.
City of Stirling, WA	-	-	✓	One on-demand skip bin per year.

As part of the recent community survey, Council asked respondents if they preferred waste vouchers, bulk kerbside collections, a combination of both or a 'user pays' system. The question also detailed the expected domestic waste charge increase or decrease depending on the option. Based on preliminary results, the most preferred option was to retain four waste vouchers per year, which would not have an effect on the domestic waste charges and is likely to limit the incidents of illegal dumping. The least preferred option was a 'user pays' system.

City of Newcastle's system of providing 'on request' self-haul vouchers allows renters to submit requests directly with the Council through an online form. On presentation at the waste facility, proof of occupancy, (such as a driver's licence) must be provided.

Lismore Council also allows ratepayers, as well as tenants, to request waste vouchers online. Lismore Council also provides free courtesy trailers to individuals and community groups. This would assist members of the community who do not have access to a trailer to haul their own waste. However, it is unclear how Lismore Council manages insurance and liability with regard to trailer usage. Talis would recommend further investigation of how Lismore runs their system if Council wished to progress this further.

Shoalhaven City Council provides ratepayers with two waste disposal vouchers per financial year. The vouchers give the option for residents to drop off their waste to one of Council's facilities or to request an on-demand pick-up for garden waste or bulk waste. There are some materials that are not accepted for the pick-up service

such as building and demolition waste. The pick-up service allows for a reduced volume of waste ($1m^3$) and does attract a subsidised fee.

Based on the councils reviewed for comparison purposes, there is a mix of waste vouchers and bulk kerbside collections along with an alternative, on-demand skip bin system (Stirling) and hybrid models (Newcastle and Shoalhaven), which offer both self-haul and collection services as an alternative.

A number of LGAs have had success with the introduction of on-demand skip bins to replace bulk kerbside collections. The Cessnock community highlighted in the recent survey regarding some people's inability to haul waste to facilities due to limited or no access to a suitable vehicle and/or trailer. Benefits of on-demand skip bins include:

- Considered tidier than verge collections;
- Residents do not need to wait until the next scheduled bulk kerbside collection;
- Residents do not need to haul their own waste, assisting those that do not have suitable vehicles and/or trailers;
- Booking system can be managed online or over the phone; and
- No need to manage the issuing and acceptance of waste vouchers.

However, this may require additional staff to manage a new on-demand skip bin service and Council do not currently have suitable vehicles to drop off and collect the skip bins.

Of the respondents who participated in the recent community survey, there was a slight preference (54%) for vouchers to be mailed to the property address rather than with the rates notice. Alternatively, Council could review the method in which the vouchers are issued. For example, it could consider including the issuing of waste vouchers through a mobile application or via rates notices by email. This could be phased in over a number of years to allow for residents to transition to the new process but could result in cost and resource savings such as reduced postage, paper and staff time. In addition, by ensuring more residents receive the vouchers, it is hoped that fewer residents will feel the need to illegally dump waste.

6.6 Waste Diversion

In 2014, Council reported in its Waste Management Strategy, a waste diversion rate of approximately 27% of kerbside domestic waste from landfill. In 2018, the total waste diversion rate was reported to have increased to 32%. The increase in waste diversion can, at least in part, be attributed to the introduction of the organics collection service. However, this figure does not account for increased diversion of materials through the Container Deposit Scheme, which was introduced in New South Wales in December 2017.

A comparison of waste diversion rates was undertaken with a number of local governments including Singleton, Maitland and Lake Macquarie Councils within the Hunter region, the Shire of Esperance in Western Australia and Murray River Council in southern NSW, shown in Table 6-6.

Table 6-6: Comparison of landfill waste diversion rates

Local Government	Total waste diversion from landfill
Cessnock City Council (2018)	32%
Singleton City Council (2018)	10%
Maitland City Council (2018)	37%
Shire of Esperance, WA (2016)	19%
Murray River Council (2016/17)	41%

Local Government	Total waste diversion from landfill
NSW WARR Strategy Target (All waste types) by 2021	**75%**

The Cessnock Waste Management Strategy 2014-2019 outlines the waste diversion target of 70% of all waste by 2022 in line with the NSW WARR target.

In 2017, Council undertook a waste bin audit, six months after the implementation of the garden organics service. This showed an average of 4kg of food waste per bin per week, which provides an estimate of the potential food waste that could be diverted from landfill with a FOGO collection service. A 2016 Ipsos report prepared on behalf of NSW EPA, stated that "*58% of those who live in areas where FOGO is offered use the service*". On the basis of the estimated food waste generation rate and the projected number of participating households in 2024, which is the expected first year of FOGO collections in Council. Talis undertook some high level calculations to estimate the potential additional waste diversion that could be achieved with the introduction of a FOGO collection service. This is summarised in Table 6-7.

Table 6-7: FOGO collection service waste diversion – 2024 (Expected Year 1 of service)

Projected number of households with service	Participation rate	Estimated number of participating households	Food waste generated per household per week (Year 1)	Estimated tonnes of food waste diverted with FOGO (Year 1)	Waste tonnages*	Waste diverted with FOGO (%)
24,621	58%	14,280	4.3kg	3,185	42,762	7.5%

The following assumptions were applied to the FOGO waste diversion calculations:

- Number of households participating derived from 2018 kerbside collection figures, adjusted annually from projected growth (1.83% per annum).
- Assumes weekly FOGO collections (tonnages could vary slightly with fortnightly collections due to loss of moisture).
- 4kg per bin per week of food waste derived from 2017 Council waste bin audits – adjusted for projected increase in waste generation growth of 1% per annum.
- Participation rate derived from the Ipsos Household Waste and Recycling Research Report (2016).
- Projected total waste tonnages and calculated percentage diversion rate for FOGO assumes no other waste diversion initiatives are in place.
- Assumes all food waste generated is captured and diverted from landfill.

7 Waste Management Options – Identification and Evaluation

The following section outlines a variety of potential waste management options across the various levels of the Waste Management Hierarchy to assist Council in progressing towards a more sustainable waste management system.

A Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis was undertaken to evaluate the resource recovery options following the assessment of support structures. The SWOT analysis includes identification of the environmental, technical, social and financial impacts of each option as well as the associated infrastructure, support services and capital requirements. In addition, Talis has considered the financial and non-financial costs and benefits of each strategic option.

7.1 Avoid and Reduce

7.1.1 Community Waste Education and Behavioural Change Programs

Providing waste education is a key factor in the success of a waste management system and is important in supporting new and existing waste management services. The best performing waste management systems are supported by strong waste education programs. Information provided within a Waste Education Program should cover the following two key questions:

- **Why?** Outlining the benefits of sustainable waste management practices and environmental justification for undertaking such activities; and
- **How?** How the community can participate in waste management services provided.

Waste education usually focusses on initiatives at the top of the Waste Management Hierarchy (Avoid, Reduce, Reuse and Recycle) as well as informing on a particular service provided. For maximum benefit, an education program should be directed not only to local residents but also local businesses and contractors.

Talis understands that Council has been involved with the Hunter Waste Education Group, a joint initiative between Member Councils. There are a number of waste education and behavioural change programs that Council already runs or participates in. As detailed in Council's Waste Management Strategy 2014-2019, there is acknowledgement of the importance of waste education. The strategy identified that "*Council would need 1 to 3 dedicated officers to coordinate waste education, waste contractors and waste minimisation initiatives*.". A waste education officer would provide an additional, dedicated resource to implement waste education and behavioural change programs along with reviewing existing initiatives and resources, such as Council's website for community and commercial waste management information.

In addition, utilising wording that further promotes the preferred levels of the waste hierarchy within the Community Waste Education and Behavioural Change Programs, can consciously remind residents to consider alternative methods to disposal. An example of this approach may be to change the name of the CWMC by removing the words 'waste management' and utilising 'resource recovery' (or similar) instead.

A SWOT of the community waste education and behaviour change program is shown in Table 7-1.

Table 7-1: Community Waste Education and Behavioural Change Programs SWOT

Internal		External	
Strengths	**Weaknesses**	**Opportunities**	**Threats**
• Advance the cultural of recycling and waste minimisation. • Improvement to existing services. • Opportunity to promote initiatives preferred in the Waste Management Hierarchy. • Improved use of waste management services. • Greater ability to promote waste education via a regional approach. • Clean waste stream.	• Achieving full community engagement. • Cost and resources.	• Cooperation with local community groups and businesses. • Community support for larger waste initiatives.	• Lack of community support. • Misinformation lead by special interest groups to confuse.

The estimated costs associated with the implementation of a Community Waste Education and Behavioural Change Programs are shown below.

Capital Costs		Operational Cost	Total Annualised Cost	
Low	**High**		**Low**	**High**
-	-	$70,000	**$70,000**	**$70,000**

Notes: Operational cost includes resources to implement education initiatives. Staff resources not included (see 7.1.3). These costs could include activities such as a compositional waste audit or bin monitoring initiatives.

7.1.2 Commercial Waste Minimisation Practices

In Council's 2014-2019 Waste Management Strategy it was acknowledged that "*there are still gaps within Council's waste education programs, for example, the lack of initiatives to encourage waste diversion in the C&I and C&D sectors..*".

Council already undertakes some engagement with local businesses including Wise on Waste funded through NSW EPA's Waste Less Recycle More Initiative. This project focusses on food related businesses and helping to reduce food waste and increase recycling. Council could also encourage businesses to get involved with EPA NSW's Bin Trim program to compliment work already undertake with local food businesses. This could be promoted on Council's website at little to no cost.

Providing information to commercial business operators to improve their waste management practices should be undertaken to:

- Educate businesses to be smarter with their operations, including potential cost savings, in relation to waste management;

- Inform businesses of the waste management services available; and
- Obtain support for larger waste management initiatives.

Council could facilitate greater communication with the local commercial sector, with focus on practices from the upper tiers of the Waste Management Hierarchy. This should include promoting the financial benefits of practices such as reducing oversupply, reuse of materials and separating recyclable waste streams to reduce disposal costs. Council may wish to revisit incorporating these activities into the role of a dedicated Waste Education Officer. The SWOT for commercial waste minimisation practices is outlined in Table 7-2.

Table 7-2: Commercial Waste Minimisation Practices SWOT

Internal		External	
Strengths	**Weaknesses**	**Opportunities**	**Threats**
• Engagement with local businesses. • Opportunity to promote initiatives preferred in the Waste Management Hierarchy. • Targets a significant proportion of the waste stream.	• Cost and resources. • Getting buy-in from the industry sectors.	• Influencing consumer behaviour. • Increased availability of recycled materials for Council activities. • Potential for new business for Council.	• Impacts on charity organisations and small businesses currently involved in resource recovery.

The estimated costs associated with the implementation of a Commercial Waste Minimisation Practices are shown below.

Capital Costs		Operational Cost	Total Annualised Cost	
Low	**High**		**Low**	**High**
-	-	$30,000	**$30,000**	**$30,000**

Notes: Operational cost includes resources to implement education initiatives. Staff resources not included (see 7.1.3)

7.1.3 Waste Education Officer

As previously outlined, providing waste education is a key factor in the success of a waste management system. Whilst waste education can be delivered through existing staff resources, if workloads allow, a Waste Education Officer would provide the means for Council to deliver an integrated waste education program and develop closer partnerships between industry, towns and communities.

The Waste Education Officer would be responsible for gaining community acceptance and support for new waste management services to assist Council in moving towards a more sustainable waste management direction. In particular, the Waste Education Officer will manage the delivery of the various waste education and behaviour change programs. It is important that engagement by the Waste Education Officer with the community is undertaken early to increase the chances of success for the preferred strategic options and increasing waste diversion from landfill. It is difficult to quantify the benefits of waste education without undertaking activities such as waste audits or bin inspections in order to gather data to measure its success (Audit Office of NSW, 2019).

Consideration should be given to continuing to cooperate with surrounding Member Councils to implement a coordinated regional waste education program, through the Hunter Waste Education Group, or a similar body. This could include using common messages, resources and floating Waste Education Officers if budgeting will not allow for a full-time waste education at the Council. The Waste Education Officer SWOT is shown in Table 7-3.

Table 7-3: Waste Education Officer SWOT

Internal		External	
Strengths	**Weaknesses**	**Opportunities**	**Threats**
• Involvement with community groups, local businesses and other LGAs. • Consistent regional approach to ensure that services are efficient and effective. • Promotes new Strategic Options. • Promote the Waste Management Hierarchy. • Ability to target all waste streams. • One coordinated approach with shared resources (if regional).	• Cost and resources. • Spreading resources evenly amongst the LGA.	• Influencing consumer behaviour. • Involvement with local businesses and other community groups. • Provide resources to support other Strategic Options. • Improve community support for Strategic Options.	• Potential for mixed messages, due to different waste systems. • Community recognition and interest. • Failure to adequately service all communities across the region.

Cost estimates associated with a Waste Education Officer are shown below.

Capital Costs		Operational Cost	Total Annualised Cost	
Low	**High**		**Low**	**High**
-	-	$105,000	**$105,000**	**$105,000**

Notes: Operational cost includes one Waste Education Officer who is responsible for implementing education program, commercial initiatives to reduce waste to landfill. Costs are based on 1 Full-Time Equivalent (FTE) staff member at $75,000 per annum plus 40% overheads. Non-labour waste education related costs such as advertising and materials would be covered under other waste management options.

7.1.4 Education Centre

As outlined earlier, waste education is a key element of a successful waste management system. The provision of waste education will help to support the waste services offered across Council and the CWMC and detail why and how the community should interact with the various services. The best performing waste management systems are supported by strong waste education programs. Waste education usually focuses on initiatives at the top of the Waste Management Hierarchy (avoid, reduce reuse and recycle) as well as creating awareness on the particular services provided.

An education centre could be constructed at the CWMC to assist with improving community awareness of sustainable waste management practices as well as educating the community on the use of the facility. The education centre could include features such as a modern classroom with displays, IT equipment for presentations and parking for visitors. In conjunction with this, Council could consider introducing tours of the CWMC for schools and community groups and with providing a space for community groups to hire for events such as workshops. The education centre SWOT is outlined in Table 7-4.

Table 7-4: Education Centre SWOT

Internal		External	
Strengths	**Weaknesses**	**Opportunities**	**Threats**
• Involvement with community, local businesses and other LGAs. • Promote the Waste Management Hierarchy. • Ability to target all waste streams. • Potential small revenue stream (venue hire).	• Cost and resources. • Spreading resources evenly amongst the LGA.	• Influencing community behaviour through education. • Involvement with local schools, businesses and other community groups. • Improve community support for Council services. • Provide a facility for community groups to use.	• Community interest and use.

Cost estimates associated with an Education Centre are shown below.

Capital Costs		Operational Cost	Total Annualised Cost	
Low	**High**		**Low**	**High**
$100,000	$200,000	$10,000	**$15,000**	**$20,000**

Notes: Capital cost estimates are based on market rates for a small education centre (100m^2), capital costs may vary depending on Council's requirements. Operational costs do not cover staff costs.

7.1.5 Commercial waste management

In terms of commercial operations in the LGA, Council could encourage business recycling through NSW EPA's Bin Trim to complement the work they already undertake with local food businesses through the Wise on Waste program. This could be achieved by simply promoting the Bin Trim program on Council's website. Council's 2014-2019 waste strategy stated, "*there are still gaps within Council's waste education programs, for example, the lack of initiatives to encourage waste diversion in the C&I and C&D sectors. Therefore, Council strives to develop its current education programs further in order to address current shortcomings and to continue to encourage a sense of ownership throughout the community*" (Waste Management Strategy, 2014).

The Responsible Cafés initiative encourages cafes and restaurants to reduce waste generated by takeaway coffee cups/lids. This is coupled with offering customers a discount with the use of reusable cups, promoting responsible decisions and sustainable practices. There are currently over 4,700 cafes participating in the program Australia-wide including a small number of cafes in Cessnock and Kurri Kurri. Again, Council could

promote the Responsible Cafés initiative on its website and through social media to demonstrate its support for sustainable initiatives.

7.2 Reuse

7.2.1 Reuse Shop

Reuse Shops are designed to facilitate the collection and storage of small quantities of reusable materials for re-sale. Items may be given minor improvement prior to sale. These items are generally available to the community for free or a minimal fee. In terms of infrastructure, reuse shops generally include a shed for the storage of items that need to be held indoors, as well as a forecourt area for larger, outdoor items and drop-off zone. There are a number of potential reuse shop options available to Council including:

- Reuse Shop located at the CWMC;
- Reuse drop off area located at CWMC; and
- No Council involvement. Charities manage reuse sales.

7.2.1.1 Reuse Shop located at the CWMC

Council does not currently operate a Reuse Shop at either of its waste management facilities. Historically, Council had a Reuse Shop at its CWMC. Talis has recently designed a number of Community Reuse and Recycling Centres, which include Reuse Shops as part of modern integrated waste management facilities.

A new Reuse Shop at the CWMC would provide an expansion of existing services offered by Council and encourage increased waste diversion by the community. Its location at the CWMC would allow for convenient drop-off of items for reuse, higher up the waste hierarchy, prior to recycling and disposal options. Talis understands that Council had originally planned to include a Reuse Shop as part of its new Community Recycling Centre.

However, the introduction of an additional service would require capital investment by Council. This would include construction of the Reuse Shop at the CWMC and ongoing operational costs. The operation of the Reuse Shop at the CWMC may be undertaken wholly or in part by community groups. This would increase support and awareness of the facility as well as reduce operational costs to Council. The Reuse Shop at CWMC SWOT is shown in Table 7-5.

Table 7-5: Reuse Shop at CWMC SWOT

Internal		External	
Strengths	**Weaknesses**	**Opportunities**	**Threats**
• Local employment opportunities. • Expansion of existing services. • Direct community involvement. • Opportunity to promote initiatives preferred in the Waste Management Hierarchy. • Diversion of waste from landfill.	• Capital and operational costs. • Maintaining standards for items and presentation. • Training requirements from staff (if in-house).	• Cooperation with local charities and businesses. • Employment and training opportunities for community groups. • Revenue generating.	• Occupational health and safety risks. • Impact on existing charities and businesses. • Safety standards for reused goods.

Internal		External	
• Colocation with waste management facility ('one stop shop').			

The estimated costs to re-establish a Reuse Shop at the CWMC are shown below.

Capital Costs		Operational Cost	Total Annualised Cost	
Low	High		Low	High
$200,000	$500,000	$300,000	**$310,000**	**$325,000**

Notes: Capital costs are based on market rates but would vary depending on the size and type of infrastructure required. Operational costs based on information provided by Council.

7.2.1.2 Reuse Drop-off area at CWMC

Council could facilitate the drop-off of reusable goods at the CWMC for regular collection by charitable organisations. The establishment of a drop-off area at the CWMC would encourage the community to consider whether items are suitable for reuse and on-selling by other parties.

This option would require less capital investment and ongoing operational costs than establishing a reuse shop at the CWMC but would still encourage waste diversion by offering a drop-off area for reusable materials. It would need to be managed in collaboration with charitable organisations to ensure their buy-in to such a service and that materials being dropped off are suitable for on-selling to avoid Council being liable for additional disposal costs. The Reuse Drop off area at CWMC SWOT is shown in Table 7-6.

Table 7-6: Reuse Drop off area at CWMC SWOT

Internal		External	
Strengths	Weaknesses	Opportunities	Threats
• Local employment opportunities. • Encourage diversion of waste from landfill. • Drop off located at waste management facility.	• Capital costs required for drop off area and potential operational costs. • Use of internal resources to manage drop off area.	• Cooperation with local charities and businesses. • Employment and training opportunities for community groups. • Benefit existing charities and community groups. • Revenue generating.	• Occupational health and safety risks. • Safety standards for reused goods. • Potential for misuse of service by the community by dropping off unsuitable items.

Cost estimates associated with a Reuse Drop off area at the CWMC are shown below.

Capital Costs		Operational Cost	Total Annualised Cost	
Low	High		Low	High
$25,000	$50,000	$0	**$1,250**	**$2,500**

Notes: A reuse drop off area would be envisaged to entail some hard standing along with the use of a sea container for storage of suitable goods prior to pick up by charities. Staff costs not included as assumed to be covered by existing staff at the CWMC.

7.2.1.3 No Council involvement. Charities manage reuse sales

Council could opt to leave the management of unwanted households' items to charities. This would require little involvement by Council, other than promoting charities' services on their website or other appropriate media. The Charities manage reuse sales SWOT is shown in Table 7-7.

Table 7-7: Charities manage reuse sales SWOT

Internal		External	
Strengths	**Weaknesses**	**Opportunities**	**Threats**
• No direct cost to Council for service.	• Limited ability for Council to influence reuse initiatives. • Relies on charities to appropriately manage materials.	• Employment and training opportunities for community groups. • Benefit existing charities and community groups.	• Potential for misuse of service by the community. • Increase in illegal dumping and associated clean-up costs for Council.

A summary of table of the reuse options are shown below in Table 7-8.

Table 7-8: Summary Table of Reuse options

Reuse Option	Council's infrastructure requirement	Service Delivery Model	Opportunity for revenue	Encourages waste minimisation?
Reuse Shop at CWMC	Reuse Shop infrastructure including shed and hardstand.	In-house or outsourced	Yes	Yes
Drop off area at CWMC	Shed and laydown area.	In-house (oversight)	No	Yes
No Council involvement. Charities manage reuse sales	None.	N/A	No	No / Not directly.

7.2.2 Free Trade websites

The Free Trade website is a tool for the public and businesses which promotes the reuse of household and commercial materials. The initiative was established in Dublin in 2006 and has since expanded to cover all of Ireland (http://www.freetradeireland.ie/). Users of the website are able to advertise used goods (such as household items, furniture and construction materials) for others to collect and reuse free of charge. In addition, the website could be used to advertise items held at the Reuse Shop, if reinstated.

Gumtree.com.au and Freecycle.org provides the same ability at a national scale. These websites are utilised as a medium to buy, swap, sell and give away reusable items. However, a regional approach by HJOC to develop and promote the use of a Free Trade Website, would facilitate the pooling of all these reusable items into one user friendly website. In doing so, Council would increase the minimisation and reuse of waste materials. In particular, the website would assist in providing the HJOC with credits towards the landfill diversion targets for the MSW, C&I and C&D sectors as outlined within the WARR Strategy 2014-2021. The website may also be integrated with the Reuse Shops within the region, enabling the additional online sale of items. This is convenient for the drop-off and collection locations for sales. Council could investigate and promote the use of existing dedicated Facebook pages, which facilitate the exchange of reusable materials within Council or the wider region. This includes a Local Buy Swap Sell Facebook page, which operates in a similar manner to Gumtree. In addition, the Buy Nothing Project is a social initiative, delivered through Facebook, to promote reuse of unwanted items working on a gift economy (i.e. no money exchanged) at the local scale. Buy Nothing encourages giving, sharing and lending, which encourages a sense of community. Buy Nothing has 100s of active local communities across 15 countries worldwide. At the time of writing, there did not appear to be a local Buy Nothing Cessnock Group in existence, with the closest group in Lake Macquarie. Council could encourage a local community group or individual volunteers to start a Cessnock Group. The Free Trade SWOT is shown in Table 7-9.

Table 7-9: Free Trade SWOT

Internal		External	
Strengths	**Weaknesses**	**Opportunities**	**Threats**
• Low cost. • Promotes reuse of materials and preferred levels of the waste hierarchy. • Attracts younger members of the community to participate. • Little to no space requirements.	• Small proportion of waste stream targeted. • Similar existing systems.	• Links other Strategic Options. • Local business opportunities and community engagement.	• Lack of community use/participation. • Impact charities and similar organisations.

The estimated costs to support the various reuse websites active in the LGA and wider region are shown below.

Capital Costs		Operational Cost	Total Annualised Cost	
Low	**High**		**Low**	**High**
10,000	$15,000	$5,000	**$6,000**	**$6,500**

7.2.3 Internal Waste Management Practices – waste reuse

There are potential opportunities to reuse or recycle materials that are brought to the CWMC from other waste generators on internal works and infrastructure projects and hence reduce the volumes of materials going to landfill (depending on their source and composition). The NSW Government's Roads and Maritime Services (RMS) produced a technical guide on managing road and maintenance wastes in 2016 (RMS, 2016). The recommended principles for waste manage of these wastes is reproduced in Table 7-10 below.

Table 7-10: Waste Management Principles for road and maintenance waste

Waste Management principle	Description
Waste Avoidance	Take action to firstly avoid the generation of waste and to be more efficient in its use of resources. If unable to avoid generating waste, then reduce the amount of waste generated and reduce the toxicity or potential harm associated with its generation and management.
Resource Recovery	Maximise the reuse, reprocessing, recycling and recovery of energy from materials.
Disposal	Disposal is the least desirable option and must be carefully handled to minimise negative environmental outcomes.

The waste management principles outlined in the RMS document are consistent with the Waste Management Hierarchy.

Some of the waste materials generated as part of the Works and Infrastructure team's services could be utilised on future projects if managed appropriately. This is particularly relevant for road construction waste. The benefit of reusing these materials is a reduction in materials being disposed of to landfill and the associated reduced landfill levy costs along with a reduction in the need to source virgin materials for future projects and the associated costs. One method for managing these materials is source separation at the road construction project site into clean waste streams such as concrete, clean soil and vegetation. These materials can then be hauled to Council's works depot, or the CWMC, in different loads.

Alternatively, these materials can be hauled as a mixed load then processed using screening equipment to separate soil from vegetation or other processing equipment, such as crushers for concrete. This can generally be achieved with a relatively low capital cost outlay. Processing plant can be purchased or hired, depending on its likely utilisation. Once processed, the materials can be stockpiled for future use. Vegetation, if clean, could be incorporated into garden organics stockpiles for processing, soil could be used as road subbase and crushed concrete can be utilised as road base.

In relation to street sweeping and drain clean up waste, due to the contamination of these materials with hydrocarbons, plastics and other contaminants, these materials would have limited reuse opportunities at a local scale. However, the waste collected, by its nature, generally tends to have a high water content. The waste collected could be unloaded onto a purpose-built concrete pad at Council's depot or the CWMC (if its licence allows) for drying out prior to disposal. This would significantly reduce the moisture content and, therefore, weight of these materials. The pad would need a sump or could be connected to the leachate management system, if the CWMC were able to be utilised, to ensure that any contaminated run off is captured and managed appropriately. Once dried, the material could also be screened to remove large materials prior to disposal. Downer established a Detritus Processing Facility in Rosehill in 2018 to process street sweeping and other detritus from Sydney metropolitan councils. The facility utilises the processed materials in road base, other building materials and compost (Downer, 2018). Downer are reportedly successfully disposing of the leaf litter component of this waste to a FOGO facility.

The NSW EPA's Environmental Guidelines: Solid Waste Landfills (2016) allows provision for alternative daily cover materials with EPA approval. More information would be needed to understand the current Council processes and the composition of these materials before providing specific recommendations in this regard.

A number of LGAs have successfully undertaken in-situ stabilisation of local roads as part of road upgrade works. Not only does this result in the reduction of waste by using existing materials, there are generally lower capital costs and a significant reduction in the time required for projects to be completed, resulting in less disruption to road users and local community.

The internal waste practices – waste reuse SWOT is shown in Table 7-11.Table 7-11: Internal Waste Practices – Waste reuse SWOT

Internal		External	
Strengths	**Weaknesses**	**Opportunities**	**Threats**
• Reduced capital and operational costs • Improved environmental outcomes (reduced leachate and greenhouse gas generation). • Increases diversion of organic materials from landfill. • Conservation of landfill void space.	• Education and training requirements for in-house staff. • Internal opposition to change of current practices. • Lack of designated storage/stockpiling area. • Insufficient materials available to meet requirements. • Existing contract commitments/ restrictions in use of products in-house.	• Promotes awareness and education on sustainable waste management practices. • Change behaviours within Council.	• Legislative/policy restrictions in ability to avoid/reduce waste. • Contamination risks.

7.3 Recycling

7.3.1 FOGO Collection Service

As discussed earlier in the report, Council has already implemented a kerbside garden organics waste collection service. These materials are collected and processed by a contractor, as part of a joint contract with Singleton and Maitland Councils. This contract has provision for the introduction of a weekly FOGO service to be introduced in 2024.

The introduction of a FOGO Collection Service would bring Council in line with 'best practice' organics recovery. It would result in an increase in the diversion of organic materials from landfill, which would assist Council in working towards its own waste diversion target of 70% by 2022 (Cessnock Waste Management Strategy 2014-2019) along with Regional and State waste diversion targets – 75% of all waste diverted from landfill by 2021.

In addition, the reduction in the overall volume of organic materials being disposed of into landfill would result in improved environmental outcomes for Council including reduced leachate generation along with reduced greenhouse gas generation from decomposing organic materials. An overall reduction in the volume of materials being landfilled will conserve landfill void space. The consumption of void space at the landfill would be expected to slow, extending the life of the landfill. This would also provide financial benefits to Council through reduced disposal costs, reduced leachate management costs and the costs associated with the construction of new landfill cells.

However, the establishment of any additional waste collection service would require further investment from Council in terms of implementation of the service and ongoing operational costs. However, as Council has already introduced garden organics collections, these costs would not be anticipated to be as substantial as an entirely new service. A key aspect of a successful FOGO Collection Service is a comprehensive waste education program, which would require additional staff resources along with the costs of implementing a waste education

and behaviour change program to its community to encourage improved waste management practices. As Council would be working with other neighbouring Councils in the future implementation of this service, there would be the potential for efficiencies in developing waste education materials and use of shared staff resources.

There are risks in introducing a new waste service including a lack of community participation and associated risks of contamination of organic materials. As discussed above, these risks can be reduced by implementing a comprehensive waste education and behaviour change program. The FOGO Collection Service SWOT is shown in Table 7-12.

Table 7-12: FOGO Collection Service SWOT

Internal		External	
Strengths	**Weaknesses**	**Opportunities**	**Threats**
• Considered best practice organics recovery. • Improved environmental outcomes (reduced leachate and greenhouse gas generation). • Increases diversion of organic materials from landfill (target 75% waste diversion by 2021). • Conservation of landfill void space. • Potential for local employment opportunities. • Regional contract enabling collaboration.	• Cost of service implementation. • Requires waste education and behaviour change initiatives (costs and Council resources). • Potential ongoing costs associated with compostable bin liners.	• Promotes awareness and education on sustainable waste management practices.	• Lack of community participation. • Contamination risks.

7.3.2 Internal Waste Management Practices – waste recycling

There are opportunities for Council to improve internal waste management practices, including road construction projects, drain clean up and street sweeping waste with the aim of reducing waste generated from these activities. The NSW State Government encourages waste avoidance for road and maintenance waste, followed by resource recovery and, finally, disposal.

There are a number of councils that already reuse recycled construction and demolition waste for their road base rather than using virgin products. For example, Tamworth Regional Council stockpile clean concrete and process this material for use as road base and drainage gravel. Tamworth Regional Council also sells this and other excess materials, such as bedding sand and decorative gravel back to the community. The Institute of Public Works Engineering Australia (IPWEA)'s NSW Division published an updated Specification for Supply of Recycled Material for Pavements, Earthworks and Drainage in 2010. The document aimed to "*encourage local government professionals … to use recycled concrete, brick and asphalt materials".* Crushed concrete is

considered to be a good road base, although good design principles need to be applied. In fact, a 2010 study found that recycled road base is "*at least equivalent to virgin quarried road-base if not better*" (WALGA, 2010). A number of other materials have been utilised in road construction projects including printer toner and soft plastics, along with glass fines.

The NSW EPA has a number of resource recovery exemptions under Part 9 of the *Protection of the Environment Operations (Waste) Regulation 2014*, including an exemption for excavated public road material (2014). The benefit of maximising the use of recycled materials includes conservation of natural resources, reduced materials sent to landfill, potential cost savings from using recycled materials and overall improved environmental outcomes (IPWEA, 2010).

In relation to road construction upgrade projects, a number of LGAs and state government authorities have undertaken in-situ stabilisation of roads. Not only does this result in the reduction of waste by using existing materials, there are generally lower capital costs and a significant reduction in the time for projects to be completed, resulting in less disruption to road users and the local community. In-situ stabilisation is defined as "the process of stabilising natural earth to strengthen and allow it to function as a pavement layer" (SBEnrc, 2013).

The internal waste practices – waste material recycling SWOT is shown in Table 7-13.

Table 7-13: Internal Waste Practices– Waste material recycling SWOT

Internal		External	
Strengths	**Weaknesses**	**Opportunities**	**Threats**
• Reduced capital and operational costs. • Opportunity to promote initiatives preferred in the Waste Management Hierarchy. • Diversion of waste from landfill. • Improved environmental outcomes (reduced leachate and greenhouse gas generation). • Reduced landfill disposal costs.	• Education and training requirements for in-house staff. • Internal opposition to change of current practices. • Lack of designated storage/stockpiling area. • Insufficient materials available to meet requirements. • Existing contract commitments/ restrictions in use of products in-house.	• Benefits to road users and local community due to shorter road closures/disruptions. • Promotes awareness and education on Council's sustainable waste management practices.	• Legislative/policy restrictions in ability to avoid/reduce waste.

7.3.3 Public Place Recycling

The primary use of public bins is waste collection however, their public presence allows for the dual purpose of promotion and education of sustainable waste management. It is best practice for public recycling bins to accept the same materials as is collected in kerbside recycling in order to create cleaner streams and standardise recycling practices.

Public bins can be established permanently throughout the Council or temporarily for "special events" such as fetes, festivals and sporting events to manage the generation of public waste. Council advised that their contractor has stopped providing recyclable bins for special events as the containers and bins get stolen. For special events, recycling bins may need to be modified to account for the Return and Earn scheme such as being secured or provide larger receptacles such as lidded skip bins. For best results the *EPA Better Practice Guide for Public Place Recycling (2005)* suggests that MGBs are located in clear view at:

- Parks;
- Shopping centres;
- Beaches;
- Walkways and high traffic areas;
- Near entrances and exits to public infrastructure and facilities;
- Near tables/picnic areas;
- Toilet Ablution blocks; and
- Carparks.

Ideally, the public place recycling bin would be paired with a general waste bin and be accessible from all sides of the bin to limit contamination risks and increase visibility. It is advised that public MGBs are secured, locked or placed within a specialised housing or cabinet. The external housing is beneficial for aesthetics, waste education and security of the MGBs. The most preferred application of public place recycling involves integration across the waste hierarchy with the Waste Education Officer providing education to the public in the importance of their use which can assist in reducing litter within the Council.

The Town of Cambridge in Perth's western suburbs installed a number of public place dual bin enclosures (see Plate 7-1) throughout its jurisdiction. In conjunction with this, it ran a public education campaign, Maximum Recovery, which aimed to engage the community through the delivery of simple, clever messages demonstrating how easy it is to recycle.

Plate 7-1: Town of Cambridge public place 2-bin configuration

The key aspects of best practice public place recycling are:

- Development and implementation of a waste education campaign to promote initiative;
- Clear labelling and signage consistent with wider waste management system, ideally consistent with Australian Standard bin colours;
- Well planned placement of bins in locations that will maximise the amount of waste and recyclables captured;
- Placement of public place bins in 2 or 3 bin configurations, ideally side by side with both general waste and recyclables receptacles; and

- Bin enclosures should be standardised as much as possible across a council so that standard bin keys can be used. This can also assist with consistency of messaging and recognition.

The public place recycling SWOT is shown in Table 7-14.

Table 7-14: Public Place Recycling SWOT

Internal		External	
Strengths	**Weaknesses**	**Opportunities**	**Threats**
• Improved waste management services. • Low cost. • Promotes preferred levels of the Waste Management Hierarchy. • Simple operation.	• Unable to achieve full community engagement. • Not feasible to service all areas of the community. • Contamination issues.	• Cooperation of local community and businesses. • Community engagement. • Influence consumer behaviour. • Free service.	• Lack of community support. • Disruption due to contamination. • Fails to service all areas.

The estimated costs to implement wider public place recycling is shown below.

Capital Costs		Operational Cost	Total Annualised Cost	
Low	**High**		**Low**	**High**
$30,000	$50,000	$2,340	**$5,340**	**$7,340**

Notes: Assumes a capital cost outlay of $1500/unit (low) to $2,500/unit (high) initially for a public place recycling trial with 20 receptacles including supply and installation. Operational costs assume a lift rate of $4.50/lift collected fortnightly. Assume collections are undertaken by contractor and that processing costs are factored into the lift rate.

7.3.4 On-demand Bulk Kerbside Collections for Elderly and/or Disabled Residents

Traditionally, bulk kerbside collections are a scheduled service whereby Councils provide collections at set time periods through the year to relevant residents. This approach can be subject to abuse, which results in unsightly piles of waste, subsequent scavenging, collection delays and significant collection costs.

In recent years, on-demand services have become increasingly popular amongst local governments with residents being allocated a maximum number of verge collections annually. Providing an on-demand service results in structured composition of waste expelled as residents have placed thought into what waste they will get rid of. An on-demand collection service for the elderly and/or disabled residents can provide those within the community who cannot typically access one of Council's waste management facilities, with a service to remove unwanted recyclables and waste at any time during the year.

As part of the establishment of an on-demand service, Council would need to consider the creation of guidelines to outline which eligible residents can participate in the collections and what is classified as acceptable forms of recyclables and waste. Residual waste collection may be restricted in volume whilst recyclables may be unlimited. Typically, there are three options to be considered for material presentation:

- loose unlimited volume;
- loose volume limit (often $3m^3$); and
- skip bins (often $3m^3$).

A summary of the advantages and disadvantages of bulk kerbside collection options are shown in Table 7-15 and the SWOT is shown in Table 7-16.

Table 7-15: Advantages and disadvantages of bulk kerbside collection options

Loose unlimited volume	Loose volume limit (often 3m^3)	Skip bins (often 3m^3)
Advantages		
• Convenient as no skip bin ordering • Convenient for elderly or disabled used as no overhead lifting required • Source separation	• Convenient as no skip bin ordering. • Convenient for elderly or disabled used as no overhead lifting required. • Less safety and environmental concern.	• Restricts volume of materials disposed. • Suitable recovery at transfer station as waste not compacted
Disadvantages		
• May attract illegal dumping. • Visually unappealing. • Safety risk and visual obstruction. • Environmental risk.	• Visually unappealing. • Safety risk and visual obstruction.	• Composition not known until transfer station. • Little flexibility of collection vehicle type. • High capital investment. • Increased contamination risk. • Council outlay cost for provision of skips, collection, waste sorting.

Table information derived from City of Swan Council's Review of Bulk Verge Collection Services (July 2016).

Table 7-16: On-demand bulk kerb/verge collections SWOT

Internal		External	
Strengths	**Weaknesses**	**Opportunities**	**Threats**
• Improved waste management services. • Relatively low capital / operational cost to provide service. • Simple operation.	• Visually unappealing. • Unable to achieve full community engagement. • Lack of existing capacity (fleet/staff).	• Community engagement. • Influences consumer behaviour. • Free service.	• Distribution of process due to contamination. • External contractors could offer competing service.

The estimated costs to implement on-demand bulk kerbside collections are shown below.

Capital Costs		Operational Cost	Total Annualised Cost	
Low	High		Low	High
$46,000	$69,000	$81,691	**$83,991**	**$85,141**

Notes: *Assumes the purchase of a small tipper truck (e.g. Hyundai Mighty EX6 Tipper). Elderly and Disabled population based on profile id (ABS) service age groups numbers in 2016 and Need for assistance with core activities in 2016. Percentage of elderly and disabled people that would use an on-demand service assumed to be 20% for each. Disabled population excludes elderly population who are already captured under age*

Capital Costs		Operational Cost	Total Annualised Cost	
Low	High		Low	High

group. Projections have the annual average growth rate of 1.83% p.a. applied. Projections do not take account of increase in proportion of population that will be classified as elderly over 20 years. Operational costs include 45 minutes time allowance per collection for two staff members. Staff rate per hour is $40 per hour adjusted annually for inflation (2%) and administration costs - $10 per service request. Disposal costs not included.

7.3.5 Cardboard Baler

Figure 7-1: Cardboard Baler example

Council currently accept cardboard waste at the CWMC through a split level raised drop off into a hook lift bin. This can result in contamination of cardboard with other materials and inefficient storage of the cardboard, no compaction resulting in low volumes of materials in the bins. Council could implement improvements to manage the cardboard material including a cage for cardboard acceptance, increased staff training, ensuring visual inspection of materials being dropped off. Any changes implemented should endeavour to avoid double handling of the materials, where feasible. Council could investigate the procurement of a cardboard compactor/baler to efficiently process and store the materials (see Figure 7-1). Due to the relatively low volumes of cardboard accepted (70 tonnes in 2018), a small unit, such as the Mil-tek 2509, would be considered the most suitable size. The costs of such equipment would vary depending on Council's operational requirements such as anticipated frequency of use and the need for a compressor. If Council purchased a cardboard baler and an EPS Compactor, efficiencies could be realised in using the same compressor for both units.

If Council decided to purchase a cardboard baler and were monitoring material acceptance to ensure a clean stream of materials, it could investigate selling the product direct to market rather than using a contractor and subsequently reducing the current cost to recycle cardboard ($800/tonne) with a view to making the management of cardboard cost neutral. The Cardboard baler SWOT is outlined in Table 7-17.

Table 7-17: Cardboard Baler SWOT

Internal		External	
Strengths	Weaknesses	Opportunities	Threats
• Potential to sell product direct to market with potential revenue stream. • Potential to increase diversion of waste from landfill. • Plant could accept other materials including plastics for baling.	• Capital costs for purchasing baling equipment.	• Cooperation of local community and businesses.	• Lack of involvement / buy-in from community. • Contamination of cardboard resulting in product being unsuitable for sale to market.

The estimated costs to purchase and run a cardboard compactor are shown below.

Capital Costs		Operational Cost	Total Annualised Cost	
Low	High		Low	High
$16,000	$21,000	$1,000	**$2,600**	**$3,100**

Notes: Model costed is Mil-tek 2509. *Operational costs includes six monthly servicing. Utilities and other operating costs (e.g. labour) not included. A compressor may be required (costs included in High option).*

7.3.6 Polystyrene Compactor

Expanded Polystyrene (EPS) is a lightweight packaging material that, when landfilled, can take up significant void space compared to its weight. Therefore, compacting EPS can, if destined for landfill, reduce the consumption of void space or help to facilitate the source separation and recycling of this material.

The price of an EPS compactor can vary depending on its processing capacity. However, initial indications from one supplier (Mil-tek) who are based on the NSW Central Coast indicated the EPS1000, which can process 3-4m^3 per hour would be sufficient. Larger units are also available. Talis understands that Muswellbrook Shire Council undertook an EPS compactor trial and purchased a unit (HJOC, 2017) and received a $20,000 government grant for the project.

If Council were interested in this option, they could consider undertaking a trial individually, as part of a joint initiative with neighbouring Councils or look to partner with Muswellbrook if their unit is still in operation. There are examples of regional councils in Victoria utilising an EPS compactor across multiple sites with the use of a custom-built trailer. There are a number of EPS recyclers that offer collection services or the ability to lease an EPS compactor. The polystyrene compactor SWOT is shown in Table 7-18.

Table 7-18: Polystyrene Compactor SWOT

Internal		External	
Strengths	Weaknesses	Opportunities	Threats
• Encourage source separation of materials. • Potential to increase diversion of waste from landfill. • Reduce void space consumption in landfill.	• Targets limited waste materials.	• Cooperation of local community and businesses.	• Lack of involvement / buy-in from community.

The estimated costs to purchase and run a polystyrene compactor are shown below.

Capital Costs		Operational Cost	Total Annualised Cost	
Low	High		Low	High
$23,000	$30,000	$1000	**$3,300**	**$4,000**

Notes: Model costed is Mil-tek EPS 1000, capacity 15-20kg per hour. Does not include cost of hopper (required). Operational costs includes six monthly servicing, utilities and other operating costs (e.g. labour) not included.

7.3.7 Soft Plastics Recycling Program

There are currently limited opportunities for soft plastics recycling in Australia. The main soft plastics recycling scheme is run by REDcycle. However, there are a number of new smaller initiatives starting to operate in Australia. Some of these initiatives allow Councils to provide a soft plastics drop-off service for its community if they commit to purchasing products such as asphalt and street furniture. Central Coast Council has piloted a scheme to use some recycled soft plastics materials (known as reconophalt) in road construction projects. The soft plastics recycling SWOT is shown in Table 7-19.

Table 7-19: Soft plastics recycling SWOT

Internal		External	
Strengths	**Weaknesses**	**Opportunities**	**Threats**
• Increase diversion of waste from landfill.	• Focus on small number of waste materials.	• Demonstrates commitment to sustainable initiatives.	• Lack of community participation.

7.4 Recover and Treat

Council is planning to extend its third bin kerbside collection service from garden organics to a FOGO service by 2024. As Council has an agreement in place to process its green waste and, eventually, its FOGO waste from kerbside collections, composting by Council has not been considered as an option in this report.

7.4.1 Regional Residual Waste Resource Recovery

In order to increase waste diversion from landfill, Council could consider collaborating with other Councils in the Hunter Region to develop a regional resource recovery initiative for treating residual waste, such as an EfW facility. Collaborating at the regional level would enable economies of scale in terms of residual waste tonnages. As discussed in Section 4, there are a number of technologies that are now operating or in the planning stages within Australia.

Thermal waste treatment processes are able to process all wastes except for non-combustible materials such as inert wastes and some forms of hazardous wastes. Thermal processes can be used to recover the energy content of the waste stream to produce electricity, heat or fuel. Thermal treatment is able to reduce the volume of waste by up to 90%-95%, thereby significantly reducing the quantity of waste disposed of to landfill. Disposal of the facility residues needs to occur in appropriate landfill facilities. The residual waste resource recovery SWOT is shown in Table 7-20.

Table 7-20: Residual waste resource recovery SWOT

Internal		External	
Strengths	**Weaknesses**	**Opportunities**	**Threats**
• High diversion (up to 90%-95%) of waste from landfill. • Treat significant portion of the waste stream.	• Large minimum throughput requirement to be economical. • High capital and operational cost.	• Production of energy. • Funding from external sources.	• Planning and environmental approval. • Community concerns about emissions.

Internal		External	
• May provide electricity generation.	• Diversion of material from recycling. • Would require a regional approach.		

7.5 Dispose

This section focusses on the waste infrastructure rationalisation analysis undertaken by Talis. Whilst it is included in the 'Dispose' section, in reality, any changes to waste infrastructure within the LGA could complement other, higher levels of the waste hierarchy as well.

7.5.1 Waste Infrastructure Rationalisation

As previously outlined, Council currently operates two waste management facilities, namely the CWMC near Cessnock town site and Greta WTS located in the north of the LGA. Using Maptitude software, Talis undertook analysis based on locations of the current waste management facilities utilising aggregated population centre data and road network information to determine drive times to access the waste management facilities across two different scenarios, these are shown in Figures 1 and Figure 2, namely:

- Scenario 1 – Current facilities; and
- Scenario 2 – Only CWMC (Greta WTS closed).

The purpose of this analysis was to provide Council with an understanding of the accessibility of its waste management facilities for its residents. The location and accessibility of waste management facilities, along with service offerings and infrastructure and cost of use, all play a role in the use of the facilities. Indeed, the NSW Illegal Dumping Strategy (2017) states that "*adequate, well-located facilities for waste disposal and recycling will deter people from illegal dumping*".

However, it should be noted that the purpose of this assessment was to analyse the accessibility of Council's waste management facilities for its residents and not the neighbouring Councils even though, it can be clearly seen from Figures 1 and 2 that the catchment areas of each waste management facility reach into the neighbouring Council areas. Council will provide an appropriate service that suits its residents first and foremost and investigate options to service neighbouring Councils' residents if the opportunity arises in the future.

The waste infrastructure rationalisation analysis assumptions include:

- The boundary used to calculate the populations is slightly different from the LGA boundary (which is why total population used is slightly higher than the LGA population (55,999));
- Population data is sourced from 2016 Australian Bureau of Statistics Census data at Statistical Area Level 1 (SA1); and
- Road and transport data is sourced from PSMA Australia.

7.5.1.1 Scenario 1 – Current facilities

Based on the current locations of the facilities on the outskirts of Cessnock and Greta, 56% of the population is within 10 minutes' drive of a facility with 94% within 20 minutes' drive of a facility. In total, an estimated 3.5% (1,950 people) of the population must drive over 30 minutes (one way) to reach a facility, currently.

7.5.1.2 Scenario 2 – Only CWMC (Greta WTS closed)

If Council were to close the Greta WTS and only retain the CWMC, 96.5% of the population would still have a waste management facility within 30 minutes' drive. There will be a 12% decrease in the proportion of the population that has a waste management facility within 10 minutes' drive, with some 6,712 people increasing their drive time as a result of the closure of the Greta WTS. However, only 3.5% of the population would be expected to drive more than 30 minutes to access a facility, which would be the same as is currently with both CWMC and Greta WTS (see Scenario 1).

7.5.1.3 Scenarios Summary

A summary of the scenarios and the drive times for the population are shown in Table 7-21.

Table 7-21: Waste Management Facilities – Drive Time Scenarios Summary

Scenario	Aggregate Population Coverage (%) per Drive Time Range			
	0 to 10 minutes	10 to 20 minutes	20 to 30 minutes	Total within 30 minutes
1	55.6	38.8	2.2	**96.5**
2	43.6	44.9	8.1	**96.5**
% change (from Scenario 1 to 2)	*-12%*	*+6.1%*	*+5.9%*	*0%*

There would be a 12% reduction in the proportion of the population within a 10 minute drive of a waste management facility, with more residents having to drive 10-20 minutes (an additional 6%) and 20-30 minutes (6%). However, having only the CWMC operational (Scenario 2), the proportion of the population within a 30 minutes' drive would remain unchanged between both options with most members of the community (96.5%) able to access a facility within 30 minutes' drive. The closure of Greta WTS would be likely to result in a cost saving to Council. If the site was to remain open, it is anticipated to require upgrades which would come at a significant cost to Council. Having just the CWMC operational would also facilitate a larger proportion of residents utilising a greater range of services provided at the CWMC.

However, it is recommended that a more detailed analysis of the wider potential impacts should be undertaken before making a strategic decision on the future of Council's waste management infrastructure. The waste infrastructure rationalisation SWOT is shown in Table 7-22.

Table 7-22: Waste infrastructure rationalisation SWOT

Internal		External	
Strengths	**Weaknesses**	**Opportunities**	**Threats**
• Minimises transport and double handling of materials which are brought to the CWMC. • Reduces Council liability and operational costs associated with WTS.	• Residents in north of LGA may be disgruntled with decision to close Greta WTS and increase in drive time (whilst still within 30 minutes' drive).	• Promotes awareness and education on sustainable waste management practices. • Promotes increased access to a greater range of resource recovery services at the	• Risk of increase in incidence of illegal dumping due to closure of Greta WTS.

Internal		External	
• Significant proportion of residents would still be within 30 minutes' drive of a waste facility.		CWMC than offered at Greta WTS.	

7.6 Waste Service Extension

As discussed earlier in the report, historically, it has not been feasible for Council to provide a kerbside collection services to all of its residents with its current waste collection fleet, due to a small proportion of the community residing in low density, remote and rural areas that are not readily accessible by these vehicles. These residents are currently offered an alternate waste service for both general waste and recycling, which involves the purchase of alternate service vouchers from Council.

Council were keen to explore options for providing an extended service to these areas. The options considered were:

- Provision of a smaller waste collection vehicle that could collect waste from areas inaccessible to a larger truck; or
- Establishment of a small, simple waste transfer station located closer to the communities not serviced by kerbside collections.

In order to compare a 'like for like' comparison of the two options, a proposed new service area was identified, based on the waste infrastructure drive time analysis undertaken in Section 7.5.1. Disposal and processing costs have not been included in either option as these would be considered to be comparable for both options. Additionally, no bin infrastructure costs have been included in either option as it is assumed that residents already have bins.

7.6.1 Provision of Small Waste Collection Vehicle

Council could procure a small waste collection vehicle to provide an extended waste service provision to some residents outside of the current service area. It was assumed that Council would offer a general waste and comingled recyclables collection service, comparable to the current alternate waste service offered. There are an estimated 2,000 households that are not serviced by kerbside waste collection services currently. However, it would not be realistic to assume that all of these households could be covered by the extended service. For the purposes of the calculations, it is assumed that 1,000 households could be captured as part of an extended service provision. The area with households within a Potential Service Extension Area are shown in Figure 4.

A smaller waste collection vehicle would be more likely to access remote areas of the LGA that the current waste fleet cannot. A small, 7 metre rear loader (Hino 816) with a bin lifter and compaction system was adopted as the waste vehicle in the calculations. The suitability of this vehicle for Council's requirements would need to be determined based on the route and areas requiring access. A summary of the vehicle's capacity and estimated payload is shown in Table 7-23.

Table 7-23: Small waste collection vehicle capacity and estimated payload

Truck Capacity	General waste		Recyclables	
	Conversion factor (compacted)	Truck Payload	Conversion factor (compacted)	Truck Payload
8.32m^3	0.425 tonnes/m3	3.5 tonnes	0.15 tonnes/m3	1.25 tonnes

According to the Hino 816 truck's specifications, its load capacity is 8.32m^3, equating to a maximum payload of 3.5 tonnes for compacted general waste and 1.25 tonnes of comingled recyclables.

The estimated average bin weights were derived from Council's general waste and comingled recyclables waste tonnages in 2018 and total number of services (see Table 5-1). For the calculations, there was assumed to be a bin presentation rate of 90%, equating to an estimated 11.8 tonnes of general waste requiring collection per week and 8.5 tonnes of comingled recyclables per fortnight across the 1,000 households. This information is summarised in Table 7-24.

Table 7-24: Small waste collection vehicle option

Material type	Average weight of bin per household	Estimated number of bins presented per week/ fortnight	Tonnes per week/ fortnight	Conversion factor (tonnes/ m^3)	Max. Truck payload (tonnes)	Average bin lifts per trip	Runs required per week / fortnight	Runs per year
General waste	13kg	900	11.8	0.425	3.5	191	4	208
Comingled recyclables	9kg	900	8.5	0.15	1.25	178	6	156

On the basis of the above waste generation rates, the truck would need to make four runs for general waste collections per week and six runs per fortnight for comingled recyclables, or a total of 10 runs on alternate weeks when both general waste and recyclables require collection.

It is difficult to estimate the time required for the waste collection vehicle to complete a full run as this would vary significantly depending on the locations of the properties requiring a service. This level of detail was not readily available for this high level, preliminary assessment. However, based on the number of dwellings located geographically the furthest away from Cessnock, there are 1,075km of road covering the approximately 1,000 households in the Potential Service Extension Area (see Figure 4). For the purposes of the calculation, it was estimated that the waste collection vehicle would cover, on average, 150km to start at the CWMC, complete a full collection run and return to the CWMC. The estimated average travel speed of the truck is assumed to be 60 kilometres per hour (kph). Each collection run includes 15 minutes unloading time at the CWMC at the conclusion of the run. A summary of the collection frequency and staff hours required each week are shown in Table 7-25.

Table 7-25: Small waste collection vehicle – estimated collection frequencies and duration

Collection week	Number of runs required	Time required per run (CWMC – return)	Hours required per week
General waste collections	4	2.75 hours	11
General waste and comingled recyclables collections	10		27.5

The capital costs for this option include the purchase of a small waste collection vehicle to add to Council's current waste fleet. This could range from approximately $100,000 to $200,000 depending on the vehicle type and whether it is bought new or second hand. Depreciation of the asset and loan costs have not been factored into the calculations. The operational costs include vehicle running costs such as fuel, maintenance and insurances along with staff time, which includes provision for two staff members. The estimated average annual costs over 10 years for the small waste collection vehicle option is shown in Table 7-26.

Table 7-26: Estimated average annual costs (over 10 years) for the small waste collection vehicle service extension option

	Low	High
Capital costs (annualised)	**$10,000**	**$20,000**
Operational costs	**$92,000**	**$92,000**
• Vehicle running costs	*$31,000*	*$31,000*
• Staff costs	*$61,000*	*$61,000*
Total average costs over 10 years	**$102,000**	**$112,000**

The estimated average annual costs of providing an extended waste service provision to an additional 1,000 households in the LGA, utilising a small waste collection vehicle were between $102,000 and $112,000 per annum over 10 years.

As previously outlined, the above costs do not include disposal or processing costs for the materials collected and should be considered a high level estimate based on the information set out in this section.

7.6.2 Establishment of a Small Waste Transfer Station

The second service extension option was to consider the establishment of a small waste transfer station that would enable residents in areas not serviced by kerbside collections to self-haul their waste to a more convenient location than the CWMC, sited in the vicinity of Wollombi. The establishment of a small waste transfer station would require capital investment by Council to build the necessary infrastructure, such as a split level drop off area and, potentially, access roads and hard standing. This is anticipated to include a three bay sawtooth arrangement that would allow users to drop off their waste into skip bins, which would be regularly collected by Council and taken to the CWMC for disposal or onward processing. It is anticipated that the general waste skip bin would have a retractable lid but also need to be collected twice weekly to ensure that odour and the risk of vermin infestations are minimised.

A summary of the drive time ranges with a new WTS in Wollombi are outlined in Table 7-27 and are shown in Figure 3.

Table 7-27: Population accessibility to a waste management facility based on drive time – establishment of new WTS

Scenario	Aggregate Population Coverage (%) per Drive Time Range			
	Always within 30 minutes	No longer within 30 minutes	Becomes within 30 minutes	Never within 30 minutes
Establishment of WTS at Wollombi (closure of Greta WTS)	96.53%	0%	1.02%	**2.45%**

If Council were to close Greta WTS and establish a new WTS near Wollombi, the analysis of the available spatial data suggests that there would be a small increase (1%) in properties within 30 minutes' drive of a waste management facility, compared to the current situation. However, households that currently use Greta WTS would still be within 30 minutes' drive a waste facility, with access to the CWMC, which could result in a cost saving to Council through the reduction in double handling of materials dropped off at Greta WTS that requires transport to the CWMC and the associated operational costs for Greta WTS. However, as shown in Table 7-27, there would still be an estimated 2.45% of the population over 30 minutes' drive from a waste management facility.

Depending on the infrastructure required, the capital costs are estimated to be between $250,000 and $750,000. The 'low' scenario would include provision for a split level saw tooth arrangement for three skip bins with a 1.6m high raised platform. It is anticipated that, given the height of a 30m^3 bins, the bins would act as a railing at the top of the platform. The 'low' scenario does not include costs of a hook lift truck and assumes Council could utilise an existing vehicle. A 'high' capital cost scenario has been included with provision for additional infrastructure such as access roads and hard stand along with a hook lift truck. However, it is important to note that capital costs do not include any costs associated with procuring a suitable site and relate only to the anticipated infrastructure required.

The calculations include operational costs covering the provision of Council staff to operate the site three half days per week along with maintenance of the site and haulage of waste from the transfer station to the CWMC, as required. There is potential for the introduction of a security shutter gate and barcode scanning technology to allow users to access the site without the need for the site to be staffed. This technology is utilised at some regional sites for registered users. This would be in the region of an additional $250,000 to establish, although these costs have not been included in the calculations. In addition, operational hours at the site could be reduced to further save on costs. The estimated average annual costs over 10 years for the establishment of a small waste transfer station option is shown in Table 7-28.

Table 7-28: Estimated average annual costs (over 10 years) for the establishment of a small waste transfer station option

Cost item	Low	High
Capital costs (annualised)	**$25,000**	**$75,000**
Operational costs	**$77,000**	**$77,000**
• Vehicle running costs and sundries	*$11,000*	*$11,000*
• Staff costs – site/haulage	*$66,000*	*$66,000*
Total average costs over 10 years	**$102,000**	**$152,000**

The estimated average annual costs of providing an extended waste service provision in the form of a new waste transfer station is between $102,000 and $152,000 per annum over 10 years, depending on infrastructure required. Cost estimates do not include the costs of purchasing of land or site clearance costs, if required. As previously outlined, the above costs do not include disposal or processing costs for the materials collected and should be considered a high level estimate based on the information set out in this section along with the modelling assumptions detailed in Appendix A.

7.7 Waste Management Options – Cost Summary

All of the infrastructure and service options considered as part of the evaluation are summarised in Table 7-29, along with their associated estimated capital and operational costs.

Table 7-29: Waste Management Options Cost Summary

Waste Hierarchy Level	Option	Capital Costs			Annual Capital Costs		Operational costs	Total annual cost	
		Low	High	Lifespan	Low	High		Low	High
Avoid/Reduce	Community Waste Education /Behavioural Change Program	$ -	$ -	NA	$ -	$ -	$70,000	$ 70,000	$70,000
Avoid/Reduce	Commercial Waste Minimisation Practices	$ -	$ -	NA	$ -	$ -	$30,000	$30,000	$30,000
Avoid/Reduce	Waste Education Officer	$ -	$ -	10	$ -	$ -	$105,000	$105,000	$105,000
Avoid/Reduce	Education Centre at CWMC	$100,000	$200,000	20	$5,000	$10,000	$10,000	$15,000	$20,000
Reuse	Reuse Shop (CWMC)	$200,000	$500,000	20	$10,000	$25,000	$300,000	$310,000	$325,000
Reuse	Reuse Drop off area at CWMC	$25,000	$50,000	20	$1,250	$2,500	$ -	$1,250	$2,500
Reuse	No Council involvement	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Reuse	Reuse/Free Trade websites	$10,000	$15,000	10	$1,000	$1,500	$5,000	$6,000	$6,500
Recycle	Public place recycling (trial)	$30,000	$50,000	10	3000	$5,000	$2,340	$5,340	$7,340
Recycle	On-demand bulk kerb collections for elderly and/or disabled residents	$46,000	$69,000	20	$2,300	$3,450	$81,691	$83,991	$85,141
Recycle	Cardboard compactor/baler	$16,000	$21,000	10	$1,600	$2,100	$1,000	$2,600	$3,100
Recycle	Polystyrene compactor	$23,000	$30,000	10	$2,300	$3,000	$1,000	$3,300	$4,000
Dispose	Service extension – small waste transfer station	$250,000	$750,000	10	$25,000	$75,000	$76,622	$101,622	$151,622
Dispose	Service extension – small waste collection truck	$100,000	$200,000	10	$10,000	$20,000	$92,185	$102,185	$112,185

8 Discussion

This section outlines the key discussion aspects identified in the report that warrant further consideration by Council including:

- Waste Education;
- Reuse Shop;
- FOGO Collection Service;
- Waste Service Extension Assessment;
- Emerging Waste Streams; and
- Regional Collaboration.

8.1 Waste Education

The introduction of a dedicated waste education officer would assist Council in delivering a range of waste education and behaviour change initiatives including the future introduction of the FOGO collections service (see also Section 8.3). Based on case studies of other LGAs who have implemented significant changes to their waste management system, particularly FOGO collection services, the provision of waste education is a key factor in their success. A dedicated waste education officer would also enable Council to develop closer partnerships between industry, towns and the community. The cost of implementing this option is relatively low at approximately $105,000 per year for staff costs along with $30,000-70,000 for associated programs but would help to support a range of sustainable waste management initiatives for Council including tackling illegal dumping. Talis would recommend that Council investigate the cost and feasibility of introducing a dedicated Council officer to implement waste initiatives including community waste education and behavioural change programs and to assist with planning and eventual implementation of the future FOGO collection service. Council could undertake activities such as compositional waste audits and continue to monitor illegal dumping activity in order to measure the success of its waste education initiatives to demonstrate the benefit of having a dedicated officer.

8.2 Reuse Shop

The inclusion of a Reuse Shop would encourage waste diversion amongst the community, help to reduce landfill costs – including reduced landfill levy payments – and reduce the rate of void space consumption of the landfill. The previous tender process undertaken by Council in 2016 for a Reuse Shop resulted in the decision to shelve this service, with the anticipated operational costs of outsourcing this service exceeding the expected benefits of diverting a very small quantity of materials from landfill. If Council wanted to revisit the possibility of reintroducing a Reuse Shop at the CWMC, Council could look to undertake a further, revised tender process or look to undertake operations in-house. The benefits of undertaking the services in-house include retaining control of the service, local employment opportunities and the ability to promote diversion of waste from landfill. There is also the potential for a small revenue stream from the sale of goods. The establishment of a reuse shop could be coupled with an education centre at the CWMC that would further promote sustainable waste management initiatives and could be run in partnership with the community.

Alternatively, Council could explore the option of establishing a reuse drop off area at the CWMC so that suitable materials could be collected by charities for on selling at their stores. However, this would require Council to work in collaboration with charitable organisations to ensure the service operated effectively.

8.3 FOGO Collection Service

The comparison of other Councils that have implemented a FOGO collection service provides a useful overview of how a system could be implemented in Council.

There are a number of considerations for Council to make prior to the implementation of their FOGO service including collection frequency, receptacle size, materials to include in the roll out and waste education strategy.

The most common collection frequency for FOGO bins are weekly collections. All of the LGAs reviewed offered a 240L FOGO bin with one offering an optional 140L FOGO bin in addition to the 240L bin for low organics generating households (i.e. small or no garden, singles and avid composters). In addition, all LGAs collected refuse in 140L bins with two offering an optional larger, 240L refuse bin.

Most LGAs provide FOGO participants with starter packs during the roll out period. These commonly included kitchen caddies and bin liners, although one LGA (Shellharbour) opted to avoid using bin liners altogether recommending residents use newspaper or similar materials to line their bins. The decision to use bin liners as part of a FOGO collection service should be considered in consultation with the organics processor as some processors are unable to accept them as part of their organics feedstock. When making decisions regarding caddies and bin liners, the estimated costs of ongoing supply of the bags and whether the caddies and bags will be offered on a mandatory or opt-in basis should be considered.

A key message from the LGAs reviewed was the importance of effective planning and implementation of comprehensive community engagement and education programs at all stages of the program from planning to post-implementation, in making a success of the FOGO collection service.

In order for Council to effectively plan for the implementation of a future FOGO collection service, Talis would recommend that Council undertakes a compositional waste audit and prepare an implementation plan detailing tasks and timescales for the service. A waste audit would assist Council to plan for the expanded green bin service to minimise the risk of capacity issues when the service is rolled out. If refuse collections were reduced from weekly to fortnightly collections there may be capacity issues for a small number of residents such as those with young children or ongoing medical issues.

The introduction of a FOGO collection service will:

- Bring Council in line with best practice kerbside collection systems;
- Increase the range of materials source separated to include food waste, diverting a greater proportion of the waste stream from landfill and aiding Council in reaching their waste diversion targets;
- Divert a significant proportion of compostable material from landfill resulting in better environmental outcomes for Council and its community including reduced greenhouse gas emissions;
- Reduce the consumption of landfill void space due to increased materials diversion;
- Provide potential cost savings to Council with the reduction in leachate generation and avoidance of the landfill levy for material that can be dealt with in a more sustainable manner; and
- Further develop a culture of source separation and recycling in the community.

However, in order to ensure the success of the service, Council should aim to develop a comprehensive FOGO collection service implementation plan to assist with effective planning for the service's roll out and full implementation.

8.4 Waste Service Extension Assessment

Council were keen to explore options for providing an extended kerbside collection service to areas of the LGA that are not currently provided with a kerbside collection service. The two options considered were:

- Provision of a smaller waste collection vehicle that could collect waste from areas inaccessible to a larger truck; or
- Establishment of a small, simple waste transfer station located closer to the communities not serviced by kerbside collections.

Based on the calculations undertaken as part of a high level Waste Service Extension Assessment, the option of a new small waste collection vehicle and establishment of a small waste transfer station near Wollombi are comparable on a cost basis. Both options would be approximately $102,000 per annum over a ten year period based on the 'low' capital costs scenario.

The benefit of a small waste collection vehicle is that it would potentially allow for a more flexible service offering by being able to service different areas of the LGA. However, being a smaller vehicle, its load capacity would be smaller resulting in an increased number of collection runs and associated operational costs. Due to the low density of the areas not currently serviced, this would result in increased travel time driving to and from the CWMC to unload the vehicle. In addition, road network requirements would need to be further investigated and adhered to by the waste collection vehicle. These would include, as a minimum, load limits for small bridges and roads and to ensure the safety of road users on narrow sections. This is particularly relevant when the frequent stopping of the waste collection vehicle may occur along sections of windy road where visibility may be obstructed around a corner or bend.

There would be a lower capital investment required for this option, with just a truck required. However, the operational costs could vary significantly depending on the locations of the households that would be serviced. The estimates were based on the indicative number of services required across 1,000 households in a Potential Service Extension Area resulting in an estimated average operating cost of $92,000 per annum.

The establishment of a small waste transfer station would potentially introduce an improved level of service to a larger geographical area of the LGA than a small waste collection vehicle. Whilst the community would still need to self-haul their waste, the facility would be in closer proximity to the CWMC for many residents. However, there could be significant capital investment required, depending on the infrastructure needed. A basic waste transfer station with split level drop off and skip bins could cost in the region of $250,000 up to approximately $750,000. However, the capital costs do not include any costs associated with procuring a suitable site and relate only to the anticipated infrastructure required. The operational costs are estimated to be comparatively lower than the waste collection truck at approximately $77,000 per annum over 10 years.

It is understood that Council already services a small number of the residents captured in the Proposed Service Extension Area. However, an additional service offering – through either additional collection services or a small waste transfer station – would increase the service level to the community. This would potentially help to reduce the incidence of illegal dumping in the local area. A detailed investigation into the feasibility of servicing additional households in this area with either an additional waste collection vehicle or a small waste transfer station in Wollombi would be recommended prior to Council making a decision on which option is preferred.

8.5 Emerging Waste Streams

As discussed in Section 4, there are a number of emerging waste streams that are increasing in prevalence in Australia. Such materials include e-waste, household furniture, photovoltaic systems and engineered stone benchtops. These materials can pose a risk to both the environment and human health when not managed

appropriately. There are a number of initiatives in development to effectively manage some of these materials such as a product stewardship scheme for photovoltaic systems and legislation to ban disposal of materials, such as e-waste, in landfill in some states. Talis would recommend that Council monitor developments in this area and develop guidelines and appropriate training for staff in the handling of materials that can pose a human health risk.

8.6 Regional Collaboration

Council has a good working relationship with other regional Councils, including existing waste collection and processing contracts with Singleton and Maitland Councils. In addition, Council is an active participant in the Hunter Joint Organisation of Councils.

Whilst Council is currently undertaking a landfill expansion project at the CWMC, which will extend the life of the facility a further 20 years, Talis recommends Council continues to collaborate with other Councils in relation to waste management, including considering appropriate sustainable waste management initiatives at a regional scale, to help meet the long term waste management needs of Council after the landfill reaches capacity or to prolong its useful life. This includes exploring alternative waste technologies that would require regional collaboration due to the scale of the capital investment required.

To further increase the effectiveness of the existing regional collaboration, Council should explore opportunities to create economies of scale for problematic or difficult to recycle materials such as polystyrene and soft plastics. In addition, by combining quantities of materials collected such as cardboard, the participating councils could obtain a better market price for the sale of such products. This approach would require further investigation however, could be delivered through a 'milk run' type service where Council, or councils in collaboration, collect from all the separate waste management facilities within the region to achieve a full load of material ready for sale at market or for further processing.

9 Preferred Options

Following review of Council's waste practices, current priorities and potential opportunities, Talis recommends that Council give consideration to the following opportunities and establish appropriate timeframes for their implementation.

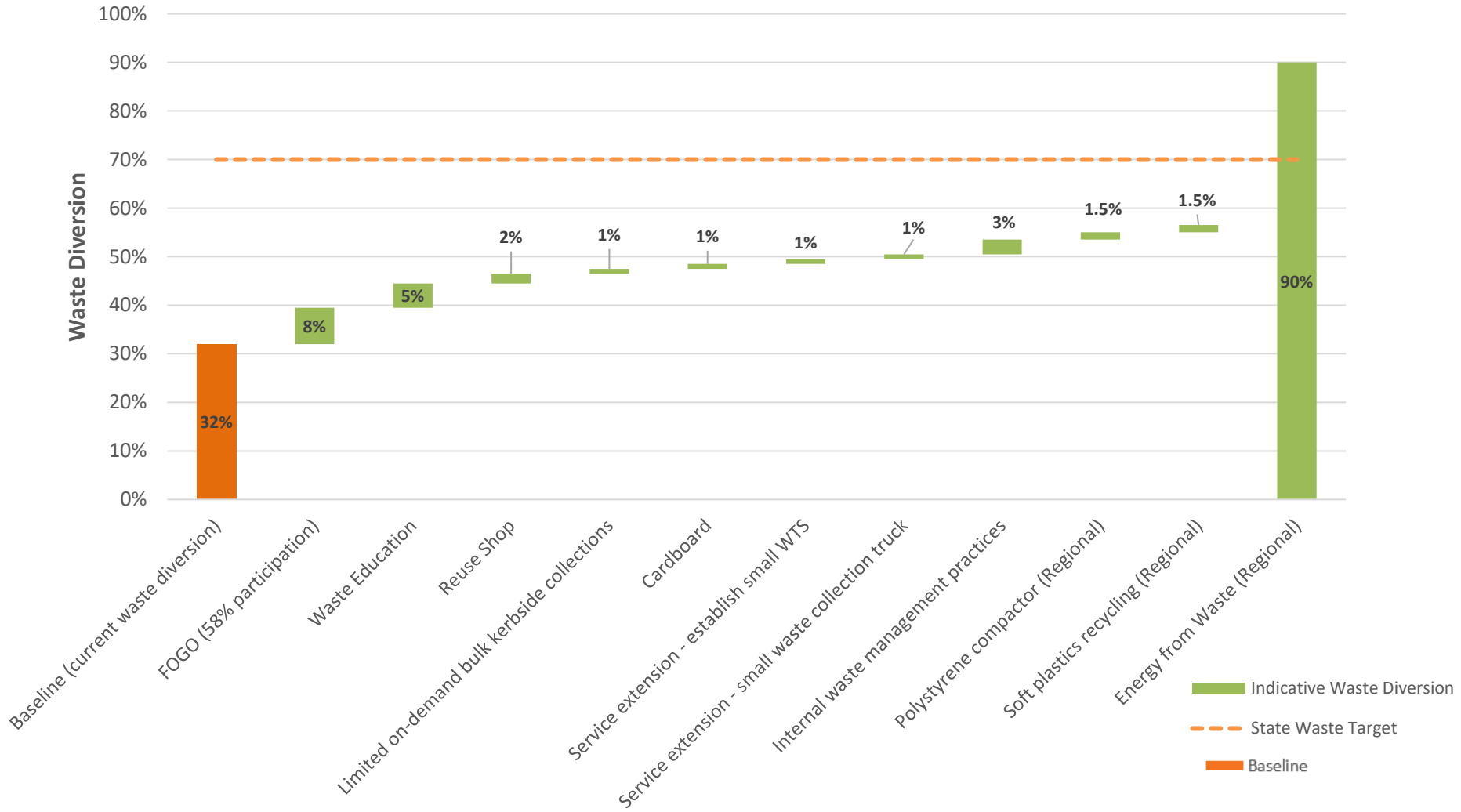
Table 9-1: Waste Management Options Recommendations

Waste Management Option	Potential action(s)
Waste Education Officer	Investigate the cost and feasibility of introducing a dedicated Council officer to implement waste initiatives including community waste education and behavioural change programs and assist with planning and eventual implementation of the future FOGO collection service. Undertake regular compositional waste audits and monitor illegal dumping activities in order to measure the success of its waste education initiatives.
Education Centre	Investigate opportunities for the establishment of a waste education centre at the CWMC with the inclusion of offices and amenities for waste management staff.
Reuse Shop	If Council wanted to revisit the possibility of reintroducing a Reuse Shop at the CWMC: • Investigate potential funding opportunities for the establishment of a reuse shop. • Investigate whether the facility should be run in-house or through a local third-party contractor such as a community group or a combination of the two. • If, Council's preferred service delivery model was through a third party, develop a revised tender process with a well worded contract for the operation of a reuse shop to understand the current market rates for outsourcing this service.
Waste Fees and Charges	In order to provide more clarity for users and potentially reduce concern regarding the cost of disposal at the CWMC, Council could consider reviewing the way waste fees and charges are presented.
FOGO collection service	Talis recommends that Council undertakes a compositional waste audit and develop a comprehensive implementation plan to assist with effective planning for Council's future FOGO collection service.
Cardboard baler/compactor	Prepare a business case and investigate potential funding opportunities for the procurement of a cardboard compactor/baler.
On-demand bulk kerbside collections for elderly and disabled residents	Undertake a detailed feasibility assessment, including consultation with stakeholders, on the likely costs and demand for bulk kerbside collections for elderly and disabled residents.
Service Extension area	Consider undertaking a detailed investigation into the feasibility of implementing a service extension to households not covered by kerbside collection services with the introduction of either a new waste collection vehicle or establishment of a small, waste transfer station.
Regional collaboration	Continue to work collaboratively with other Councils in the region on waste education and long-term sustainable waste management initiatives.

10 Performance Improvement

A waterfall diagram (Figure 10-1) was prepared to illustrate Council's current waste diversion rate against potential waste management options that could help Council work towards the NSW WARR Strategy waste diversion target (State Waste Target) of 70% by 2021.

Figure 10-1: Waterfall diagram – Waste Management Options for increased waste diversion



The waste diversion rates for each of the options is indicative only. The actual diversion rates that could be achieved by implementing each of the options would need to be tested or, at least require detailed modelling to more accurately estimate this. However, there are several initiatives that would support increased community awareness and behaviour change relating to waste that could lead to greater waste diversion including the appointment of a dedicated waste education officer, establishment of an education centre, presentation of fees and charges (all incorporated within the Waste Education option in Figure 5-1) and/or a new reuse shop. Additionally, several options, whilst not indicating they will directly increase waste diversion rates significantly, could provide an increased level of service to the community such as the service extension options and bulk kerb collections for elderly and/or disabled residents.

In terms of the FOGO collection service, the overall participation rate of 58%, from which the waste diversion rate was estimated, could be increased to achieve better overall waste diversion (see Section 6.6). Well performing FOGO collection services have achieved high participation rates and low contamination rates through effective education and engagement programs, which would be supported by other waste management options, such as a dedicated waste education officer.

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Appendix A: Service Extension modelling assumptions

Service Extension - general

Waste tonnages are based on the average bin weight per households for general waste and recyclables. This is calculated based on the total tonnages collected in Cessnock's current kerbside collection (March 2018-Feb 2019) and total number of services. For the waste tonnage estimates, it is assumed that 1,000 households would utilise the services.

Waste generation growth has not been factored into the calculations over the 10 years modelled.

Assumes both options would include provision for a two bin system - general waste and comingled recyclables only (no garden or FOGO waste), comparable to the current alternate waste service.

All staff costs are $40 per hour plus 40% overheads per staff members.

Capital and operational costs have been annualised over a 10 year period to provide an annual average cost.

Small waste collection vehicle option

The waste collection vehicle used in the calculations is a 7m rear loader (Hino - 816 Auto), with a capacity of 8.32m3 based on the vehicle specifications.

The conversion factors for compacted waste of 0.425 tonnes/m3 (general waste) and 0.15 tonne/m3 have been utilised.

Average travel speed of the truck assumed to be 60kph. Each collection run includes 15 minutes unloading time at the CWMC at the conclusion of the run. Due to the uncertainty of the exact requirements of the collection run, each run estimates a travel distance of 150km. This equates to a total of 2.75 hours per run.

Due to the uncertainty of the exact requirements of the collection run, each run estimates a travel distance of 150km.

Total waste volumes and number of collections are based on a bin presentation rate of 90%.

The number of lifts per collection run is based on the vehicle’s payload for the material being collected and the estimated average bin weight.

The number of collection runs required is rounded up to the nearest whole number.

Staff resources include one driver on each collection run.

Capital costs include the estimated truck purchase costs only. Operational costs include vehicle running costs such as fuel, plant repairs and maintenance and insurance along with staff time.

No provision for a ‘like for like’ back-up collection truck has been included in these calculations.

WTS option assumptions

Assumes the waste transfer station is in the immediate vicinity of Wollombi. Cost per trip is $84.00 in Year 1, adjusted for inflation (2%) annually. The cost per trip for collection of the skip bin is based on a return trip to/from CWMC to Wollombi.

Calculations assume operations would be undertaken by Council. Staff costs are $40 per hour plus 40% overheads.

Time/cost provision for loading (15 minutes) and unloading (15 minutes) per trip.

Skip bins are assumed to be 30m3 bin (one for general waste, one for recyclables). The general waste bin would require a lid to minimise vermin infestations.

The hook lift truck purchased under the 'high' scenario, for the purposes of modelling was the Hino 500 Series 1022 FC at a purchase price of $120,000. No depreciation or loan costs have been included in the calculations.

Conversion factors for uncompacted materials of 0.3 tonnes/m3 (general waste) and 0.063 tonne/m3 (recyclables) have been utilised.

Skip bin collection frequency is based on capacity requirements (comingled recyclables) and the effective management of odour and vermin for general waste. The general waste bins would not be likely to be at capacity when collected twice weekly.

Operational costs include provision for the site to be open three days per week (half days) totalling 14 hours per week including 2 hours maintenance each week.

Capital costs include a split level saw tooth arrangement for three skip bins and a 1.6m high raised platform. It is anticipated that, given the height of a $30m^3$ bins, this would act as a railing at the top of the platform.

Capital costs do not include any costs associated with procuring a suitable site and relate only to the anticipated infrastructure required.

Appendix B: Mapping Figures

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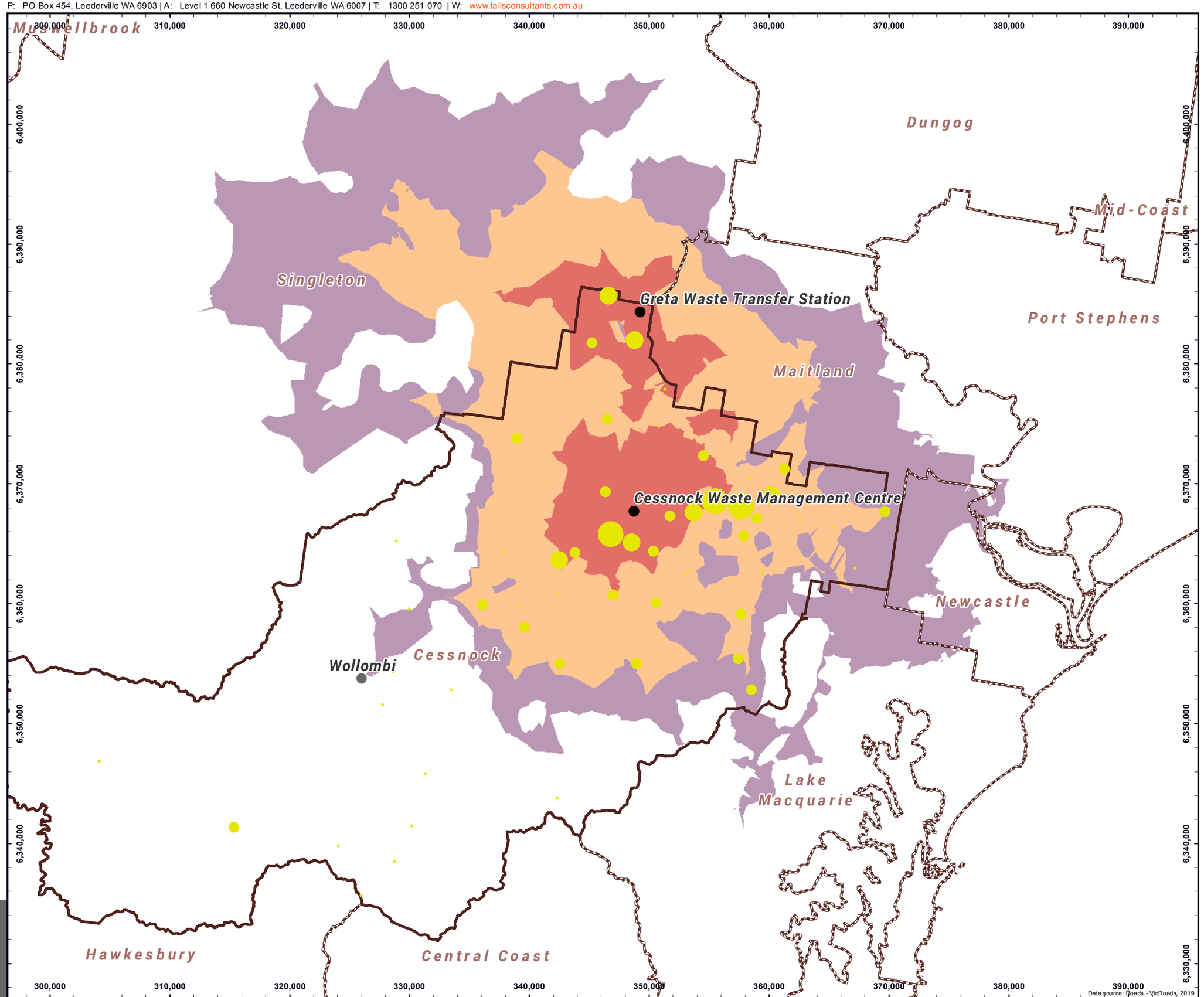

LEGEND

- Cessnock City Council LGA
- Other LGAs
- Sites Used in Analysis
- Other Sites

Drive Time

- 0 - 10 minutes
- 10 - 20 minutes
- 20 - 30 minutes

Suburb Population

- 0 - 200
- 201 - 1500
- 1501 - 3000
- 3000+

0 87.5 175 350 525 700 km

DRIVE TIME ANALYSIS
SCENARIO 1
(Cessnock, Greta)

Waste Strategy Options
Cessnock City Council

N
0 3 6 9 12 Km

Coordinate System: GDA 1994 MGA Zone 56
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3: 1:300,000

Prepared: F Walker	Date: 10/09/2019
Checked: A Upitis	Project No: TW19035
Reviewed: T Allen	Revision: A

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Figure 01

Data source: Roads - VicRoads, 2019.

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Muswellbrook
Dungog
Mid-Coast
Singleton
Port Stephens
Greta Waste Transfer Station
Maitland
Cessnock Waste Management Centre
Newcastle
Wollombi
Cessnock
Lake Macquarie
Hawkesbury
Central Coast

300,000 310,000 320,000 330,000 340,000 350,000 360,000 370,000 380,000 390,000
6,400,000 6,390,000 6,380,000 6,370,000 6,360,000 6,350,000 6,340,000 6,330,000

LEGEND

- Cessnock City Council LGA
- Other LGAs
- Sites Used in Analysis
- Other Sites

Drive Time

- 0 - 10 minutes
- 10 - 20 minutes
- 20 - 30 minutes

Suburb Population

- 0 - 200
- 201 - 1500
- 1501 - 3000
- 3000+

LOCALITY

0 87.5 175 350 525 700 km

DRIVE TIME ANALYSIS SCENARIO 2 (Cessnock)

Waste Strategy Options
Cessnock City Council

N 0 3 6 9 12 Km

Coordinate System: GDA 1994 MGA Zone 56
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3: 1:300,000

Prepared: F Walker	Date: 10/09/2019
Checked: A Upitis	Project No: TW19035
Reviewed: T Allen	Revision: A

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Figure 02

Data source: Roads - VicRoads, 2019.

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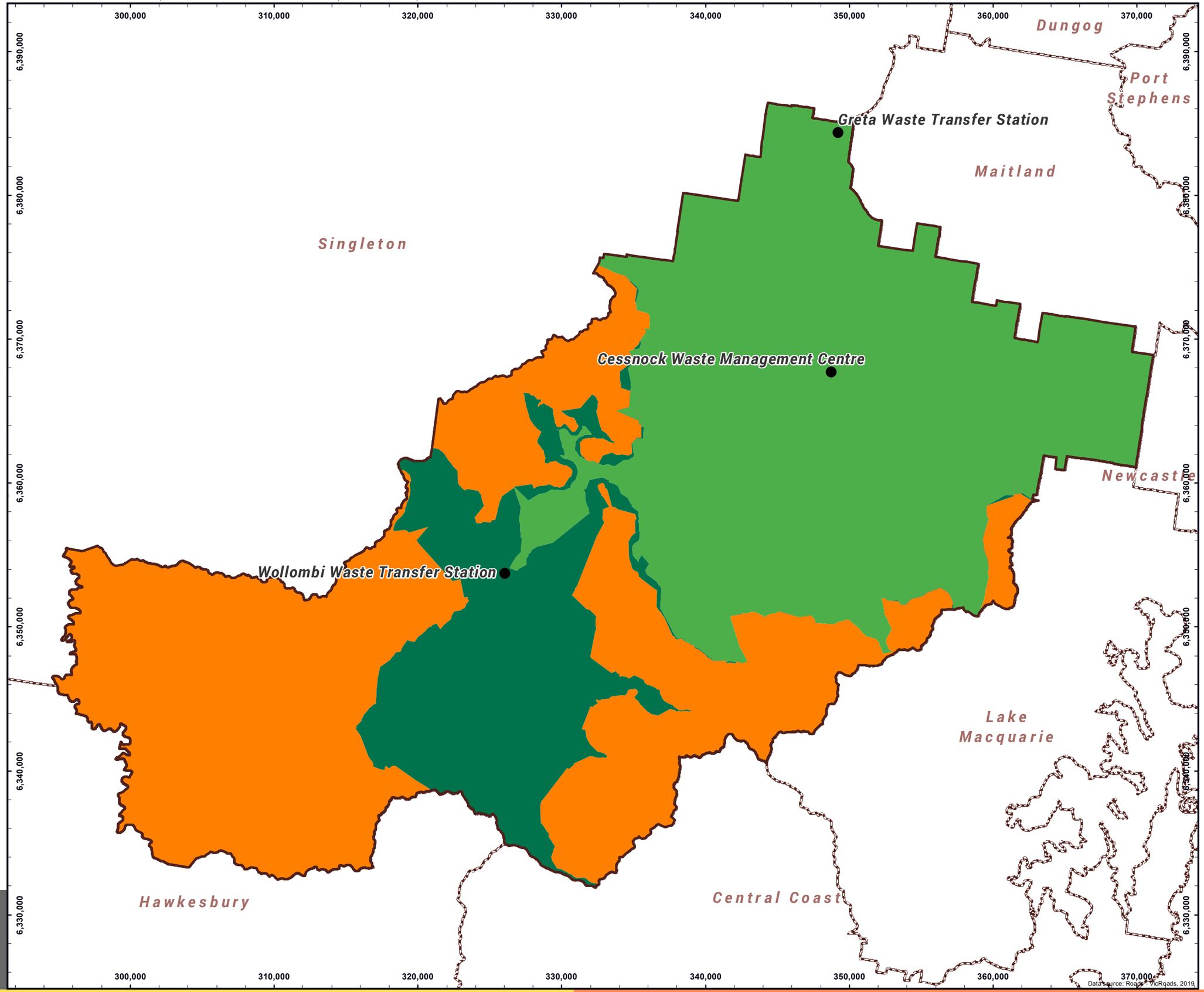
P: PO Box 454, Leederville WA 6903 | A: 604 Newcastle St, Leederville WA 6007 | T: 1300 251 070 | W: www.talisconsultants.com.au



LEGEND

- Cessnock City Council LGA
- Other LGAs
- Waste Facility
- Become within 30 minutes drive of waste service
- Always within 30 minutes drive of waste service
- Never within 30 minutes drive of waste service
- No longer within 30 minutes drive of waste service

0 87.5 175 350 525 700 km

DRIVE TIME ANALYSIS
REMOVAL OF GRETA WTS
ADDITION OF WOLLOMBI WASTE SERVICE

WASTE STRATEGY OPTIONS
CESSNOCK CITY COUNCIL

N 0 2.5 5 7.5 10 Km

Coordinate System: GDA 1994 MGA Zone 56
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3: 1:250,000

Prepared: F Walker	Date: 27/08/2019
Checked: A Upitis	Project No: TW19035
Reviewed: T Allen	Revision: A

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Figure 03

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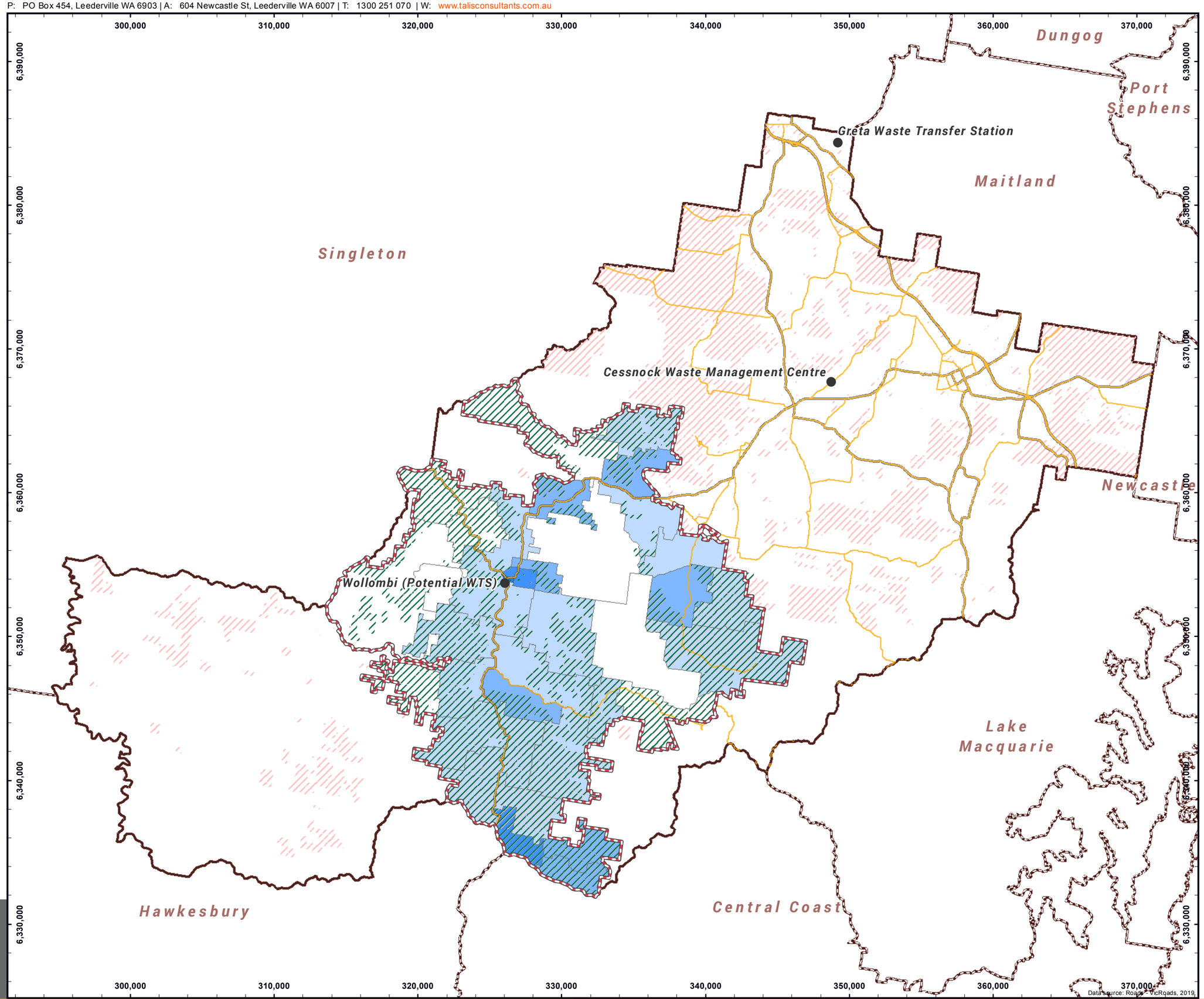

LEGEND

- Cessnock City Council LGA
- Other LGAs
- Potential Service Extension Area
- Waste Facility

Dwelling Density

Dwellings / Ha

- 0.00 - 0.01
- 0.01 - 0.03
- 0.03 - 0.08
- 0.08 - 0.2
- 0.2 - 0.5
- Freehold Property with No Waste Service
- Freehold Property Formerly with No Waste Service

0 87.5 175 350 525 700 km

POTENTIAL SERVICE EXTENSION AREA

WASTE STRATEGY OPTIONS
CESSNOCK CITY COUNCIL

N 0 2.5 5 7.5 10 Km

Coordinate System: GDA 1994 MGA Zone 56
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3:1:250,000

Prepared:	F Walker	Date:	5/09/2019
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Reviewed:	T Allen	Revision:	A

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Figure 04

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