Waste and Recycling in Otago

eunomia

OTAGO MAYORAL FORUM

Report for the Otago Mayoral Forum

Prepared by:
Duncan Wilson, Lisa Eve, Bruce Middleton,
Niki Bould, and Ella van Gool.

Approved by

……

Duncan Wilson

(Project Director)

Eunomia Research & Consulting Ltd
PO Box 78 313
Grey Lynn
Auckland 1245

New Zealand

Tel: +64 9 376 1909

Web: www.eunomia.co.nz

Acknowledgements

Disclaimer

Contents

Glossary

C&D	Construction and demolition waste
CAP	Climate Action Plan
CCC	Climate Change Commission
CH4	Methane
Clutha DC	Clutha District Council
CO2	Carbon dioxide
CODC	Central Otago District Council
DCC	Dunedin City Council
DEF	Default emissions factor
ELTs	End of life tyres
ETS	Emissions Trading Scheme
GHG	Greenhouse gas
HDPE	High-density polyethylene, plastic type 2
HSNO	Hazardous Substances and New Organisms Act
LGA	Local Government Act
LTP	Long term plan
LULUCF	Land use, land use change and forestry
MDF	Medium-density fibreboard
MfE	Ministry for the Environment
MOU	Memorandum of understanding
MRF	materials recovery facility
NBA	Natural and Built Environments Act
NES	National environmental standard
NWDF	National waste data framework
NZU	New Zealand units
NZWS	New Zealand Waste Strategy
ORC	Otago Regional Council
PET	Polyethylene teraphthalate, plastic type 1
PP	Polypropylene, plastic type 5
QLDC	Queenstown Lakes District Council
RMA	Resource Management Act
RTS	Refuse transfer station
SdE	Southland disAbility Enterprises
SDHB	Southern District Health Board
SFF	Silver Fern Farms
SWAP	Solid waste analysis protocol
TA	Territorial authority
TDF	Tyre-derived fuel
TDM	Tyre-derived medium
UEF	Unique emissions factor
WAM	Waste Management NZ Ltd

WasteMINZ	Waste Management Institute of New Zealand
WDC	Waitaki District Council
WMA	Waste Minimisation Act
WMF	Waste Minimisation Fund
WMMP	Waste Management and Minimisation Plan
WRRP	Waitaki Resource Recovery Park
WRRT	Waitaki Resource Recovery Trust
WWTP	Waste water treatment plant

Foreword from the Otago Mayoral Forum

When the Otago Mayoral Forum met for the first time following the 2019 local elections, members put waste and recycling at the top of our shared agenda.

The Otago Mayoral Forum is comprised of Otago's five Mayors, the Chair of the Otago Regional Council, and the territorial authorities' Chief Executives. The Forum's role is to enable communication and coordination across the region, paving the way for councils to work together on issues of shared importance. We can't direct our councils to collaborate, but we can investigate issues and options at a regional scale and offer new perspectives.

Thinking regionally to address waste makes a lot of sense. Otago's five district and city councils manage waste and recycling responsibilities individually on behalf of residents, and mostly independently of each other. But working together could provide the scale and shared resources we need to do things better.

Though many New Zealanders are doing the right thing - reducing waste, reusing and recycling - huge amounts of materials still go to landfill. Volumes are increasing[1] and space is limited. Climate change is another incentive, as organic materials sent to landfill create methane, a greenhouse gas.

For Otago, waste and recycling challenges are magnified by our large area, small population and large distances between populations centres and to national waste facilities. If we are to better manage our own waste, we need to work harder than most.
To understand the very specific waste and recycling challenges that we face in Otago, the Forum commissioned this report from environmental consultancy Eunomia.

In this report, Eunomia documents waste and recycling infrastructure, volumes and activity throughout Otago. It also provides a national, regional and local overview of waste planning, responsibilities, challenges and opportunities.

The report includes examples of large organisations in the region and how they are tackling waste, including the Southern District Health Board, University of Otago and Harraways Oats. We'd like to thank all of these organisations for giving us access to important information.

This information is a resource for councils, waste industry organisations and the community to better understand our waste activity and how to improve it. While councils are responsible for managing waste, we all play a part.

We trust you will find useful information in this report, and encourage you to have conversations with your council, within organisations and with each other about how we can collectively improve Otago's waste management. We look forward to supporting those conversations through the Forum.

Mayor Tim Cadogan
Chair, Otago Mayoral Forum
Mayor of Central Otago

Foreword from Ngai Tahu Rūnaka ki Otago

Kāi Tahu are encouraged by and support the Otago Mayoral Forum initiative to have this report on 'Waste and Recycling in Otago' prepared. The report helpfully summarises the national context and range of initiatives designed to improve waste infrastructure and management at the local and regional level.

The report usefully describes the current waste infrastructure in Otago and its adequacy, the nature and source of waste while also identifying issues and opportunities.

As mana whenua of the region, Kāi Tahu have long expressed the view that poorly sited and dysfunctional waste management systems pose a serious threat to the cultural values of whānau, hapū and iwi. A values system is required that recognises an interconnection between land, water, sea and air, and the ongoing welfare of people.

It is in this context that mana whenua have long been engaged during the era of the RMA with regional and local government in Otago on waste management policy and plan initiatives to achieve sustainable and positive outcomes for waste management.

This report is a positive contribution to informing not only councils and waste industry, but importantly community understanding of our waste activity. We join with the Mayoral Forum in encouraging the interest and engagement of all communities in finding better solutions to waste management in the region.

Edward Ellison
Upoko Rūnaka
Te Rūnaka o Ōtākou

Overview

This report is organised into five parts as follows:

National, regional and local context (p. 1) provides a summary of national policy, legislation, investment and other government initiatives, all in one place with weblinks where possible. The regional context includes plans and policies, and outlines connections with Southland. The section on local context looks especially at each district's Waste Minimisation and Management Plan.

Key infrastructure (p. 18) documents Otago's waste infrastructure, from large class 1 landfills to small-scale rural transfer stations and reprocessing facilities, and comments on their adequacy.

Waste flows (p. 32) presents volumes of landfill and kerbside waste, focusing on waste types that can be diverted with the right alternative solutions. It also covers what is known about farm waste.

Waste sources (p. 52) discusses individual waste sources: household recycling, tertiary institutions, hospitals, food processors, horticulture, boiler ash, construction and more, all at a regional scale.

Issues and opportunities (p. 75) presents the authors' assessment of key issues and opportunities for working together to address waste in Otago.

Waste and Recycling in Otago has been shared with everyone who contributed to its preparation.

Further electronic copies can be obtained by emailing secretariat@otagomayors.org.nz

1.0

National, Regional and Local Context

1.0 National, Regional and Local Context

1.1 National Context

The last four years has seen an increased focus on waste management and minimisation from central government and a correspondingly widened work programme. This ranges across policy, legislation, investment, and specific projects such as extended producer responsibility and material bans with the express intent of "accelerating New Zealand's transition towards a circular economy."

In this section, we look at how national policy and legislation is paving the way toward this important transition. In August 2021, the Ministry for the Environment (MfE) released its Waste Reduction Work Programme, which describes the various projects to be completed during the remainder of the political term (roughly to mid-2023) and beyond, and how these all interact and link.

The work programme sets out five objectives, and the relevant key workstreams are listed under these five headings. The key workstreams and objectives for this project include:

- a long-term waste infrastructure plan, to be published in 2022 to support the objective of 'building the foundations for a transformed waste system';
- establishing the Plastics Innovation Fund to support the objective 'expanding investment in the sector'
- revising and expanding the Waste Minimisation Fund, also in support of also 'expanding investment'
- several materials-focused projects as part of the 'individual material streams and products' objective – plastics, tyres, organics/food waste, construction and demolition materials, hazardous substances; all supported by regulated product stewardship.

In addition, there are several relevant over-arching workstreams that are described in following sections.

1.1.1 National Policy

The current New Zealand Waste Strategy (NZWS) was released in October 2010.

MfE has released a draft revised New Zealand Waste Strategy, which was open for consultation until late 2021. The proposed Strategy has a focus on achieving a more 'circular economy' for waste, and sets out a multi-decade pathway towards this. MfE is currently considering submissions on the draft document.

1.1.2 National Legislation

There are five important pieces of legislation that impact on the management of waste in New Zealand. These are discussed briefly below.

1.1.2.1 The Waste Minimisation Act 2008

The Waste Minimisation Act 2008 (WMA) provides a regulatory framework for waste minimisation and aims to encourage a reduction in the amount of waste disposed of in New Zealand.

Alongside the development of a revised NZWS, MfE is also currently working on a review of the WMA to improve or amend provisions and consider new provisions. The provisions for use of landfill levy funds and the administrative and decision-making processes around this use will also be reviewed and improved. As for the NZWS, consultation on possible changes took place during November/December 2021. This review will also consider whether, and how, the Litter Act (1979) could be reviewed to better integrate with and support the WMA.

The WMA has been amended by the 2021 waste disposal levy regulations, which set out the progressive increase and expansion of the landfill levy starting 1 July 2021; and supplemented by regulations banning specific items, including microbeads (2017) and plastic shopping bags (2018).

Currently, the WMA provides for half of the revenue from the waste levy to be distributed to territorial authorities (TAs). These funds are provided pro rata, based on population, and must be spent on waste minimisation and in accordance with each authority's Waste Minimisation and Management Plan (WMMP).

1.1.2.2 Emissions Trading Scheme (ETS)

Since 2013, Class 1 landfill owners have been required by the Climate Change (Emissions Trading) Amendment Act 2008 to surrender emission units to cover methane emissions. If any solid waste incineration plants are constructed, this act would also require emission units to be surrendered to cover greenhouse gas emissions from the incineration of household wastes.

Some landfill operators have reduced their liabilities under the ETS through use of a unique emissions factor (UEF). UEFs rely either on a landfill having methane capture technology or limiting biodegradable waste.

Other landfills use a default emissions factor for waste (DEF). This is the methane assumed to be generated by each tonne of waste and is currently 1.19 tonnes of CO_2-e (CO_2 equivalent). However, during May 2021 MfE consulted on some possible changes to the ETS including:

- special treatment for waste removed from a closed landfill (not currently falling under the ETS) and re-disposed of at another landfill (that does fall under the ETS)
- decreasing the DEF from 1.19 to 0.91 to reflect the most recent composition estimate for waste going to Class 1 landfills

In early 2022, New Zealand units (NZU) were selling for around $85. Based on an NZU figure of $80 and a DEF of 1.19 the ETS adds $87.60 to the cost of disposing of a tonne of waste. However, the application of a UEF could lower this cost substantially.

Class 2-5 landfills and closed landfills (along with certain other excluded landfills) are not currently covered by the ETS.

1.1.2.3 Local Government Act 2002

The Local Government Act (LGA) sets out the decision-making and consultation processes TAs must follow to prepare or review a WMMP.

The LGA was amended in 2012 by the Local Government Act 2002 Amendment Act 2012 (the LGA Amendment Act), with the aim of encouraging local authorities to focus more on cost-effective service provision.

The LGA was further amended in 2014, with these amendments encouraging collaboration and shared services, more flexible consultation requirements, provision for new significance and engagement policies, and new requirements for asset management planning and infrastructure strategies.

The 2014 amendments also included requirements for carrying out regular service delivery reviews. In 2017, the councils of the Otago region undertook a region-wide, high level, section 17A assessment for solid waste services.

1.1.2.4 The Resource Management Act 1991

The Resource Management Act 1991 (RMA) also has significant implications for waste management and minimisation activity by placing controls on the environmental effects of activities and facilities through national, regional, and local policy, standards, plans, and consent procedures. Government has considered the recommendations of the Resource Management Review Panel and will, during this current term, repeal the RMA and replace it with three new acts:

1. Natural and Built Environments Act
2. Strategic Planning Act
3. Climate Change Adaptation Act

The Natural and Built Environments Act (NBA) is likely to be the key replacement legislation. While not yet clear what all the ramifications will be for waste management and minimisation, one likely outcome is that various regional rules will be aligned and consolidated in a shorter list of national environmental standards.

1.1.2.5 Hazardous Substances and New Organisms Act (HSNO)

This Act, along with the 2015 Amendment Act, addresses the management (including disposal) of substances that pose a significant risk to the environment and/or human health. The Act relates to waste management primarily through controls on the import or manufacture of new hazardous materials and the handling and disposal of hazardous substances.

Depending on the amount of a hazardous substance on site, HSNO sets out requirements for material storage, staff training and certification. These requirements need to be addressed within operational and health and safety plans for waste facilities.

Hazardous substances commonly managed include used oil, household chemicals, asbestos, agrichemicals, LPG and batteries.

HSNO provides minimum national standards that may apply to the disposal of a hazardous substance. However, under the RMA a regional council or TA may set more stringent controls relating to the use of land for storing, using, disposing of, or transporting hazardous substances.[1]

1.1.3 Investment

1.1.3.1 Waste Minimisation Fund

The Waste Minimisation Fund (WMF) is a key source of funding for waste minimisation projects. The purpose and operation of the WMF is described on MfE's website.

While only a few projects across the Otago region have benefited from funding through the WMF, some national-scale projects have included the region. Examples of Otago projects funded through the WMF include:

- 'Agriwaste to wealth', University of Otago (completed in 2012)
- 'ResOURceful Communities', Wanaka Wastebusters (2018 – 2021)
- 'Otago Polytechnic Resource Recovery Hub', Otago Polytechnic (in progress since 2019)

The most recent 2021 funding round had a focus on organic waste, and construction and demolition waste.

1.1.3.2 InfraCom

Te Waihanga, the Infrastructure Commission was established in 2019 with the goal of making infrastructure investment in New Zealand more purposeful and strategic, including investment in waste infrastructure. Te Waihanga released its findings in the 'Infrastructure for a Better Future' consultation document in May 2021.

1.1.3.3 COVID-19 Response and Recovery Fund

A proportion of this fund was invested in waste management and minimisation infrastructure. While no investment was made into the Otago region specifically, some funding was provided to national projects, such as Plasback, with a baler funded for several locations including Waimate.

1.1.3.4 Other Funds

There are a number of funding streams that are focused on specific waste material types:

[1] From: MfE 2009: Waste Management and Minimisation Planning, Guidance for Territorial Authorities.

- Plastics Innovation Fund: As of 1 November 2021, any legal entity can submit an expression of interest for funding from the $50 million fund that supports the reimagination of how plastics are made, used and disposed of. Funding is available for, amongst others, designing out waste, new products, improved recycling and new technologies; and
- Glass Forum: a proportion of the levies paid by Glass Packaging Forum members provide a contestable fund for initiatives that "improve outcomes for glass" such as infrastructure, equipment, or funding for research.

1.1.4 Other Relevant Initiatives

1.1.4.1 Emissions Reduction Plan

The Climate Change Commission (CCC) was established to provide impartial expert evidence to government to support initiatives that would reduce greenhouse gas emissions and address climate change mitigation and adaptation, contributing towards the goals set out in the Climate Change Response Act 2002. The CCC reviewed the waste sector as part of its work during 2020 and 2021 and has provided its final advice to government with respect to this sector, amongst others.

The recommendations for the waste sector included an increase in waste minimisation infrastructure investments to decrease methane emissions from waste by at least 40% by 2035 from 2017 levels. New Zealand has a long-term target of net zero greenhouse gases by 2050, and a specific target for biogenic methane of 24 – 47% reduction by 2050 under the Climate Change Response Act (2002 Act).

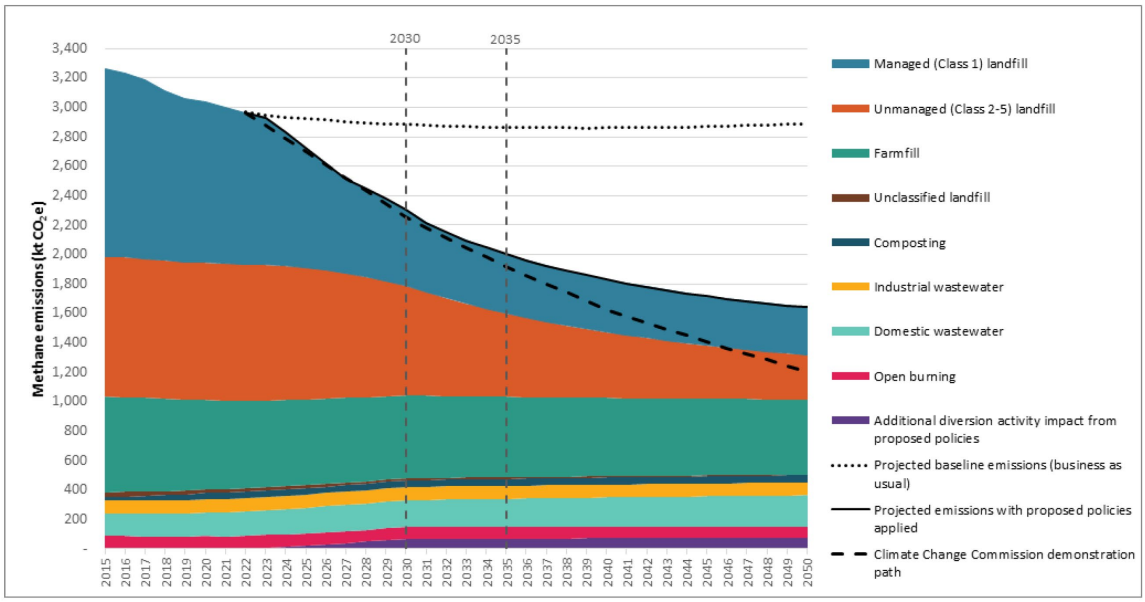
The advice of the CCC is that unless waste management practices and policy settings in New Zealand change significantly, we will not meet the targets set in the 2002 Act. Comprehensive action is required to reduce waste overall, divert waste from landfill disposal, and improve/extend landfill gas capture systems.

The main source of biogenic methane emissions from the waste sector is the anaerobic decomposition of organic wastes in landfill (81%). As one possible way to significantly reduce this, the emissions reduction plan proposes "key organic materials such as food, green, and paper waste could also be banned from Class 1 landfills by 2030" with a note that this could also be extended to wood waste. Further possible methods to reduce organic waste going to disposal include food and green waste collections, services to enable commercial premises to divert food and green waste, better paper and cardboard recycling, and improvements to infrastructure such as transfer stations and material recovery facilities (MRFs).

Other relevant proposals relate to reducing the generation of food waste, construction and demolition waste, and options to divert treated timber from disposal.

It is worth noting that even with all of the initiatives proposed this would still fall short of achieving the CCC's proposed target for waste emissions, as shown in Figure 3.

Figure 1: Total projected methane emissions from waste showing the impact of proposed combined waste policy options



Source: Ministry for the Environment. 2021. *Te hau mārohi ki anamata | Transitioning to a low-emissions and climate-resilient future: Have your say and shape the emissions reduction plan.* Wellington: Ministry for the Environment.

1.1.4.2 Container Return Scheme

Container return schemes (CRS) place a deposit on all containers when sold. This deposit can then be redeemed by consumers when they return the containers. These schemes are in wide use worldwide including Australia and are designed to promote higher rates of recovery of containers and reduce littering by providing an incentive to consumers.

In 2019, a WMF-funded project led by Auckland Council and Marlborough District Council embarked on the research and design of a potential container return scheme for New Zealand. The outcomes from this project were reported to MfE, who have analysed the information and produced advice for ministers.

MfE is now seeking feedback on a detailed implementation proposal for a container return scheme in New Zealand. This is included in the 'Transforming Recycling' consultation document, and consultation closes on 8 May 2022.

1.1.4.3 Kerbside Standardisation

WasteMINZ was commissioned by MfE to complete a national review of kerbside collections and make recommendations as to how to achieve consistency across the country. The report was completed in 2020, and MfE is currently considering implementing the three main recommendations:

1. A standard set of items accepted in kerbside recycling collections
2. Glass collected separately to other material streams
3. A weekly kerbside food waste collection service for households.

MfE is now seeking feedback on a detailed implementation proposal for kerbside standardisation in New Zealand. This is included in the 'Transforming Recycling' consultation document, and consultation closes on 8 May 2022.

The proposals include, alongside the points above from the original review, options to achieve the diversion of food waste from businesses. The three possible options set out in the consultation document are:

- Phasing in source-separation of food waste only from businesses that produce or sell food;
- Phasing in source-separation of food waste from all businesses; or
- Prohibiting the disposal of food waste to landfill entirely (which would also preclude disposal of food waste from household sources).

1.1.4.4 TA Performance Reporting

In addition to the proposals for a container return scheme and the standardisation of kerbside recycling, the MfE's current consultation also covers a number of related issues.

One of these is the requirement for TAs to report to MfE on a number of performance standards/targets; including a minimum 50% diversion standard for dry recyclables and food waste in kerbside collections. This is supported by a 70% high performance 'stretch target' which would be non-enforceable, but is intended to further encourage and motivate TAs.

The proposal is that the minimum standard would need to be achieved by 2030, to align with timeframes proposed in the draft New Zealand Waste Strategy and the ERP.

1.1.4.5 Priority Products

Until July 2020, the ability under the WMA to name a product as a 'priority product' had not been used. Once a product has been named such, an extended producer responsibility approach must be taken and a regulated product stewardship scheme developed. The first six priority products named were:

1. Plastic packaging
2. Tyres
3. Electrical and electronic products (e-waste including large batteries)
4. Agrichemicals and their containers
5. Refrigerants
6. Farm plastics

Working with industry, MfE has developed product stewardship schemes for tyres, large batteries, refrigerants, and agrichemicals. Consultation has commenced for tyres and large batteries, and due to take place in the second half of 2022 for refrigerants and farm plastics.

1.1.4.6 Infrastructure Investment Strategy

With the increased and expanded landfill levy comes an increased pool of funds that can be invested in waste management and minimisation initiatives.

MfE is developing a proactive strategic investment plan for waste infrastructure, supported by a detailed stocktake of current infrastructure and prioritisation of possible new infrastructure. The goal of this work is to give a national view of the waste investment New Zealand needs over the next 15 years. It is due for completion in mid-2022.

1.2 Regional Context

In this section, we consider the responsibility of territorial authorities, the regional council and mana whenua on waste minimisation in what is New Zealand's second largest region in terms of land mass.

In Otago, distances between the major centres of the regions are significant, as are the distances within the Otago region – Queenstown is a 3 ½ hour/280km journey from Dunedin. This is significant in terms of accessing waste facilities.

Geographically, the administrative centres of the five TAs within the Otago region fall into three groups:

1. Coastal Otago – Dunedin and Waitaki represented by the Dunedin City Council (DCC) and Waitaki District Council (Waitaki DC)
2. Central Otago – Queenstown Lakes and Central Otago represented by Queenstown Lakes District Council (QLDC) and Central Otago District Council (CODC)
3. Clutha District Council (Clutha DC), which is roughly equidistant from Invercargill and Dunedin

The three southern Otago TAs (QLDC, CODC, Clutha DC) are geographically closer to the Southland TAs than they are to Dunedin, with Invercargill a 2 ½ hour/188 km journey from Queenstown.

1.2.1 The Regional Council

The Otago Regional Council (ORC) has adopted plans and policies that guide environmental management, iwi engagement, and waste management across the region. The statutory role of regional councils such as the ORC in waste management and minimisation generally relates to managing the potential environmental impacts (on air, land and water) of how waste is managed or minimised. Regional plans dictate whether specific types of activities are permitted activities that don't require a consent; or if a consent is required, what needs to be considered.

In the Otago region, there are currently three separate plans pertaining to Air, Coast, and Water. There is also a specific Waste Plan.

The Regional Council is currently reviewing its Water and Waste Plans toward producing a new Land and Water Plan that will incorporate waste provisions.

1.2.1.1 Kāi Tahu strategies and policies

As tangata whenua of the South Island, Kāi Tahu has produced strategies and policies that have implications for solid waste management:

- Natural Resource Management Plan (2005) – key issues are:
  - Preventing human waste discharge to water and food production land
  - Contaminated land from landfills, industrial sites and waste disposal sites – requiring site remediation plans
  - Waste discharges from mining
  - Impact on waterways from waste activities including disposal, biosolids management, coastal littering, tourism-associated waste
  - Investigating the location of informal dumps particularly from the mid-20th century
- Te Tangi a Tauira (the Cry of the People), Ngāi Tahu ki Murihiku Natural Resource and Environmental Iwi Management Plan (2008) – key issues are:
  - Ensure waste disposal does not adversely affect tangata whenua values with high standards for waste disposal consents
  - Contribute to central government waste reduction initiatives
  - Reducing waste generation, maximising re-use, recycling and recovery
  - Zero waste at marae
  - Supporting community-based recycling schemes
  - High environmental standards for waste facilities
  - Promoting community awareness, zero waste, and economic incentives and communication between communities
  - Clear responsibility for legacy, closed, or unused landfill sites

Te Tangi a Tauiri is formally recognised by Queenstown Lakes District Council – the Murihiku Runānga Rohe extends into the Queenstown Lakes District.

1.2.1.2 Otago's Emissions Project

A report by Ernst & Young in May 2021 developed a greenhouse gas emissions profile for the Otago region. The report considered emissions across stationary storage, transportation, agriculture, waste, and industrial processes and product use, as well as offsets from the 'land use, land use change and forestry' (LULUCF) sector. It also provided a breakdown of the results by TA.

Overall, the report found that Otago's largest source of emissions is agriculture (65%), with waste accounting for 6% of gross emissions. The proportion of emissions from waste would appear to be slightly higher than, but still broadly consistent with, the National Greenhouse Gas Inventory , which estimates emissions from waste at about 4% of gross emissions nationally.

Table 1 shows the emissions from waste split by sub-classification and district.

Table 1: Summary of Carbon Emissions from Waste

	Central Otago	Clutha	Dunedin	Queens-town	Waitaki	TOTAL	%
Active Landfills	0	6,947	49,005	26,684	117	**82,753**	28%
Closed Landfills	396	0	3,116	120	0	**3,632**	1%
Wastewater treatment and discharge	1,084	3,386	13,852	5,005	11,766	**35,093**	12%
Farm fills and rural waste	47,525	78,221	38,020	12,191	1,156	**177,113**	59%
TOTAL	**49,005**	**88,554**	**103,993**	**44,000**	**13,039**	**298,591**	**100%**
Percent	16%	30%	35%	15%	4%	**100%**	

There are a couple of points to note on the above data: the report did not account for waste generated in a district but disposed of out of the district; and farm fills and rural waste are likely to be overstated due to the methodology selected.

We have provided feedback to the ORC on each of these points to inform future iterations of the Otago emissions inventory. Until such time, the 2021 report is the best available information.

1.2.2 Southland Connection

Geographically, facilities in Southland are as accessible as facilities in other parts of Otago; Queenstown, for example, is 100km closer to Invercargill than to Dunedin.

The central Otago councils including QLDC, CODC and CDC report that they have a significant ongoing working relationship with WasteNet Southland, which manages solid waste issues on behalf of the Invercargill, Gore and Southland councils.

The three districts also make use of significant waste facilities in Southland, such as the AB Lime landfill near Winton and aggregating/processing of farm waste, for example silage wrap.

These TAs have also been watching progress on various possible organic waste processing facilities, which could be located within reach of both Southland and the three southern Otago councils, while having the benefit of being in a rural area.

Invercargill City Council had previously indicated plans to progress an organic-waste focused project over the three years from July 2021, but it has now revised these plans

and instead intends to undertake a wider review of waste activities in the Invercargill area, with the intention of delivering a business case towards the end of 2022. This review will look at what materials are collected for recycling or other processing in Invercargill, what processing options exist, and what end markets are available.

1.3 Local Context

All councils in New Zealand are required, under the WMA, to adopt a Waste Minimisation and Management Plan (WMMP). These plans must be reviewed at least every six years, or sooner, and should set out how waste in the district or city is to be 'managed or minimised'. While the Plans are developed and adopted by councils, they need to consider all waste not just council-controlled waste such as household kerbside collections.

WMMPs are supported by Waste Assessments, which are technical documents intended to pull together the relevant information and data relating to waste in the city and district, providing the context for the WMMP by identifying the key waste management and minimisation issues.

1.3.1 Queenstown Lakes District Council

QLDC last reviewed its WMMP in 2018 and completed a Waste Assessment in 2019.

While the QLDC WMMP doesn't strictly include a list of 'key issues', the Plan highlighted that large quantities of organic, glass, and construction and demolition waste were going to landfill.

QLDC used a 'programme business case' approach to identify the preferred approach for the six-year term of the Plan. From the seven programmes outlined, ranging from do minimum (programme 1) to aspirational (programme 7), programme 6 was chosen which had a focus on glass and organics. This decision meant that any significant action on construction and demolition waste would largely be deferred for the course of this Plan.

The planned programme of work was forecast to achieve a 19% decrease in waste to landfill during the term of the WMMP.

It should be noted that Council is also working on biosolids, which would continue to be implemented alongside the WMMP.

Since the adoption of the WMMP, two additional key issues have arisen:

1. The Queenstown materials recovery facility (MRF) is beyond its anticipated life and is currently struggling to cope with incoming recyclables from the QLDC area. CODC also currently relies on the Queenstown MRF for processing of recyclables, and frequently has to stockpile recyclables or transport them to Southland disAbility Enterprises (SdE) for processing.
2. The sub-region lacks a full facility resource recovery park with large capacity. Wanaka benefits from Wanaka Wastebusters, a social enterprise operating on Council land, but this operation does not have the space or resources to serve

the wider sub-region, and is roughly one hour from Queenstown and 45 minutes from Cromwell.

QLDC has identified a site near Queenstown that could potentially accommodate a new MRF and full resource recovery hub. It is currently exploring the consenting and site requirements.

The QLDC 2021 long term plan (LTP) confirms funding for two key work areas:

1. $519k over three years to research and trial methods to divert organic waste from landfills, with a reference to possible MfE diversion targets (although no capital funding for implementing solutions has been allocated);
2. Funding for the proposed Wakatipu MRF/transfer station to form the beginning of a more extensive resource recovery centre is brought forward to start in year 6, allowing the current MRF in Frankton to be decommissioned.

QLDC has a Climate Action Plan (CAP), adopted in 2019 and with a further revision due shortly. The CAP identifies greenhouse gas emissions from landfills as an example of emissions that need to be reduced. The 'keystone action' of Outcome 5 (our economy and natural environment thrive together) is to *"work with the tourism system to become a net zero carbon and zero waste destination…"*

The CAP also notes that a circular economy contributes to climate benefits, compared to a traditional linear economy.

1.3.2 Central Otago District Council

Central Otago District Council's WMMP, and supporting Waste Assessment, were adopted in 2018 and 2017 respectively.

Key issues identified in the WMMP include:

- An increasing percentage of kerbside refuse going to landfill
- Capacity of kerbside collection containers and frequency of service
- Fees and charges for waste services
- Needs of urban vs rural householders
- Biosolids management
- Hazardous waste disposal
- Large quantities of construction and demolition waste going to landfill
- Public place waste management

The issues relating to kerbside containers and servicing frequencies have partially been resolved following changes made to council's services. These changes have also slightly decreased the percentage of kerbside refuse going to landfill, although not significantly.

While biosolids management is identified as a key issue, management of organic waste overall was not, and this has since been noted as an area needing addressing.

Central Otago currently rely on using QLDC's MRF. This facility is beyond its anticipated functional life and is struggling to cope with the recycling material collected within QLDC's area. If the operator doesn't have capacity to take CODC's material, it needs to

be stockpiled until they do or sent elsewhere. This raises cost, through double-handling, and reduces the quality of the material.

With CODC also using the Victoria Flats landfill (although they do use AB Lime for small quantities), it is largely reliant on QLDC for significant waste infrastructure.

CODC is also experiencing ongoing difficulties in recycling bottle glass as they are unable to meet the logistics operator 5R's contamination requirements. It has concluded that the best option is to crush the glass and send it for different end uses (such as roading and footpath base course) rather than attempting to meet the contamination requirements which would enable the glass to be sent to Auckland for reprocessing into new bottles. CODC has purchased a crusher to enable this to occur.

Other waste management issues in the Central Otago district that are not directly highlighted in the Council's WMMP include:

- Management of agricultural, viticultural and horticultural organic wastes:
    - the majority of these currently appear to be managed on-property. A small amount of fruit processing waste reaches the vermicomposting facility at Cromwell; however, this is only a very small proportion of the expected overall volume. Local waste operators report that they do service these properties but only to move the wastes from one part of the site to another. While no water quality issues have been identified in the sub-region (in comparison to Marlborough, where viticulture waste was causing significant and noticeable issues with water quality), this is a potentially large waste stream and management of this could be better understood.
- Organic waste management generally, with audits at Victoria Flats showing that household rubbish is roughly one third food waste.
- Better management of rural non-household waste generally.

CODC's 2021 LTP indicates that council would work on a plan for greenwaste for implementation through the 2024 LTP, with a possible district-wide greenwaste collection and processing system. No significant changes were made with respect to waste management and minimisation planning, with the focus for the next three years on reviewing existing waste services and re-tendering contracts for these; alongside investigation of improvements to the Cromwell transfer station and greenwaste processing.

In September 2021 CODC consulted with their community regarding waste collections and facilities, with a focus on the renewal of its rubbish and recycling services contract by 1 July 2023. Two of the new collection service packages include a four-weekly greenwaste collection from a 240L wheeled bin, while the third incorporates a weekly collection of mixed food and greenwaste from a smaller bin. The community feedback and the subsequently released central Government consultation on a new waste strategy, "Taking Responsibility for our Waste" have informed the structure of the contract that was put out for tender in January 2022. A decision on the new contract award is expected July 2022.

CODC has a Sustainability Strategy, adopted in 2019. This strategy mentions various undesirable activities, including 'waste or biomass burning' (due to air quality impacts). Waste-related actions include:

- Waste audit for council facilities
- Aligning community education provision with waste management and minimisation plan objectives
- Measuring progress using waste per capita to landfill
- Reporting through a six-monthly review with the Waste and Property Committee

1.3.3 Clutha District Council

Clutha DC's administrative centre, Balclutha, is roughly equidistant from Dunedin and the main centre of Southland, Invercargill. The council maintains strong links with Southland, and in this way is strategically aligned with the Central Otago councils; but also has strong links with Dunedin.

Clutha DC owns and operates a small, unlined landfill at Mt Cooee. All kerbside recyclables from the Clutha district are transported to Dunedin's MRF, which does not accept glass. Glass can be taken to Mt Cooee, where it is used in landfill engineering.

Clutha DC's current WMMP was adopted in 2018. Key action areas from this Plan include:

- Evaluating options for beneficial use of glass
- Investigating and evaluating benefits of landfill gas capture/flaring at Mt Cooee
- Investigating and evaluating the best way to reduce organic waste to landfill

In addition, Council is working on two key infrastructure projects:

1. The possible extension/renewal of the resource consent for a landfill at Mt Cooee, with the existing consent due to expire during 2023
2. The development of a resource recovery park at the Mt Cooee site, to be co-located with the landfill

Clutha DC are also aware that DCC are currently progressing a new landfill site and, if this is located towards the south of the DCC area, this could potentially be an alternative disposal avenue for Clutha District's waste.

Clutha DC's WMMP describes a kerbside organics collection and subsequent composting as being financially out of reach; although this could change should a regional or sub-regional collaborative project address this waste stream.

The extension of kerbside collection services, particularly recycling, to suburban and some rural areas is also explored; but ruled out as too costly. These areas will continue to be supported through drop-off and rural transfer station sites.

In its 2021 LTP, Clutha DC make it clear that it plans to invest in a long-term consent extension for Mt Cooee landfill to 2053, alongside development of a resource recovery park on the site; at a total estimated cost of $3.4M for consenting and associated work. Increasing diversion from landfill beyond the current 9% is a key goal, and the

introduction of liners for new landfill cells could enable better management of landfill gases.

While construction and demolition waste is highlighted as a key source of landfill waste, the LTP provides no budget to directly address this issue; although it is noted that data will be collected to feed into the 2022/23 waste assessment process.

1.3.4 Dunedin City Council

DCC has several strategic initiatives that are intended to guide action in the waste sector. These include:

- A WMMP (2020)[2] which embodies a zero waste and circular economy approach
- The Waste Futures project which an overarching programme of work for waste services and infrastructure taking a whole of systems approach and based on a Better Business Case methodology
- A target of net zero carbon emissions from waste by 2030

The Green Island Landfill is due to close in 2023. Work is ongoing to develop a new landfill at Smooth Hill, just south of the city. At this stage it is anticipated construction on the new landfill could start in 2024/5. The latest plans announced suggest that the new landfill may be smaller than originally intended, in order to meet local environmental concerns.[3]

In the intervening period between Green Island closing and Smooth Hill opening it is likely that waste will have to be transported out of the region for disposal – most likely to AB Lime in Southland.

While Dunedin is the largest population centre in the region and can achieve sufficient economies of scale for most types of facility on its own, it is geographically distant from much of the rest of the region, with only Waitaki and Clutha in relatively close proximity from a transport and material flow perspective.

During consultation on its 2021 LTP, DCC sought the community's views specifically on options for kerbside collections. The two proposed options were:

1. Four bins for glass, other recyclables, food waste and residual waste (plus an optional greenwaste bin) for $270 - $310 per year
2. Three bins – excluding the food waste collection - costing $260 - $300 per year.

Following consultation, DCC confirmed the preferred option is option 1, and aims to implement this from mid-2023 as part of the wider Waste Futures project.

[2] https://www.dunedin.govt.nz/__data/assets/pdf_file/0020/342902/WMMP-Waste-Minimisation-and-Management-Plan-Updated-May-2021-WEB.pdf
[3] https://www.odt.co.nz/news/dunedin/smaller-smooth-hill-landfill-proposed

1.3.5 Waitaki District Council

In 2017, Waitaki DC signed a memorandum of understanding (MOU) with Waste Management (WAM) and The Waitaki Resource Recovery Trust (WRRT) to facilitate the ongoing provision of waste and recycling services to the community. Under the agreement WAM will provide a transfer station for the public and the WRRT will receive all recycling. The MOU states that the parties will endeavour to ensure that all waste they control is processed through the WAM RTS and the recycling through the WRRT resource recovery facility. It puts certain obligations on the parties to provide fair access, including operating hours, and provide waste diversion options. It also provides for the provision of data and reporting. The Council financially supports the WRRT to deliver waste minimisation outcomes.

In Waitaki, waste is almost entirely controlled by the private sector. The Council provides no kerbside collections or recycling services and does not own a transfer station in Ōamaru (the largest centre). It owns four rural recovery parks (transfer stations) located at Ōtemātātā, Ōmārama, Kurow and Hampden, and a landfill in Palmerston which is used by the local community (it accepts 250tpa), and recycling drop-off facilities in Papakaio, Enfield and Herbert;

Waitaki DC's 2021 LTP addresses the Palmerston landfill, and outlines plans to make best use of the remaining life and closure. The LTP also proposes that Council work more closely with the Waitaki Resource Recovery Trust and other providers on education and waste minimisation, and review the 2010 solid waste bylaw.

A full-time Waste Minimisation Officer has recently been employed.

1.3.6 Solid Waste Bylaws

Three of the five TAs in the Otago region have current solid waste bylaws.

These bylaws vary in detail and scope, and only support waste operator licensing and limited data collection. This is a key aspect as, like many other regions, much of the waste in the Otago region is managed by the private sector. Being able to access data relating to the quantities, types, and management pathway of these wastes is crucial in being able to complete a detailed waste assessment and develop a comprehensive WMMP.

2.0

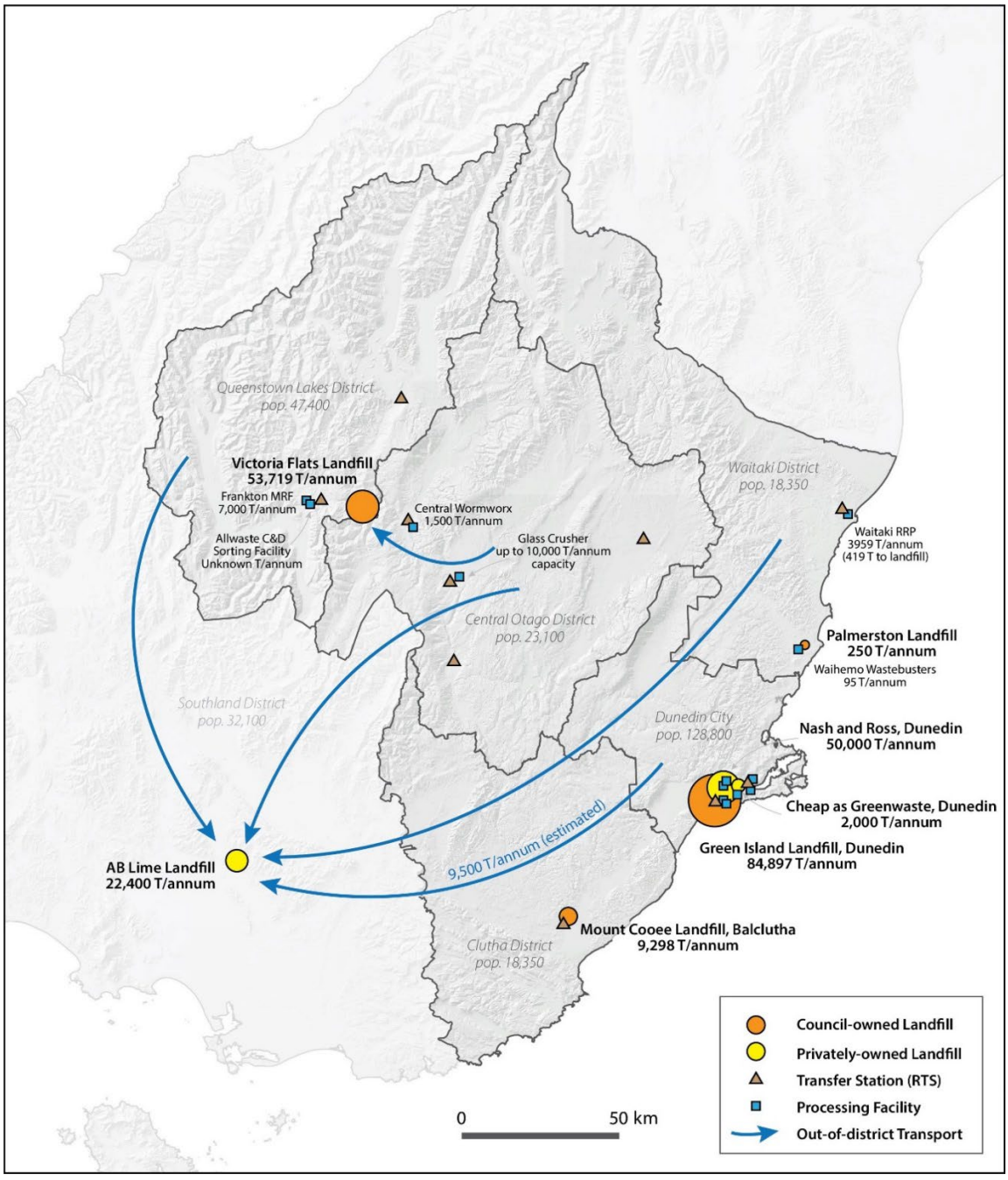
Key Infrastructure

2.0 Key Infrastructure

This section describes the existing waste management and minimisation infrastructure across the Otago region, and further afield where applicable – for example, the main glass recycling facility in New Zealand is in Auckland.

The map below shows the key infrastructure of the Otago region and nearby. It also shows (where known) annual tonnages and movements between council areas and into the Southland region.

Figure 2: Significant Waste and Recovery Infrastructure



Facilities have been split into categories depending on their role – landfills, transfer stations/recycling centres (these are often co-located), and infrastructure that accepts collected recycling for reprocessing.

2.1 Disposal Infrastructure (Landfills)

Landfills in New Zealand are generally identified as one of five 'classes', according to the WasteMINZ' 'Technical Guidelines for Disposal to Land'. The five classes of landfills are summarised below.

Class of landfill	Description
Class 1 - Municipal Landfill	A Class 1 landfill accepts municipal solid waste. It generally also accepts construction and demolition waste, some industrial wastes and contaminated soils. Functionally the equivalent of a "disposal facility" as defined in the WMA.
Class 2 - Construction and demolition / Industrial Landfill	A Class 2 landfill accepts non-organic wastes including construction and demolition wastes, inert industrial wastes, managed fill material, and clean fill material.
Class 3 - Managed Fill	A Class 3 landfill accepts materials comprising predominantly clean fill materials, but also includes other inert materials and soils with chemical contaminants.
Class 4 - Controlled Fill	A Class 4 landfill accepts predominantly controlled fill and cleanfill materials but may also include soils with chemical contaminants;
Class 5 - Cleanfill	A Class 5 cleanfill accepts only clean excavated natural materials.

Until 1 July 2021, only Class 1 landfills paid the landfill levy. The landfill levy has now been extended to Class 2-4 landfills, and is also now scheduled to increase annually as described in section 1.1.2.1.

The table below lists key disposal facilities, including all known landfills that accept waste produced within the Otago region.

Table 2: Disposal Facilities

Facility	Detail	Annual Tonnage
Green Island Class 1 landfill, Dunedin	Owned by DCC, disposes of waste from Dunedin. Operated by Waste Management NZ. Consent expires 2023. DCC are currently developing plans for a new landfill which will be located towards the south near Henley (Smooth Hill specifically).	84,897
Mt Cooee Class 1 landfill, Clutha	Owned/operated by Clutha District Council, disposes of waste from Clutha District (has in the past accepted waste from out of district). Consent expires 2023, but Council has resolved to seek a new consent to 2053.	9,298
Victoria Flats Class 1 landfill, Frankton	The Victoria Flats Landfill is owned and managed by Scope Resources. The land is owned by QLDC, and the landfill operates under a BOOT (Build Own Operate Transfer) contract, which expires at the end of June 2034. The landfill consent expires in 2032. Waste from CODC is also received at the Victoria Flats Landfill through this arrangement (until 2029), with QLDC administering this contract with Scope Resources on behalf of CODC. Scope Resources recently invested significantly in gas capture and flare infrastructure to reduce emissions and is recovering the cost through operating fees.	53,719
Palmerston Class 1 landfill, Waitaki	Owned by Waitaki District Council. Currently operates to accept only local waste, but has no annual tonnage limit.	250

Facility	Detail	Annual Tonnage
AB Lime Class 1 landfill, Southland	Owned by AB Lime. Accepts waste from Oamaru and Dunedin, and some waste (screenings and/or biosolids) from Central Otago and Queenstown Lakes. AB Lime recently received consent for receiving unlimited tonnage into its facility (although the facility footprint won't change).	22,400
Nash & Ross Class 2 landfill, Dunedin	Class 2 landfill taking construction and demolition waste and contaminated soils. Accepts everything except household waste, greenwaste, and hazardous waste. Can take asbestos. Consented to 2036 but enough airspace for 80 years at current rates of fill.	50,000
Cheap As Greenwaste, Kaikorai Valley, Dunedin	Accepts domestic and landscape greenwaste. Mulches material and uses on site.	2,000[4]
Parkburn Quarry Class 4 landfill, CODC	Owned and operated by Fulton Hogan.	Not available
Various Class 4/5 Cleanfills	In Queenstown, Scope Resources and Wilsons Contractors on Kingston Rd and Fulton Hogan on Shotover Delta Rd. A cleanfill facility in Clutha district recently closed due to increasing regulation and landfill levy requirements.	

[4] No weights available. Estimates are based on information supplies of 60m3 per day at a bulk density of approximately 91kg/m3 (1,971 tonnes per annum)

2.2 Transfer Stations and Recycling Centres

Transfer stations are sites where a wide range of materials are accepted, including recyclables, and can be open to the public or only available for use by waste companies. Resource recovery centres or recycling centres are usually sites that focus on accepting material that can be reused, recovered, and reprocessed – although they may sometimes accept small quantities of landfill rubbish.

Table 3: Transfer Stations & Resource Recovery Centres

Facility	Detail	Annual Tonnage (where known)
Green Island RTS, Dunedin	Owned by DCC, disposes of waste from Dunedin. Operated by WAM. The RTS separates out material on the current Green Island Landfill site. Site is due for redevelopment into an RRP when the new contract commences and the landfill closes.	Mixed recyclables (glass, fibre, plastic, metal): 1260 Greenwaste: 500 Batteries: 3.7 Gas Bottles: 7.8 Clothing: 25.3 Oil: 1.7 Special / Hazardous: 3
Dunedin Inner-City Cardboard Collection	Cardboard from businesses. Provided by DCC.	Cardboard: 169
Inner city recycling hubs (PLUS - Glass from bottle banks AND Public Places Recycling), Dunedin	Comingled recycling including cardboard. Provided by DCC.	Glass: 123 Comingled: 60
Rural resource recovery (incl Green Island, Pop ups & BP stations), Dunedin	Provide rural drop off sites: Waikouaiti and Middlemarch Transfer Stations. Rural recycling Hoopers inlet, Lee Stream. Rural skip days 3x year in Sawyers Bay, Warrington, Long Beach, Aramoana, Outram, Allanton, Portobello, and Henley/Berwick	113

Facility	Detail	Annual Tonnage (where known)
Wickliffe St RTS, Dunedin	Owned and operated by Waste Management Ltd.	Not available
Rural Recycling and RTS, Dunedin	Provide rural drop off sites Waikouaiti and Middlemarch Transfer Stations. Rural recycling Hoopers inlet, Lee Stream. Rural skip days 3x year in Sawyers Bay, Warrington, Long Beach, Aramoana, Outram, Allanton, Portobello, and Henley/Berwick	
Oamaru RTS (Waitaki)	Owned and operated by Waste Management Ltd; not open to the public. Waste goes to AB Lime in Southland.	10,000 (estimate)
Waitaki Resource Recovery Park, Waitaki	Waitaki Resource Recovery Park (WRRP), owned by Waitaki Resource Recovery Trust and supported by Waitaki District Council, handles all recycling from Waitaki district.	Card 550 E-waste: 181 Glass: 615 Metal 85 Paper 300 Plastic 157 Reuse: 641 Total: 3,959 (including landfill and organics)
Waihemo Wastebusters, Waitaki	Collect recycling and reuse from Palmerston; operated by Waihemo Wastebusters. It is open for nine hours a week and has a re-use shop. Recovered materials are transported to the WRRP.	Mixed recyclables: 81.5 Reuse store: 13 Other reuse: 0.5 Total: 95
Rural Recycling Centres, Waitaki	Waitaki District Council owns 4 rural transfer stations located at Hampden, Ōmārama, Kurow & Ōtemātātā. These sites are managed under contract. There are three unstaffed recycling drop off centres in Enfield, Papakaio and Herbert.	These sites supply an estimated 2,000 tonnes of the 4,000 tonnes processed by WRRT annually

Facility	Detail	Annual Tonnage (where known)
Mt Cooee landfill, Clutha	The transfer station at the landfill also accepts cleanfill, other recyclables, greenwaste, scrap metal, e-waste.	
Rural RTS, Clutha	Ten rural drop-off/mini transfer stations, five of these accept recyclables/ Council provides waste transfer stations at Beaumont, Clinton, Clydevale, Lawrence, Maclennan, Milton, Owaka, Papatowai, Tapanui and Taieri Mouth. These facilities open at least monthly for residents to dispose of their waste which is then transferred to and landfilled at Mt Cooee.	120 (residual)
Roxburgh RTS, Central Otago	Provided by Council under contract to AllWaste and Wanaka Wastebusters.	
Ranfurly RTS, Central Otago	Provided by Council under contract to AllWaste and Wanaka Wastebusters.	
Cromwell RTS, Central Otago	Provided by Council under contract to AllWaste and Wanaka Wastebusters.	
Alexandra RTS, Central Otago	Provided by Council under contract to AllWaste and Wanaka Wastebusters.	
Recycling Drop-off Centres, Central Otago	Alexandra, Cromwell, Omakau, Oturehau, Patearoa, Poolburn, Ranfurly, Roxburgh, and Tarras. Provided by Council under contract to AllWaste and Wanaka Wastebusters.	
Central Otago Wastebusters, Alexandra, Central Otago	Operated by Wanaka Wastebusters.	
Frankton Transfer Station, Queenstown Lakes	Acceptance of general waste, greenwaste, used tyres, car seats, domestic quantities of hazardous wastes, whiteware and scrap metal, e-waste, clean fill.	

Facility	Detail	Annual Tonnage (where known)
Wanaka Wastebusters, Wanaka, Queenstown Lakes	Sited on Council land, but operated as an independent community enterprise by Wanaka Wastebusters.	
Wanaka Transfer Station, Wanaka, Queenstown Lakes	Acceptance of general waste, greenwaste, used tyres, car seats, domestic quantities of hazardous wastes, whiteware and scrap metal, e- waste.	
Rural greenwaste drop off points, Queenstown Lakes	Glenorchy, Kingston, Luggate, Hawea and Makarora managed by a mix of QLDC and community associations involvement and sitting situated on a variety of QLDC, Department of Conservation (DoC) and Land Information New Zealand (LINZ) land.)	

2.3 Resource Recovery Infrastructure

Resource recovery infrastructure accepts material that has been collected through kerbside collections, at RTS, or at recycling centres and prepares it for export, such as sorting recyclables at a MRF, or reprocesses the material. Facilities are shown below, grouped into those located within the Otago region and those in other parts of the country.

Table 4: Resource Recovery Infrastructure in the Otago Region

Facility	Detail	Annual Tonnage (T)
Frankton MRF, Queenstown Lakes	Owned by QLDC and operated under contract with Waste Management NZ Ltd on a site owned by Council. Acceptance, sorting and storage of recyclable materials for commercial resale from Queenstown Lakes and Central Otago. Consolidation of separated recyclables and transport to processing facilities within NZ and overseas. There is a drop-off point and a resale shop for unwanted, reusable goods operated by the Salvation Army.	7,000
Green Island MRF, Dunedin	Operated by OJI, handles kerbside-collected material from Dunedin and Clutha.	6,500
Nash & Ross, Dunedin	Recover 10,000 tonnes of aggregate and about 500 tonnes of steel.	10,500
Keep it Clean, Dunedin	Rendering plants in Abbottsford and Mosgiel.	Not available
Central Wormworx, Cromwell	Accepts a range of putrescible materials, e.g. fruit waste, dairy shed waste, pelts, biosolids, and produces vermicast.	300
Hall Bros, Dunedin	Has a number of sites, mostly with mobile equipment. Grinds asphalt (6,000T), concrete (30,000T), some wood, pulls out metal, recovers bark from port. Uses materials back in own construction operations.	37,000
Green Island Composting, Dunedin	Windrow composting of greenwaste dropped off at Green Island (co-located with Green Island RTS).	500
Doubt not Compost, Dunedin	Commercial scale compost of organic waste for businesses in Dunedin.	180

Facility	Detail	Annual Tonnage (T)
AllWaste C&D Sorting Facility, Queenstown Lakes	AllWaste are doing a small amount of construction and demolition sorting – mostly a single client. They send scrap metal to Otago metals in Cromwell, gib board to Christchurch.	Not available
Glass Crusher, **Central Otago**	Owned by CODC. Currently being commissioned.	Up to 10,000 tonnes capacity

In addition, there are a number of key processing facilities that are located out of the Otago region, but which accept material from the region. These are shown below in Table 5.

Table 5: Processing Infrastructure Outside the Region

Facility	Detail	Annual Tonnage
Visy Glass, Auckland	Beneficiation and reprocessing, Onehunga, Auckland. Accepts glass from the region (excluding Clutha and Central Otago) via 5R.	9,849 (to beneficiation site)
Tyres	Multiple sites, via the Tyrewise product stewardship programme.	3,988
OJI Fibre Solutions, Auckland	Fibre reprocessing, Penrose, Auckland.	3,000
Scrap metal yards	Numerous sites, industry estimate.	28,530
ITRecycla, Remarkit Solutions, Wellington	e-waste reprocessing, Wellington.	53
Plasback	Nationwide product stewardship scheme for waste plastic on farms.	470
Agrecovery	Nationwide product stewardship scheme for agrichemicals and their containers.	25

Facility	Detail	Annual Tonnage
Comspec, Christchurch	Pre-consumer plastic reprocessed to manufacturing feedstock (flake, pellet), Christchurch.	375
Flight Plastics, Wellington	PET reprocessing, Wellington.	195
Astron, Auckland	Plastics reprocessing, Auckland (two sites).	425
Expol	Numerous sites, product stewardship programme for polystyrene.	21
Terracycle	Numerous sites, product stewardship programme for specified food, cosmetic and other consumer packaging.	1

2.4 Summary

2.4.1 Disposal (Landfill) Infrastructure

In general, landfill disposal infrastructure at a cross-regional level appears to be adequate for the needs of the region for some time to come, particularly considering the capacity of AB Lime (as shown in Table 2). However, there may be issues with respect to how efficiently this infrastructure is being provided.

DCC and Clutha DC are both currently undertaking consenting processes for new disposal facilities; DCC for a new landfill that is likely to be located at Smooth Hill and Clutha DC for an extension of their existing landfill at Mt Cooee – the two locations are estimated to be around 40 minutes travel time apart.

This is discussed in more detail in section 5.8.

2.4.2 Recycling, Recovery, and Reprocessing Infrastructure – local and national opportunities

While landfill disposal infrastructure appears adequate for the needs of the region for some time to come; the same cannot be said of recycling, recovery, and reprocessing infrastructure. There is very little reprocessing infrastructure in the region, and existing infrastructure is dated.

The extent to which this type of infrastructure could or should be provided locally is largely dependent on the material type/s targeted.

2.4.2.1 Organic waste

Organic waste infrastructure is usually very local to the source of the waste. It is highly scalable and it is not very desirable to transport organic waste long distances due to the speed at which odour and leachate become an issue.

There is a general lack of organic waste processing infrastructure across the region, with a few exceptions:

- Green Island composting facility in Dunedin (which only accepts greenwaste);
- Doubt Not in Dunedin which processes commercial organic wastes; and
- Central Wormworx in Cromwell which processes a variety of commercial putrescible (wet) organic wastes.

Organic waste is a large waste stream which makes up a significant proportion of what is currently going to Class 1 landfill, particularly from households.

2.4.2.2 Construction and demolition waste

Recovery infrastructure, such as construction and demolition waste facilities and MRFs, are usually able to be provided at a relatively local level. There is a compromise to be found between achieving an effective quantity of material for the facility and the distance that the material needs to be transported.

The two MRFs in the region, located in Dunedin and Queenstown, are both dated and are currently struggling to cope from both a quantity and quality perspective. The presence of SdE in Invercargill alleviates this issue somewhat for the central TAs and Clutha.

Construction and demolition waste is a very large waste stream and makes up a significant proportion of waste to all kinds of landfills, particularly cleanfills.

2.4.2.3 Reprocessing facilities

Large reprocessing facilities, such as those for fibre and glass, are so capital intensive that in New Zealand there is essentially only one key provider for each of these material streams, and both are in Auckland. There is one small fibre reprocessing facility located in the Hawkes Bay.

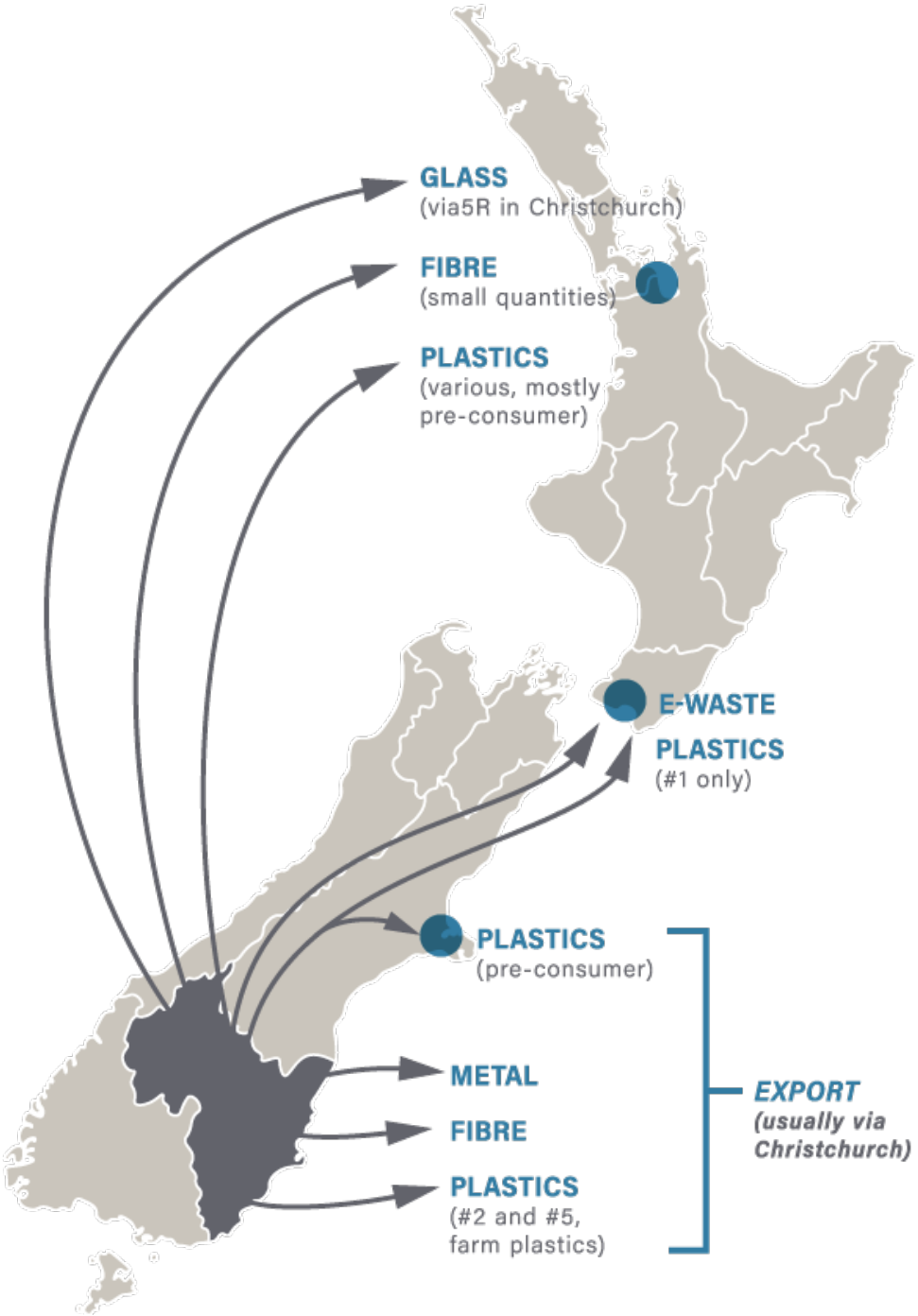
Located in the south of the South Island, the Otago region is almost as far away from key facilities as it is possible to get, which makes the cost-benefit consideration of recycling very marginal. This can be a challenging issue to communicate to the public.

For fibre, there is a viable alternative option of exporting for reprocessing, which only requires transport to the nearest port. Contamination and quality of the fibre stream is a key consideration for the export market.

Glass, however, is not generally exported and the only alternative for the Otago region is to put this material to alternative use such as roading base course, or crushing for use as filter media.

Fixing the gaps in Otago's recycling, recovery and reprocessing infrastructure will require a mix of local and regional investment. It will also require solutions that improve access to infrastructure further afield.

Figure 3: Key movements of recovered recyclables out of Otago



3.0

Current Waste Flows

3.0 Current Waste Flows

This section presents and analyses the available data relating to waste in the Otago region; both waste to landfill and then recovered materials.

Section 4.0 then presents and analyses the sources of this material.

3.1 Waste to Landfills

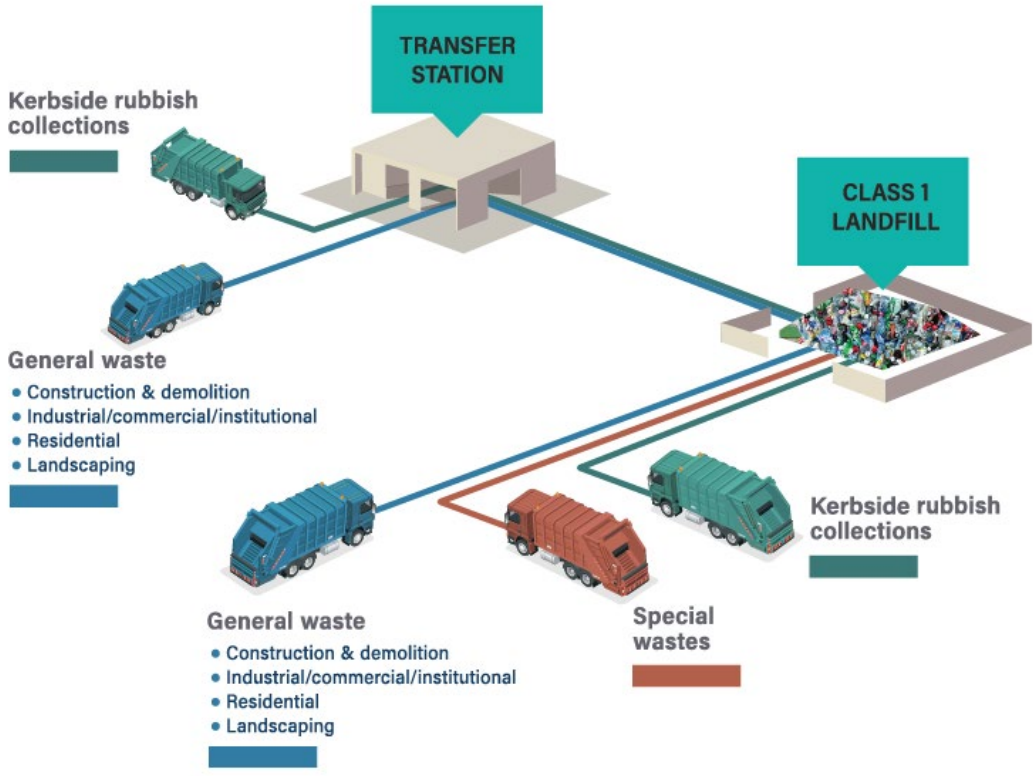
3.1.1 Classification of Waste Streams

As different waste streams require different management strategies, a standardised system for classifying waste streams was developed for the National Waste Data Framework. This system is used for the presentation of the data in the following sections.

'Overall waste', in this report, refers to all waste that is disposed of at a Class 1 landfill and is subject to the waste levy. 'Diverted materials', such as waste used for cover material or other engineering purposes, is not included. The waste levy is not paid on diverted materials.

'Overall waste' is broken down, in this report, into three waste streams - general waste, kerbside rubbish, and special wastes (such as biosolids and contaminated soils). 'General waste' is further broken down into four 'activity sources' – construction and demolition, industrial/commercial/ institutional, landscaping, and residential. These activity sources are defined in appendix A.6.0.

The following is a generic waste flow diagram that illustrates this system for classifying waste streams.



3.1.2 Tonnage of Waste to Class 1 Landfills

Table 6 provides an estimate of the total annual tonnage of waste originating from the Otago region that is disposed of to Class 1 landfills in the region and to Class 1 landfills outside the region. The estimate does not include waste that originates from outside the region.

Disposal in the region includes Green Island landfill, in Dunedin, Mt Cooee landfill in Balclutha, Victoria Flats landfill, in Gibbston, and Palmerston landfill.

Disposal outside of the region occurs at AB Lime landfill, near Winton, Southland, and Redruth landfill in Timaru.

The data used to calculate the estimate has primarily been drawn from surveys undertaken by Waste Not Consulting at transfer stations and Class 1 landfills in the region. Data has also been taken from waste assessments, WMMPs, and council meeting agendas and reports.

As the data used for the analysis is the most recent available but relates to different years, the tonnages are not representative of a specific year. For simplicity's sake, throughout this section the data is identified as being '2020'. In those instances where tonnage data has not been located or is considered unreliable, surrogate data based on other sources has been substituted.

It is noted that not all waste streams have been included in this total as no accurate tonnage data has been located or made available. For instance, contaminated soil from CODC is reportedly being disposed of at AB Lime, but no tonnage data is available.

Table 6: Waste to Class 1 Landfills from Otago Region - 2020

Overall waste to Class 1 landfills - 2020	% of total weight	Tonnes per annum
Disposal outside of Region		
General + kerbside rubbish	6.1%	8,700
Special wastes	2.9%	4,200
Subtotal	**9.0%**	**12,900**
Disposal in Region		
Kerbside rubbish	35.5%	50,946
General waste	52.7%	75,623
Special wastes	2.9%	4,095
Subtotal	**91.0%**	**130,664**
TOTAL	**100.0%**	**143,564**

An estimated 143,564 tonnes of waste from the Otago region were disposed of in 2020 to Class 1 landfills. The Class 1 landfills within the Otago region receive 90% of this waste. The other 10% is disposed of outside the region.

Most of the waste disposed of outside the Otago region was from Waitaki, with the remainder being biosolids from Queenstown Lakes and screenings from Central Otago. Biosolids are classified as special wastes.

3.1.3 Activity sources of Waste to Class 1 Landfills

The overall tonnage of waste to landfill has been divided into three waste streams in Table 6: kerbside rubbish, general waste, and special wastes. 'Kerbside rubbish' includes all rubbish collected from both residential and commercial properties by both council and private kerbside waste collections. 'Special' wastes include biosolids and road sweepings from council sources and potentially hazardous materials, such as asbestos-contaminated soil, from other sources.

In Table 7, 'general' waste is all waste to Class 1 landfills that is neither kerbside rubbish nor a special waste and is broken down into four activity sources. These activity sources align with those in the National Waste Data Framework and are shown as subsets of the General waste category. All waste from the Otago region, including that disposed of outside of the region, have been included.

Table 7 - Activity Sources of Waste to Class 1 Landfills - 2020

Activity sources of waste to Class 1 landfills from the Otago region – 2020	% of waste by weight	Tonnes per annum
Construction & demolition	18%	26,056
Industrial/commercial/institutional	27%	39,082
Landscaping	2%	2,569
Residential	5%	7,478
Subtotal - General waste	**52%**	**75,185**
Kerbside rubbish	36%	51,112
Special waste	12%	17,267
TOTAL	**100%**	**143,564**

It is estimated that a total of 143,564 tonnes of waste were disposed of to Class 1 landfills in 2020 from the Otago region. Of the total quantity disposed of to landfill, 36% was kerbside rubbish and 27% was industrial/commercial/institutional waste. Construction and demolition waste made up 18%, residential waste (which excludes kerbside rubbish) 5%, and landscaping waste 2%. A further 12% was special waste, which is primarily biosolids.

3.1.4 Per-capita Disposal of Waste to Class 1 Landfills

Using population figures from Stats NZ 2018-2048 subnational population estimates, per capita disposal rates of waste to Class 1 landfills has been calculated. The results are shown in Table 8.

Table 8 - Per Capita Disposal of Waste to Class 1 Landfills

Waste to Class 1 landfills from Otago Region - Per capita disposal rates	
Population	244,875
Tonnes per annum of kerbside rubbish	51,112
Tonnes/capita/annum of kerbside rubbish	0.209
Tonnes per annum of overall waste - including special waste	143,564
Tonnes/capita/annum of overall waste- including special waste	0.586

When special wastes are included, approximately 0.586 tonnes of waste per year are disposed of to a Class 1 landfill for every resident of the Otago region. Approximately 0.209 tonnes of kerbside rubbish are disposed of for every resident.

3.1.5 Comparison of Per-capita Disposal Rate to Other Councils

Waste Not Consulting has undertaken studies of waste disposal in several local authority areas, generating per capita disposal rates for the overall waste stream to landfill. In Table 9, disposal rates for the overall waste stream from a number of local authorities are compared to those from the Otago region. These figures include special wastes.

Table 9: Per Capita Disposal of Waste to Class 1 Landfills - Comparison to Other Areas

Comparison of per capita disposal rates of waste to Class 1 landfills	Tonnes per capita per annum
Gisborne District 2017	0.296
Waimakariri District 2017	0.325
Invercargill City 2018	0.528
Bay of Plenty Region 2017	0.529
Palmerston North 2017	0.545
Waikato Region 2017	0.552
Dunedin City 2018	0.554

Otago Region 2020	**0.586**
Wellington region 2016	0.608
Napier/Hastings 2019	0.630
New Zealand (to Sept. 2020)	0.663
Taupō District 2017	0.673
Hamilton City 2017	0.718
Queenstown Lakes District 2020	0.833
Auckland region 2016	1.053

The per-capita disposal rate for the Otago region is similar to many of the other areas that have been analysed. Differences in the disposal rates are associated with differences in the level and type of economic activity in an area. For example, agricultural activity generates less waste to Class 1 landfills than manufacturing. High levels of tourism activity, such as in Taupō and Queenstown Lakes Districts, result in higher per-capita disposal rates.

3.1.6 Composition of Waste to Class 1 Landfills

The compositions of the general and overall waste streams disposed of to landfill from the Otago region have been calculated using the results of Solid Waste Analysis Protocol (SWAP) audits undertaken since 2017 in four of the five territorial authority areas[5]. These SWAP audits represent 89% of the 143,564 tonnes (including special waste) disposed of annually to landfill.

The primary compositions of general waste and overall waste to Class 1 landfills are presented in Table 10. 'General waste' excludes kerbside rubbish and special waste. 'Overall waste' includes general waste, kerbside rubbish, and special wastes. The secondary compositions, which include all 25 classifications, are provided in appendix A.1.0.

Table 10: Primary compositions of Waste to Class 1 Landfills - 2020

Primary compositions of waste to Class 1 landfills - 2020	**General waste - excludes kerbside rubbish and special wastes**	**Overall waste - includes general waste, kerbside rubbish, and special wastes**

[5] The classification system for waste streams is described in Section **Error! Reference source not found.**

	% of total	Tonnes per annum	% of total	Tonnes per annum
Paper	11.2%	8,436	8.9%	12,847
Plastics	14.5%	10,877	11.0%	15,754
Organics	12.1%	9,106	26.0%	37,349
Ferrous metals	3.4%	2,558	2.5%	3,545
Non-ferrous metals	0.5%	345	0.5%	773
Glass	1.7%	1,241	2.5%	3,568
Textiles	6.5%	4,916	4.8%	6,917
Sanitary paper	2.3%	1,736	4.2%	6,075
Rubble & concrete	16.3%	12,221	9.8%	14,040
Timber	29.0%	21,820	15.9%	22,786
Rubber	1.5%	1,111	0.9%	1,267
Potentially hazardous	1.1%	820	13.0%	18,642
TOTAL	**100.0%**	**75,185**	**100.0%**	**143,564**

Timber (29.0%) and rubble (16.3%) were the two largest components of general waste to Class 1 landfills. Plastics (14.5%) was the third largest component.

The largest component of overall waste (which includes general waste, kerbside rubbish, and special wastes) was organic waste, which comprised 26.0% of the total weight. Nearly 70% of the tonnage of organic material in overall waste is kitchen waste from kerbside rubbish collections. Timber was the second largest components of overall waste to landfill, comprising 15.9% of waste. Potentially hazardous materials (13.0%) were the third largest. All special wastes have been classified as potentially hazardous.

3.1.6.1 Composition of Waste to Class 1 Landfills - By Activity Source

In Table 11, general waste is broken down into four the activity sources - construction and demolition waste, industrial/commercial/institutional waste, residential waste (which excludes kerbside rubbish), and landscaping waste. The primary composition of each of the four activity sources is shown. The secondary compositions, in terms of both percentage and tonnes per annum, are presented in appendices A.3.0 and A.4.0.

Table 11: Primary compositions of Waste - By Activity Source - 2020

Primary compositions of waste to Class 1 landfills - - 2020	Construction & demolition	Industrial/ commercial/ institutional	Landscaping	Residential
Paper	2.6%	18.2%	0.3%	8.4%
Plastics	2.6%	24.6%	0.7%	7.7%
Organic	1.0%	15.0%	80.2%	12.4%
Ferrous metals	2.2%	2.9%	0.0%	11.2%
Non-ferrous metals	0.1%	0.6%	0.0%	0.8%
Glass	0.4%	2.5%	0.0%	2.1%
Textiles	2.3%	7.8%	0.2%	17.0%
Sanitary paper	0.0%	4.3%	0.0%	0.7%
Rubble & concrete	35.4%	6.0%	17.3%	2.9%
Timber	51.7%	14.5%	1.3%	35.7%
Rubber	1.0%	2.1%	0.0%	0.6%
Potentially hazardous	0.7%	1.6%	0.0%	0.4%
TOTAL	**100.0%**	**100.0%**	**100.0%**	**100.0%**

The majority of construction and demolition waste was timber (51.4%) and rubble (35.4%). Industrial/commercial/institutional waste was more diverse, with plastics comprising the largest proportion (24.6%) and paper comprising 18.2% of the total weight. Landscaping waste was 80.2% organics, primarily greenwaste.

Residential waste often includes waste from several activities, including landscaping and construction. The largest component of residential waste was timber, comprising 35.7% of the total, which included both furniture and wood from construction and demolition. Textiles was the second largest component, comprising 17.0% of the total weight. Carpet, soft furnishings, and clothing were the major components of textile waste.

3.1.7 Diversion Potential of Waste to Class 1 Landfills

Of the 25 secondary classifications of the composition, nine are commonly recycled or recovered in New Zealand. A further four materials are compostable. There are currently diversion options available in Otago region for most of these 13 materials.

Based on these 13 materials, Table 12 shows the proportions of kerbside rubbish (see section 3.2), general waste, and overall waste that could potentially be diverted from landfill disposal. The percentages and tonnages of general waste and overall waste have been taken from appendix A.1.0. The data on kerbside rubbish is from appendix A.5.0.

Table 12: Diversion Potential of Waste to Class 1 Landfills – 2020

Diversion potential of waste to Class 1 landfills - 2020	Kerbside rubbish		General waste - excludes kerbside rubbish and special wastes		Overall waste - includes kerbside rubbish, general, and special wastes	
	% of total	Tonnes per annum	% of total	Tonnes per annum	% of total	Tonnes per annum
Recyclable and recoverable materials						
Paper - Recyclable	6.6%	3,349	4.1%	3,114	4.5%	6,463
Paper - Cardboard	0.7%	372	5.8%	4,355	3.3%	4,727
Plastic - Recyclable	2.2%	1,108	0.7%	558	1.2%	1,666
Ferrous metals	1.9%	987	3.4%	2,558	2.5%	3,545
Non-ferrous metals	0.8%	427	0.5%	345	0.5%	773
Glass - Recyclable	3.9%	2,009	0.7%	523	1.8%	2,532
Textiles - Clothing	2.4%	1,208	1.9%	1,434	1.8%	2,642
Rubble - Cleanfill	0.0%	0	4.4%	3,299	2.3%	3,299
Timber - Reusable	0.0%	0	1.7%	1,265	0.9%	1,265
Subtotal	**18.5%**	**9,460**	**23.2%**	**17,451**	**18.7%**	**26,911**
Compostable materials						
Kitchen waste	32.9%	16,827	3.4%	2,586	13.5%	19,413
Compostable greenwaste	17.0%	8,684	3.9%	2,944	8.1%	11,628
New plasterboard	0.0%	0	3.0%	2,256	1.6%	2,256
Untreated/unpainted timber	0.0%	0	4.0%	3,033	2.1%	3,033
Subtotal	**49.9%**	**25,511**	**14.4%**	**10,820**	**25.3%**	**36,332**
TOTAL - Potentially divertible	**68.4%**	**34,971**	**37.6%**	**28,271**	**44.1%**	**63,242**

Recyclable/recoverable materials accounted for 18.7% of overall waste and compostable materials 25.3%. Approximately 44.1% of the overall waste stream disposed of at Class 1 landfills could be readily diverted either by either by recycling/recovering or by composting.

3.1.8 Activity Source of Potentially Recoverable Waste Materials

Table 13 focuses on the 'potentially recoverable' materials that are currently going to landfill; with the depth of colour highlighting the largest material quantities by volume.

Table 13 - Activity sources of potentially recoverable materials - 2020

Activity Source of potentially recoverable waste materials	Construction & demolition	Industrial/ Commercial/ Institu	Landscaping & earthworks	Residential	Kerbside rubbish
	Tonnes per Annum to Class 1 landfill				
Recyclable Paper	32	2,891	1	190	3,349
Recyclable Cardboard	560	3,374	6	415	372
Recyclable Plastics	23	477	0	58	1,108
Food waste	0	2,418	3	164	16,827
Compostable green waste	213	866	1,193	672	8,684
Other organics	17	2,298	0	7	1,767
Primarily ferrous	484	456	0	240	373
Steel, other ferrous	96	681	0	600	614
Non-ferrous	37	248	0	60	427
Recyclable glass	3	491	0	29	2,009
Cleanfill	2,685	128	443	44	0
New plasterboard	2,244	0	0	13	0
Other' rubble	4,289	2,211	2	164	1,819
Reusable Timber	1,025	170	3	66	0
Unpainted & untreated timber	1,817	984	4	228	0
TOTAL	**13,527**	**17,694**	**1,657**	**2,949**	**37,349**

Looking at the food waste example, it's clear that changing householders' behaviour through appropriate kerbside collections is a priority. When it comes to cleanfill, plasterboard, rubbish and timber in comparison, action for change should be focussed on the construction and demolition sector. To reduce recyclable paper to landfill, both households and the commercial, industrial and institutional sectors should be targeted.

3.1.9 Carbon Emissions from Waste to Class 1 Landfills

When waste is landfilled, it decomposes anaerobically and methane (CH_4) is produced. Methane is one of the six greenhouse gases (GHG) recognised in the international climate change agreement, the Kyoto Protocol. For GHG accounting purposes, all six greenhouse gases are measured and expressed in terms of carbon dioxide equivalent units, in tonnes ($tCO2_{-e}$ unit). The ETS requires all Class 1 landfills to surrender carbon credits, based on the quantity of waste the landfill receives.

Large Class 1 landfills (over 1 million tonnes total capacity) in New Zealand are required to operate landfill gas capture systems, which reduce the amount of methane gas emitted to the atmosphere. A landfill gas recovery scheme does not, however, capture all the methane gas that a landfill generates and a proportion is still released. Green Island Landfill and Victoria Flats Landfill, the large Class 1 landfills servicing Dunedin and Queenstown respectively, have landfill gas capture systems, as does AB Lime Landfill, in Southland.

The Climate Change (Unique Emissions Factors) Regulations 2009 provides a process through which a Class 1 landfill may apply for a unique emissions factor (UEF), based on the proportion of landfill gas that is captured (see 0).

UEFs are published annually in the New Zealand Gazette. Using the published UEFs for 2020 for Green Island and AB Lime landfills, and applying them to the tonnage of waste disposed of at each facility, it is estimated that the landfill gas capture systems reduce the quantity of methane released to the atmosphere waste generated in Otago Region that is disposed of at Class 1 landfills by 16%. As Victoria Flats landfill has not had gas capture in place for a year and therefore cannot yet apply for an applicable UEF, it has been assumed to have the same gas capture rate as AB Lime landfill.

Landfill methane emissions are calculated based on the composition of waste, with a different emissions factor being applied to each type of material with methane-generating potential. Table 12lists the materials that could potentially be diverted from Class 1 landfill disposal. Many of these materials are organic in nature, so diverting them from landfill will not only reduce the tonnage of waste to landfill but will change the methane-generating potential of the materials that remain. Table 14 presents:

- The carbon emissions potential of all waste disposed of to Class 1 landfills from Otago Region, before and after landfill gas is captured.
- The carbon emissions potential from the same waste after all divertible materials have been removed, before and after landfill gas is captured.

Table 14: Carbon Emissions from Waste to Class 1 Landfills

Carbon emissions from Otago Region waste to Class 1 landfills	All waste	Waste after removal of divertible materials	Change
Tonnes to Class 1 landfills	143,564	80,322	-44%
Calculated emissions factor in tCO2-e per tonne of waste	1.295	1.177	-9%
Emissions potential, based on calculated emissions factor, in tCO2-e	185,974	94,504	-49%
Actual emissions, with landfill gas capture, in tCO2-e	156,297	79,424	76,873

The 143,564 tonnes of waste currently disposed of to Class 1 landfills from the Otago region has the potential to emit 185,974 tonnes of carbon. Landfill gas capture systems reduce this potential to 156,297 tonnes of carbon.

Removal of all possible divertible materials (as per Table 12 reduces the tonnage of waste by 44% (to 80,322 tonnes) and the emissions factor of the waste by 9%. Potential emissions are reduced by 49% to 94,504 tonnes. Landfill gas capture systems currently in place in the Class 1 landfills reduce this potential to 79,424 tonnes.

3.2 Kerbside Rubbish

An estimated 51,112 tonnes of rubbish are collected from Otago's kerbsides by councils and private waste collectors. Although a high proportion of the kerbside rubbish is from residential properties, a proportion from commercial properties is also included in the total.

3.2.1 Composition of Kerbside Rubbish

Since 2018, Waste Not Consulting has undertaken sort-and-weigh audits of kerbside rubbish for three of the five territorial authorities in the Otago region. Kerbside rubbish disposed of by these three territorial authorities represents 43% of all kerbside rubbish from the region. Based on these audits, the primary composition of all kerbside rubbish collected in the Otago region is presented in Table 15. The secondary composition, which includes all 23 classifications used for the audits, is provided in appendix A.5.0.

Table 15 Composition of Kerbside Rubbish Otago Region - 2020

Primary composition of kerbside rubbish - 2020	% of total	Tonnes per annum
Paper	8.6%	4,411
Plastics	9.5%	4,878
Organic	55.3%	28,243
Ferrous metals	1.9%	987
Non-ferrous metals	0.8%	427
Glass	4.6%	2,327
Textiles	3.9%	2,002
Sanitary paper	8.5%	4,339
Rubble & concrete	3.6%	1,819
Timber	1.9%	966
Rubber	0.3%	156
Potentially hazardous	1.1%	556
TOTAL	**100.0%**	**51,112**

Based on the results of the three sort-and-weigh audits, organics was the largest primary classification of kerbside rubbish, comprising 55.3% of the total weight. Kitchen waste comprised 60% of the organic material. Plastic was the second largest primary classification, comprising 9.5% by weight, and paper the third largest, at 8.6%.

3.2.2 Diversion Potential of Kerbside Rubbish

In the sort-and-weigh audits used to calculate the composition of kerbside rubbish, secondary categories were used to differentiate between recoverable and non-recoverable materials (e.g. recyclable paper vs. non-recyclable paper). In this context, 'recoverable' is taken to mean materials which can be readily diverted by residents, through kerbside recycling and organic collections, drop-off facilities, or through home-composting.

Using the results of the three SWAP audits of kerbside rubbish conducted in the Otago region since 2017, the diversion potential of kerbside rubbish has been calculated to be as shown in Table 16.

Table 16: Diversion Potential of Kerbside Rubbish - 2020

Diversion potential of kerbside rubbish - 2020	% of total	Tonnes per annum
RECYCLABLE MATERIALS		
Paper recyclable	7.3%	3,721
Plastic - #1, #2 and #5 containers	2.2%	1,108
Steel cans	0.7%	373
Aluminium cans	0.3%	165
Glass bottles & jars	3.9%	2,009
Subtotal	**14.4%**	**7,376**
COMPOSTABLE		
Kitchen waste	32.9%	16,827
Greenwaste	18.9%	9,649
Subtotal	**51.8%**	**26,476**
TOTAL DIVERTIBLE	**66.2%**	**33,853**
Non-divertible	**33.8%**	**17,260**
TOTAL KERBSIDE RUBBISH	**100.0%**	**51,112**

Approximately 14.4% of kerbside rubbish from the Otago region could have been readily diverted through kerbside recycling collections or at drop-off facilities. Recyclable paper

was the largest single recyclable component, comprising 7.3% of the total weight of kerbside rubbish.

Organic materials that could have been composted comprised 51.8% of kerbside rubbish. Kitchen waste comprised 32.9% of kerbside rubbish (16,827 tonnes per annum), and greenwaste 18.9% (9,649 tonnes per annum). In total, 66.2% of kerbside rubbish, 33,853 tonnes per annum, could have been diverted from landfill disposal by residents.

3.2.3 Per Capita Disposal of Kerbside Rubbish

Using population figures from Stats NZ 2018-2048 sub-national population estimates, a per capita disposal rate of kerbside rubbish has been calculated. The results of the calculations are shown in Table 17

Table 17: Per Capita Disposal of Kerbside Rubbish - 2020

Waste to Class 1 landfills - Per capita disposal rates - 2020	
Population	244,875
Tonnes per annum of kerbside rubbish	51,112
Kg/capita/annum of kerbside rubbish	209

Approximately 209 kilograms of kerbside rubbish are disposed of per year for every resident of the Otago region.

3.2.3.1 Comparison of Per Capita Disposal Rates to Other Councils

Waste Not Consulting has undertaken studies of waste disposal in several local authority areas that have generated per capita disposal rates for kerbside rubbish. In Table 18, disposal rates for kerbside rubbish from a number of local authorities are compared to those in the Otago region. These figures, in most instances, include kerbside rubbish collected from commercial properties.

The per capita disposal rate of kerbside rubbish from the Otago region is higher than from most other areas. In general terms, a range of factors affect the disposal rate, including the recycling options available to residents, the volume of waste receptacles for rates-funded services, the proportion of properties that are used for holiday homes or short-term rentals, and the proportion of commercial properties that use kerbside services for rubbish disposal.

However, the primary reason for the relatively high per capita disposal rate from the Otago region is the very high disposal rate from Queenstown Lakes district. Disposal rates here are high due to the large number of visitors (who are not classified as ‘usually resident’ by the census) and a higher than average proportion of businesses that use kerbside rubbish collections for commercial waste disposal.

Table 18: Per Capita Disposal of Kerbside Rubbish - Comparison to Other Areas - 2020

Comparison of per capita disposal rates of kerbside rubbish - 2020	Kilograms per capita per annum	Principal kerbside rubbish collection services
Christchurch City 2011	110	Rates-funded fortnightly 140-litre wheelie bins (with weekly organic)
Gisborne District 2017	122	Rates-funded rubbish bag stickers
Whangarei District 2017	153	User-pays rubbish bags + private wheelie bins
Waikato Region 2017	156	Various
Auckland Council 2016	156	User-pays rubbish bags + rates-funded wheelie bin + private wheelie bins
Dunedin City 2018	187	User-pays rubbish bags + private wheelie bins
Tauranga and WBOP District 2019	192	User-pays rubbish bags + private wheelie bins
Hamilton City 2017	197	Rates-funded bags (2 per h/h max)
Bay of Plenty Region 2017	201	Various
Palmerston North 2017	201	User-pays rubbish bags + private wheelie bins
Wellington Region 2014/15	206	User-pays rubbish bags + private wheelie bins
Otago Region 2020	**209**	**Various**
Hastings District/Napier City 2019	221	Rates-funded bags (2 bags h/h max) + User-pays rubbish bags + private MGBs

3.3 Other Waste Disposed of to Land

3.3.1 Farm Waste

In 2013, a study of farm waste management practices in Canterbury region provided data that enables estimates to be made of the quantity of non-natural wastes disposed of on rural properties.[6]

The Canterbury study found that 92% of farms use one of the 'three B' methods of waste management – bury, burn, or bulk storage on property. The Canterbury study calculated average annual tonnages of waste for four different types of farm. As farm waste from a specific type of farm is likely to be similar throughout the country, the data is considered to be suitable for application to other regions, by applying the waste data per farm to the number of farms of each type in a region. Data on numbers of farm types in each region in 2020 is available from Stats NZ.

Based on the data contained in the 2013 Canterbury study, an estimate of the quantity of waste disposed of in Otago Region is presented in Table 19. The categories are those presented in the study. 'Non-natural rural waste' includes materials such as scrap metal, treated timber, fence posts, plastic wraps and ties, crop netting, glass, batteries, and construction and demolition wastes. 'Organic waste' is not well-defined in the study and is only reported in the study as including 'crop residues'.

Table 19: Estimate of On-Farm Disposal of Waste - Reported Classifications

Farm wastes in Otago Region - 2020 Tonnes/year	Dairy	Livestock	Grape growers	Other arable	TOTAL
Number of farms	**612**	**252**	**36**	**2,391**	**3,291**
Non-natural waste	3,435	2,063	182	7,993	13,673
Domestic waste	338	19	0	2,410	2,767
Animal carcasses	5,416	4,895	0	3,269	13,580
Organic waste	6,510	28	331	1,587	8,456
TOTAL	**15,698**	**7,005**	**513**	**15,260**	**38,476**
Average per farm	**25.7**	**27.8**	**14.3**	**6.4**	**11.7**

[6] GHD (2013), *Non-natural rural wastes - Site survey data analysis*, Environment Canterbury Report No.R13/52

The 3,291 farms in the Otago region[7] are estimated to dispose, on-farm, of an average 11.7 tonnes of waste per farm per annum. In total, 38,476 tonnes of waste per annum are estimated to be disposed of in this manner across the region.

Using the raw data from the 2013 Canterbury study, the composition of farm waste in Otago Region in 2020, expressed in the standard SWAP classifications, has been calculated as shown in Table 20.

Table 20: Estimate of On-Farm Disposal of Waste - SWAP Classifications

Farm wastes in Otago Region - 2020	% of total weight	Tonnes per year
Paper	0.5%	210
Plastics	8.0%	3,096
Food and other putrescibles	*27.7%*	*10,658*
Garden and other carbon sources	*48.0%*	*18,488*
Putrescibles - subtotal	**75.8%**	**29,146**
Ferrous metals	2.4%	916
Non-ferrous metals	0.0%	4
Glass	1.9%	733
Textiles	0.1%	23
Nappies and sanitary	0.1%	42
Rubble	0.2%	71
Timber	10.5%	4,032
Rubber	0.0%	4
Potentially hazardous	0.5%	198
TOTAL	**100.0%**	**38,476**

Putrescible materials, which includes 'organic' waste and animal carcasses as per the 2013 Canterbury study, tree trimmings, wood chip animal bedding, and food waste in domestic rubbish, was the largest classification of farm waste, comprising 75.8% of the total weight. Timber was the second largest classification, comprising 10.5%. The timber classification incudes both treated and untreated processed timber.

[7] Stats NZ business demography for ANZSIC06 for 2020

3.3.2 Waste to Class 2-5 Landfills

For this project, an Official Information Act request was made to MfE for the available information on Class 2-5 landfills in the Otago region.

The Class 2-5 landfill sites identified by MfE in the Otago region are listed in Table 21. The table includes the address of each site as well as the materials that are accepted, based on either the resource consents for the site or on information gathered for this project.

Table 21: Class 2-5 Landfills in Otago Region

Territorial authority	Address	Accepted materials
Central Otago	Parkburn Quarry Site beside Lake Dunstan, near Cromwell	Cleanfill, up to 5% vegetation
Clutha	Kai Point Coal Mine, Kaitangata	Boiler ash, mine overburden
Dunedin	712 Kaikorai Valley Road, Dunedin	Construction and demolition waste, contaminated soil, other non-putrescible waste
Dunedin	13 Matanaka Drive, Waikouaiti	Eggshells, boiler ash
Dunedin	20 McLeods Rd, Dunedin	Greenwaste
Queenstown Lakes	Ballantyne Rd, Wanaka	Cleanfill (possibly closed)
Queenstown Lakes	2 sites on Kingston Rd, Queenstown	Cleanfill
Queenstown Lakes	Shotover Delta Rd, Queenstown	Cleanfill
Waitaki	Works Rd, Pukeuri	Cleanfill, boiler ash
Waitaki	Awamoa Road and Beach Road, Oamaru	Offal
Waitaki	McEneany and Steward Roads, Pukeuri	Soil, cleanfill

While most of the Class 2-4 sites, which includes construction and demolition landfills and industrial disposal sites, are likely to have been identified by MfE through their resource consents, there may be Class 5 cleanfill sites that have not. Operation of a cleanfill site or greenwaste disposal site is a permitted activity so often remains undocumented.

While the landfill sites identified by MfE include cleanfill sites in proximity to several of the major towns, there are also likely to be a number of unofficial cleanfill operations on farmland and in other isolated locations that serve the other towns.

Few Class 2-5 landfills record the quantity of material they receive. Based on the information provided by MfE, only three of the resource consents for the sites listed in Table 21 include conditions limiting the amount of material that can be accepted each year.

A small number of the sites have provided MfE and/or the project team with information on the quantity of material accepted. Based on this information, it is estimated that approximately 100-200,000 tonnes of material are disposed of annually in Class 2-5 landfill sites in the Otago region. A very high proportion of this material is inert, excavated soils and other natural materials. This figure does not include the overburden from Kai Point coal mine.

3.4 Recovered Material Data

The data in Table 22 was provided by diverted material reprocessors and covers material from the Otago region that are managed within New Zealand. Excluding exports creates a gap for plastic and fibre in particular.

Table 22: Diverted Materials Reported by Reprocessors 2020

Reprocessed material	TOTAL (material in tonnes per annum)
Glass	
Bottles/jars	9,849
Organics	
Putrescibles (wet organics)	1,260
Greenwaste, wood waste, manure	2,520
Tyres	3,988
Fibre (paper, card)	
Mixed paper	450
Old corrugated cardboard	3,000
Construction & Demolition	
Aggregate	46,000
Construction and demolition	1,300

Reprocessed material	TOTAL (material in tonnes per annum)
Scrap metal	10,000
Electrical and Electronic	133
Farm Plastics	470
Plastics (various grades)	642
TOTAL	**79,612**

Table 22 shows that an estimated 80,000 tonnes of material is recovered and processed from the Otago region annually, with over half of this accounted for by aggregates.

Table 23 puts the above data in a broader context, presenting the diverted data alongside (and as a proportion of) total waste to disposal and recovery.

Table 23: Waste to Disposal and Recovery

Destination	Tonnage	Percent
Tonnes to Class 1 landfills	143,564	35%
Tonnes to Class 2 5 (est)	150,000	36%
Tonnes to rural disposal	38,476	9%
Recovery (excl. rural recovery)	79,612	19%
TOTAL	**411,652**	**100%**

The above data suggests that Otago recovers approximately 20% of the waste material generated with approximately equal quantities of material going to Class 1 and Class 2-5 disposal.

4.0

Key Waste Sources

4.0 Key Waste Sources

This section explores the key sources of waste and recovered materials. These waste sources do not cover all waste generation in the region but highlight key areas.

4.1 Household Recycling – Kerbside Collections

4.1.1 Collection Services

Apart from Waitaki, all councils provide fortnightly kerbside collection services for recycling in 240L wheeled bins, albeit through different service providers. Where glass is collected, it is collected separately from other recycling in either crates or wheelie bins.

There are currently no kerbside food waste or greenwaste collections offered through the councils in the Otago region. Dunedin intends to offer kerbside food waste and optional greenwaste collections when it awards a new waste management contract - expected to commence in mid-2023. CODC is currently consulting on three possible new service configurations; two of which include a four-weekly greenwaste collection from a 240L bin, with the third offering a weekly mixed food and greenwaste collection from a smaller bin.

Details on council-provided kerbside recycling collections in the Otago region are summarised in Table 24.

Table 24 Council-Provided Kerbside Recycling Collections Per TA

	Dunedin	Waitaki	Queenstown Lakes	Central Otago	Clutha
Glass	Fortnightly crate	No council collection	Fortnightly 140L wheeled bin	8-weekly 240L wheeled bin	No council collection
Other dry recyclables	Fortnightly 240L wheeled bin	No council collection	Fortnightly 240L wheeled bin	Fortnightly 240L wheeled bin	Fortnightly 240L wheeled bin
Plastics Accepted	#1, #2, #5	No council collection	#1 (clear bottles only), #2, #5	#1 (clear only), #2, #5	#1, #2, #5
Foil, aerosols	Foil only	No council collection	Not accepted	Not accepted	Not accepted
Annual Tonnages	Glass: 3,093 Other: 4,322	Unknown	Glass: 2,853 Other: 2,381	All: 1,538	Unknown

4.1.2 Consistency across districts

In 2020, WasteMINZ completed a review for MfE on kerbside collections and made recommendations as to how better consistency in collection systems could be achieved across the country[8]. Implementation of national harmonisation can have far reaching effects on the types, quantity and quality of material collected as well as the collection methods. MfE has commissioned a follow-up project to support the implementation of kerbside standardisation, and intends to consult on these proposals in late 2021.

It is worth pointing out where the Otago region kerbside services diverge from these recommendations (and from each other):

- consistency in the materials accepted in kerbside recycling and how they are presented (which includes containers used, and frequency):
    - collection frequency varies
    - glass included or not
    - #1 plastic containers (CODC and QLDC restricted to clear bottles only)
- food waste collections, with Dunedin proposing a weekly kerbside food waste collection but CODC proposing a greenwaste collection, or food waste co-collected with greenwaste (kerbside standardisation proposes a food waste-only collection); and
- Collection containers, with a standardised approach currently proposing a three crate-based system.

4.1.3 Signalled changes to services

Dunedin is in the process of making significant changes to its kerbside services, with the implementation of a 4 + 1 kerbside collection system with the goal of increasing the amounts of recyclable materials collected, including glass.

The two largest councils (in terms of population and together covering about 50% of all the region's households), Dunedin and Queenstown Lakes, are considering or are introducing kerbside food waste collection service. These additional services would require necessary investment in collection and processing infrastructure - which might potentially be supported by other TAs across the region. Clutha has indicated an interest in working with other councils for kerbside organics collection.

Central Otago, at this stage, has indicated that collection of greenwaste is a higher priority and is currently consulting on proposed service changes that would collect greenwaste at the kerbside, with one of the three proposed options including food waste with the greenwaste.

[8] https://www.wasteminz.org.nz/wp-content/uploads/2020/08/Final-1.0-Standardising-Kerbside-Collections-in-Aotearoa.pdf

4.1.4 Recovery and Processing

In addition, there is variability in how recovered materials are managed. Glass that is collected is not necessarily being recycled back into glass, but instead is being downgraded for other uses, such as roading and landfill cover. This is a particular issue for Central Otago, where the glass currently being collected is not meeting the quality standards set by glass recovery company 5R. Queenstown Lakes has historically had similar issues, but is currently able to direct recovered glass through 5R.

As a result of the recent international and national legislative changes regarding the import, manufacturing, sales, distribution, and export of (waste) plastics, most councils now only collect plastics 1, 2 and 5. Clutha has indicated in its LTP that they do not believe there are markets for grade 5 plastics, which is not experienced nationally. This requires further discussion.

Both MRFs in Dunedin and Queenstown Lakes are not fit for purpose, as they are dated and cannot meet the qualitative and quantitative demands of local recycling streams. Specifically, the Dunedin MRF cannot process glass, nor separate plastics by polymers, resulting in reduced diversion and quality of materials. The MRF in Queenstown Lakes regularly struggles with capacity, leading to delays or non-acceptance of recycling from Central Otago. In turn, this causes either extended transport (to Southland), double handling and storage (resulting in reduced quality), and/or the mismanagement of waste in the sense that otherwise recyclable materials will go to landfill.

4.2 Institutional Waste

Otago is home to large institutional and commercial waste generators, providers of health care, higher education and transport. Some of the larger generators are discussed in the following sections.

4.2.1 Southern District Health Board – Dunedin and Wakari Hospitals

Southern District Health Board (SDHB) is responsible for planning, funding and providing all publicly funded health care services for the Southern District. SDHB operates hospitals in Dunedin, Wakari (Dunedin), Invercargill and Queenstown and also contracts health services from rural hospitals, WellSouth (Primary Health Organisation), pharmacies, aged residential care facilities and more.

Dunedin Hospital is the main public hospital in Dunedin. It serves as the major base hospital for the Otago and Southland regions. Wakari Hospital in Dunedin comprises Mental Health facilities, administration and other SDHB support services.

Broadly speaking, there are two types of waste generated from Dunedin and Wakari Hospitals. Hazardous, or clinical, waste includes needles, blood-soaked dressings, chemotherapy chemicals, and infectious waste. Non-hazardous wastes include paper (including confidential documents, treated separately), packaging, general waste, organic waste, and recyclables.

SDHB's core function is healthcare and the use of consumables is largely driven by clinical need. That said, SDHB works to reduce waste wherever possible. Initiatives either planned or taken to date include:

- substituting medical gas (Nitrous Oxide) use where clinically appropriate due to the presence of Desflurane, a potent greenhouse gas. (Other anaesthetic gases contain Sevoflurane, a much less potent greenhouse gas)
- electrifying 50% of the SDHB's 290 fleet vehicles by 2030
- recycling pens, PVC drip lines and post-surgical cuffs
- recycling single use metal instruments, and
- improving recycling in the cafeterias for milk bottles and tins.

Throughout Dunedin and Wakari Hospitals, staff are encouraged to ensure that paper and cardboard, glass, plastics and aluminium is separated and PVC recycling options for clinical products are utilised. Provision for recycling of batteries is also accommodated.

Construction on a New Dunedin Hospital (NDH) will begin shortly. An Outpatients' Building will open in 2025, followed by an Inpatients' Building that will open in 2028. The NDH is seeking accreditation to become a five-Star, "Green Star" accredited building. Practically speaking, the NDH is being designed to mitigate carbon emissions, be resilient to our changing environment and create a modern healthcare facility to promote health and wellbeing for staff and patients.

Specific sustainability initiatives being woven into NDH's planning, design and ultimately construction are grouped around:

- water efficiency
- promoting the natural environment (including co-design with Mana Whenua)
- waste reduction, and
- use of sustainable materials wherever possible.

Additional work around sustainable transport and travel and innovation is also being undertaken.

Two "Operational Waste Management Plans" will be completed to support the NDH – one each for the Outpatients' and Inpatients' Buildings. These plans will describe how waste is collected, moves around and ultimately leaves each building. We will also include some waste target metrics and a view about how to work with staff to encourage positive waste management behaviour change.

4.2.2 University of Otago

The University of Otago is a collegiate university based in Dunedin. The university provides accommodation through 12 halls of residence with 3,000 bed spaces, student flats (a combination of university-owned flat accommodation and leased buildings), and the executive residence building that operates like a hotel for visiting academics. It owns teaching and research facilities (3,500 offices, lecture theatres, workspaces and labs across health science, humanities, science, and commerce). The university owns multiple

large building such as libraries, stores, museums, gyms, a composting facility, and a salmon hatchery. The university staff also host and run national and international conferences.

As well as Dunedin, the university operates in Wellington, Christchurch, Invercargill and Auckland. Annually, it hosts around 21,000 students and 4,000 full-time equivalent staff offering 200 undergraduate and postgraduate degree, diploma, and certificate courses across its campuses.

In 2017, the university set a waste target of halving the waste disposed of to landfill in 2012 by 2021 but achieved that goal two years early (waste dropped by 62% in 2019). Now it is working towards halving the 2018 waste total through a partnership with Waste Management NZ Ltd and has already reduced waste further in 2020, resulting in a drop of 43% since 2018.

The university replaced a multi-million-dollar waste contract held with four companies into a single contract with Waste Management NZ Ltd in March 2019. The financial arrangement is not based on number of bins emptied; rather, it is a fixed fee. This action created a unique collaborative venture that is incentivising continued and aggressive waste reduction changes.

4.2.3 Otago Polytechnic

Otago Polytechnic is a publicly-owned New Zealand tertiary education institute, centred in Dunedin with additional campuses in Cromwell and Auckland. The polytechnic provides career-focused education and training, offering a range of New Zealand accredited postgraduate qualifications, degrees, diplomas and certificates at levels 2–10.

The polytechnic owns 15 teaching buildings and a residential village accommodating 231 students, around 8,000 students, and 650 staff.

The polytechnic has a Living Campus where staff and students grow and harvest food onsite. The campus generates garden waste pruned by students from around the campus which is chipped and composted. Food scraps from the catering facilities go to an onsite worm farm. The polytechnic has a dedicated staff member who manages the compost and worm farm.

EnviroWaste, the polytechnic's main waste contractor, collects general waste, and various materials for recovery including co-mingled glass, green waste, mixed recycling, cardboard, and wood ash. Spotless Cleaning company holds the cleaning contract for the whole campus and also collects general waste from 37 locations.

The polytechnic has a 2019 waste reduction plan agreed upon by the leadership team. The midterm goal was a 20% reduction on 2017 waste generated by 2020. The long-term goal is an 80% reduction by 2021. It has a midterm recycling goal of 40% improvement from 2017 recycling amounts by 2022.

Educating students and staff as to what can and can't be recycled remains a problem. The polytechnic would like to see a regional education campaign to reinforce the

recycling habits started at home, which would require recycling to be standardised across councils to work. Polytechnic staff we interviewed felt the current situation creates a lack of trust in recycling when students and staff don't know what happens to the materials that they have separated, especially when media stories can contradict what they have been told.

4.2.4 Port Otago

Port Otago Limited is a full-service port located in Port Chalmers, Dunedin. As well as port facilities, there are container servicing and storage facilities. The storage facilities are primarily used for milk powder, fish and timber prior to export.

The company has six main locations:

1. Main port in Port Chalmers
2. Sawyers Bay warehouse
3. Cold storage at Dunedin Bulk Port
4. Dunedin depot container storage
5. Container storage operation in Mosgiel
6. Marine plant at Birch St

Various general waste types are sent to landfill from nine different facilities.

Port Otago is committed to reducing its waste through recycling, repurposing or reusing items. The majority of recycled items are packaging and scrap metal items, and clothing is repurposed and provided to Cargill Enterprises for use. There is ongoing work into removing items from the organisation to eliminate the requirement for recycling or landfill.

4.2.5 Trends and opportunities – institutional and large commercial waste

All of the large institutional and commercial waste generators studied for this project have implemented recycling into their waste collection services. They have all identified their main waste materials and looked for ways to reduce their disposal to landfill.

Polytechnic staff we interviewed felt there needed to be consistency across the country for plastic recycling.

An opportunity lies in promoting the introduction of standardised kerbside collection services across the region to begin with and providing clear concise guidance as to what can and can't be recycled nationally and within the Otago region. This would help everyone in Otago understand the impact they can make from home or work.

By better understanding what is in their waste and how different materials can be identified and managed, waste producers like the ones identified in this report will be able to manage their waste more efficiently. The SDHB's New Dunedin Hospital, for example, has a unique opportunity to change the way it manages and thinks about waste as it plans the design of the new hospital.

4.3 Pre-Consumer Food Waste

This section looks at ten Otago-based food producers and their waste programmes.

Pre-consumer food waste refers to organic waste materials resulting from the processing of food products.

4.3.1 Harraways Oats

Harraways has been processing oats in Dunedin since 1867.

Harraways processes up to 12,000 tonnes per annum of oats, wheat, barley, rye, and other specialist grains. Up to 8,000 tonnes per annum of finished product are sold into the New Zealand retail and commercial sectors and into export markets.

Based on processing 12,000 tonnes of oats, Harraways generates approximately 3,800 tonnes of organic waste materials per year.

Prior to 2018, Harraways' by-product was sold as stock food. However, during exceptionally good grass-growing years, stock producers would not purchase additional feed. In these years, 87% of this organic waste would go to landfill as neither Harraways nor the stock food manufacturer had space to store the excess product.

In conjunction with large stock food suppliers, Harraways are now able to supply approximately 90% of the oat by-product to stock food manufacturers, compost operators, re-generative farmers, and directly to the public as stock food. For the remaining 10%, since 2010, Harraways has converted its process boilers to use oat by-product as a fuel. Harraways now uses approximately 7.5% of its oat by-product as a biofuel, with the ash being used as fertiliser by local vineyards.

The remaining by-product consists of damaged grain or spillages of between 0.5% -2.5% and is either sold to specific buyers or sent to landfill.

With a high proportion of its organic waste products now being diverted from landfill disposal, Harraways' major waste material is cardboard, paper and soft plastic wrap which is all recycled, and general waste including polypropylene bulk tote bags, and other types of plastic packaging going to landfill.

4.3.2 Kraft Heinz – Cerebos Gregg's Coffee

Kraft Heinz is the third largest food company in North America and the fifth largest in the world. Kraft Heinz purchased Kiwi company Cerebos Gregg's in 2017.

Cerebos Gregg's began operations in 1861, making it one of New Zealand's oldest food companies. The Dunedin North factory has operated on the same site since 1925.

Gregg's in Dunedin North processes green coffee beans into instant coffee powder, resulting in a by-product of wet spent grounds that are transported to a composting facility in Christchurch.

Less simple to divert from landfill is the grit from Gregg's coal boiler. Grit that is not transported to the composting facility in Christchurch is disposed of to landfill in Dunedin.

Another problematic waste material generated by Gregg's is the aluminium foil used in the packaging of the coffee powder. The company is currently seeking an alternative material.

4.3.3 Lion – Speight's Brewery and Emerson's Brewery

Speight's brewery in Dunedin was established in 1876. The brewery is operated by Lion Pty Ltd, an Australasian company owned by Japanese food, beverage and healthcare company Kirin Holdings Co. Ltd.

Speights recycles cardboard and plastic. It also generates general waste which includes malt sacs and the foil bags in which hops are transported; no additional information was provided regarding the material of the malt sacs.

The Emerson's Brewery Company, also owned by Lion, is a craft brewery located in Dunedin. The brewery recycles glass and plastics as well as generating general waste. Emerson's was not able to provide a breakdown of the composition of general waste, nor whether any organic material was included in that figure.

4.3.4 Alliance Group – Pukeuri

The Alliance Group is a farmer co-operative exporting lamb, beef and venison products to more than 65 countries. It operates freezing works at eight sites in New Zealand; one of them, Pukeuri (north of Oamaru), is within the Otago region.

Alliance Group - Pukeuri employs 1,000 staff at peak season and processed 1.1 million lambs, 184,000 sheep, and 71,000 cattle in 2020-2021.

Alliance Group - Pukeuri has introduced several initiatives to minimise the organic waste generated by processing animals for meat. There is an onsite facility for composting faecal material and paunch (stomach contents). Locally sourced bark is used in the composting process.

Due to a slump in the market, one of the largest amounts of organic waste materials was disposed of to landfill in recent years including animal hides, primarily cattle hides. Due to the increasing cost of landfill disposal, Alliance Group - Pukeuri invested in a shredding machine, and shredded hides are now transported to Wormworx in Cromwell.

Alliance Group - Pukeuri has not rendered on site since 2019. Currently, sheep waste is diverted for cat food and beef waste for dog food. Other organic processing wastes are used as fish food by an Indonesian client.

Alliance Group - Pukeuri has a consented cleanfill for the disposal of boiler ash as well as inert materials, such as bricks and concrete.

4.3.5 BX Foods – Oamaru Meats (Previously Lean Meats)

Oamaru Meats is a small-scale abattoir that process sheep (including lamb and goats) and cattle.

Due to the current slump in the hide market, Oamaru Meats was sending skins to landfill. However, the increasing costs of landfill disposal is encouraging it to develop alternative management options.

The abattoir also sends general waste to landfill, including plastic film.

4.3.6 Silver Fern Farms Finegand Plant

Silver Fern Farms Limited (SFF) is owned in equal partnership by Chinese food manufacturing company Shanghai Maling and by Silver Fern Farms Co-op Ltd, a cooperative of New Zealand sheep, cattle and deer farmers.

SFF is New Zealand's largest processor, marketer and exporter of lamb, beef, venison and associated products. The company operates 14 plants in New Zealand and processes 30% of all New Zealand lamb, beef and venison production. The Finegand plant, outside Balclutha, is in the Otago region.

The plant generates general waste including both soft and hard plastics. Plastic waste includes aprons, masks, visitor clothing kits, Weasand clips, animal ear tags, plastic bin/carton liners, scrubber pads, plastic pipe centres, plastic gloves, plastic bags, plastic packaging, and shrink wrap. The weekly amount of general waste increases over summer and decreases over winter, dictated by processing peaks and stock throughput.

In terms of organic waste, market volatility has resulted in some hide and skin by products being disposed of to landfill. SFF reports that alternative options for landfill diversion are being actively investigated, along with management options. Any additional non-edible material from animals is either used for pet food or rendered.

Ash from coal boilers at Finegand is shipped back to the coal mine for disposal (at a significant cost to Finegand). The plant is moving away from coal over the next two years and is investigating technical feasibility for the use of paunch grass (stomach contents) and other organic material as mixed into other biomass fuel sources for additional energy generation.

SFF has adopted a sustainability action plan which includes the following:

- A target of 90% reduction in organic material to landfill by 2024
- A Waste reduction fund to accelerate alternative uses for organic waste in order to avoid landfill
- An across the board 10% reduction in inorganic waste to landfill by 2024
- Additional transparency and baseline measures in place to measure waste to landfill and progress against the target
- Participation in a circularity event and associated actions with x labs in 2022
- Active sustainable procurement and vendor partnerships to support goals for reducing plastic use, innovation in packaging and circularity

4.3.7 Southern Clams

Since 1982 Southern Clams, based in Dunedin, has harvested littleneck clams from the waters of Otago Coast.

The company claims minimal waste is generated through its food processing. All of the clam shells are returned to the harbours or bays where they were harvested. The fish waste generated from emptying freezers once a year is given away as fish bait. This material is landfilled if there is not sufficient demand.

Southern Clams uses a skip for a weekly collection of its general waste, which consists primarily of soft plastics such as gloves, packaging, shrink wrap and Netlon (netting used to hold clams together) as well as general office waste.

4.3.8 Danone Nutricia - Clydevale

Danone Group is a multinational food products corporation founded in Spain and based in Paris. Danone sells products in 120 markets and approximately 50% of sales is from dairy and plant-based products.

All members of the Danone Group must adhere to strict sustainability policies. For example, at least 75% of the milk supply is to comply with its sustainable agricultural practices by 2020. Other policies include reducing packaging at source, turning waste into a resource, and using packaging materials made only from sustainable resources.

Danone Nutricia manufacture infant formula in New Zealand at two locations, Auckland and Clydevale, Otago.

The factory at Clydevale processes milk, all collected from within 130 km of the plant, into powdered infant base formula. The base formula is sent to Auckland to create different infant formula products.

Danone Nutricia reports having no waste materials from its Clydevale plant that are not compostable, recyclable or reusable. Organic waste material is used for stock food. All plastics are separated into plastic type, baled and transported to SdE in Invercargill for recycling. All transport costs are covered by Danone. Other material sent for recycling include polypropylene bulk tote bags per year and aluminium nutrient containers.

Danone Nutricia generates liquid waste that is sent to the onsite wastewater treatment plant (WWTP).

4.3.9 Fonterra - Stirling

Fonterra Co-operative Group Limited is a multinational publicly traded dairy co-operative owned by approximately 10,500 New Zealand farmers. Fonterra has 96 processing plants on 30 manufacturing sites in New Zealand, including Stirling, which is southeast of Balclutha in Otago.

The Stirling plant processes milk to cheese; the cheese is packaged into 20 kg boxes and sent to Dunedin for export.

Whey is separated and delivered to Clandeboye or Edendale as a liquid for further processing into a final product. A portion is also dried for milk powder export.

During the production season, the Stirling plan produces general waste to landfill which includes soft plastic, dirty cheese bags (soft plastic), polystyrene, harder plastics such as sampling containers, label backing, strapping, salt fines, stock food cheese, cardboard, petri dishes, batteries, paper and domestic recycling. There is a target to reduce this figure annually by 30%.

4.3.10 Trends and opportunities – pre-consumer food waste

Across all of the processing operations studied, soft plastics is a key problematic waste material, with the majority of processors sending it to landfill. Small hard plastics, foil packaging materials and contaminated cardboard were also identified as materials of concern.

SdE in Invercargill is currently (December 2021) fundraising to purchase a machine to wash, dry, and shred bale wrap[9]. Once the machine is purchased, SdE will export the shredded plastic to overseas markets. Feedstock for the process will depend on bale wrap and commercial soft plastics from Southland farmers and commercial producers. SdE also takes the polypropylene bulk tote bags.

It is currently not commercially viable for SdE to transport plastics from Otago to its Invercargill plant for processing. Potentially, commercial soft plastics from Otago could be back-loaded to Invercargill, which would reduce the cost of transport.

Some bale wrap, but not commercial soft plastics, is currently collected in Otago by Plasback. Plasback produces a range of plastics products for on-farm use. An opportunity exists to expand Plasback's operations through the collection of commercial soft plastics.

In the North Island, Future Post has developed a process for manufacturing fencing products from domestic and commercial plastic waste. The fence posts are approved for use on organic farms (BioGro certified) and can be re-processed when required. Future Post has spoken publicly about being keen to expand to the South Island but has not received funds applied for through the WMF. An opportunity exists to bring this proven technology to the South Island.

4.4 Horticultural Industry Waste

The Otago region, in particular central Otago, has a strong horticultural and viticultural sector. These sectors might be expected to produce large quantities of wastes, both organic waste and packaging. However, data from landfills in the area do not suggest that large quantities of waste fruit are being sent to landfill.

Several industry organisations were spoken to during this project, including Central Otago Winemakers' Association and the Otago Fruit Growers' Association. Various waste

[9] www.sde.org.nz/page14.html#timeline2-9u

operators also provide some information on management of horticultural/viticultural wastes.

4.4.1 Grape marc

Experiences in other regions had suggested that grape marc (the skins left over after pressing for juice to make wine) may be a potential issue. However, the Regional Council has not noted water quality issues in the region, which would be expected were grape marc being managed poorly.

Anecdotally, waste companies suggest that the vast majority of this material is managed on-property and, while the waste company may provide a service, this is limited to moving the waste material from one part of the site to another.

Viticulture also uses quantities of agricultural chemicals (to a varying degree depending on a growers' particular approach). Enquiries by the Central Otago Winemakers' Association have suggested that most vineyards, and certainly the larger and high-profile ones, make use of services such as Agrecovery to dispose of their agricultural chemical containers.

When it comes to bottling, given the high number of vineyards around the central Otago region, the lack of a recycling pathway for post-consumer glass bottles is of concern, including for the industry from a reputational perspective.

4.4.2 Stone fruit

In the first half of 2021, there were frequent media reports about large quantities of waste fruit resulting from a lack of seasonal workers to pick the fruit when needed. A recent report commissioned by CODC estimated that approximately 15 percent of fruit grown in the region does not make it to market.

The available waste data does not suggest that large quantities of spoiled fruit are being sent to landfill, yet this material also does not appear to be going to off-property processing such as commercial composting or vermicomposting. Anecdotal reports from a number of fruit growers suggests that this waste material is simply being managed on-property.

Once again, there are packaging issues associated with fruit. Firstly, with agrichemical containers and secondly the containers and wrap used to sell fruit, including local sale through orchard shops and roadside stalls. Wherever possible, orchardists should be encouraged to use #1 plastic containers and minimise plastic wrap to ensure the waste impact from this sector is minimised.

4.5 Boiler ash

Within Otago there are a wide variety of boilers, sizes and use. They range from biomass, coal, wood, wood pellet, LPG and one sulphur boiler.

Typically, 0.5% of the wood that goes into wood boilers turns into ash. Wood ash is completely safe for composting or putting directly onto the land.

Approximately 6% of the coal that goes into coal boilers turns into ash. Coal ash can contain contaminants such as mercury, cadmium and arsenic and it is not recommended that coal ash goes directly onto the land or is used in composts that will feed food producing gardens. Often, large operators return their coal ash to the mine (as part of the mine's consent conditions). Our data shows approximately 4,200 tonnes of coal ash per year is returned to the mine as cleanfill (interestingly, four large operators produce 3,957 tonnes per year between them).

However, for smaller operators this is not always feasible to return the coal ash to the mine. Instead, it goes to landfill. At the Balclutha Swimming Pool, one swimming pool boiler produces approximately 55 tonnes of ash per year that is sent to landfill.

Some Otago schools are burning coal and some of them are burying ash on the school grounds to get rid of it. However, this practice will be phased out as the Ministry of Education prioritises 90 schools for replacement of their coal boilers to alternative boiler technologies such as pellet boilers, or other forms of heating.

4.6 Construction and Demolition Waste

Construction and demolition waste includes a wide range of material streams, with the most common waste types being concrete and rubble, timber (treated and untreated), plasterboard and mixed waste.

Construction and demolition is generally defined best by activity source rather than material type. Quantity estimates are presented in Table 13.

There are very few large-scale construction and demolition waste operators in the Otago region. All are located in Dunedin, and focus on aggregate recovery. There are a number of very small-scale recovery operations, particularly in central Otago, but these focus on individual projects and are very much the exception rather than the rule. The decision to make a particular effort to recover construction or demolition waste is usually made due to client needs, such as meeting the criteria for standards such as Green Star, rather than any financial consideration.

There are quite different dynamics in the construction and demolition waste recovery sector for demolition/aggregate waste, and mixed construction waste. Demolition and aggregate waste operators tend to handle high volumes of waste, and outputs are low value per unit but similarly produced in volume. Construction waste operators tend to handle much lower volumes, and the outputs from this sector are more likely to be high quality, high value items such as native timber, joinery and household fittings. It is also common for scrap metal and fibre (paper/cardboard) to be recovered.

An increase in the landfill levy for Class 1 landfills, and the expansion of the landfill levy to Class 2-5 landfills, may make diversion of construction and demolition waste more common as it becomes economically viable. Over 80% of construction companies reported that they expect the costs of waste minimisation and increasing landfill levies to have a negative or neutral impact on their operations over the next three years, while

also rating 'waste minimisation and recycling' as the top priority action to help their operations become more environmentally sustainable[10].

The general feeling of those involved in the construction waste diversion industry is that until disposal costs (to landfill) are higher, the choice to sort at source or to use a construction waste service that incorporates a sorting stage will be purely environmental and the market will be limited.

4.7 Biofuel Feedstock

Organic wastes can be used as feedstocks to generate energy. Feedstocks can come from a wide range of sources including organic waste, plastics, fibre and tyres, as well as construction and demolition wood waste. The largest potential however is from organic wastes generated through forestry, agriculture and horticulture.

Pre- and post-consumer food waste, horticultural waste and construction and demolition wastes are covered in other sections. This section therefore focuses primarily on forestry and crop residues.

4.7.1 Generation

Otago has approximately 104,000 hectares in plantation forestry which represents approximately 5.8% of New Zealand's total exotic forest.

Waste woody biomass which can potentially be used as an energy feedstock comes primarily from:

- Forestry residue - slash, tops and unmerchantable stemwood from trees harvested for saw or pulp logs. Forest residue may include the cutover (those left at the stump) depending on location of harvest, or material brought to the landing during the harvest operations.
- Wood processing residues - bark, sawdust, shavings, offcuts, etc. from processed wood for pulp, panel board, construction timber, furniture, etc. and black liquor from pulp plant residues.
- Straw and stover – the woody stalks and stems from grass and grain crops. While approximately half of this material needs to be left in situ to preserve soil nutrition and health, there is potential for some to be utilised in energy recovery.
- Orchard residues - stumps and old vines. Turnover rates in orchards range from 4% to 12% per annum depending on the crop[11].

[10] Teletrac Navman and Civil Contractors New Zealand (2020) "Construction Industry Survey" available at www.civilcontractors.co.nz

[11] Saggar S., Giltrap D., Forgie V. and Renquist R. (2007). *Bioenergy Options report: Review of Agricultural resources*. Landcare Research Contract Report; LC0708/016

Scion (2017) calculated the potential of biomass feedstocks for energy generation on a regional basis in NZ.[12] The outcomes of its calculations for the Otago region are shown in the table below. The quantities of material shown exclude material that is currently recovered.

Table 25: Estimated Tonnages of Woody Wastes Generated

	In Forest	Orchard	Straw & Stover	Wood Processing	Total
2017 (actual)	233,680	14,748	28,527	23,228	300,183
2022	392,462	15,043	29,098	23,228	459,831
2027	457,848	15,344	29,679	23,228	526,099
2032	271,753	15,651	30,273	23,228	340,905

Source: Scion

In addition, Scion also calculated the quantities of material that could practically be recovered from each of the sources examined. The calculations allow for the need to leave some material in-situ and the difficulty of accessing material. Scion's estimates are shown in the table below:

Table 26: Estimated Tonnages of Woody Wastes Recoverable (low estimate)

	In Forest	Orchard	Straw & Stover	Wood processing	TOTAL	%
2017 (actual)	98,971	9,586	17,116	20,905	146,578	49%
2022	173,466	9,778	17,459	20,905	221,608	48%
2027	195,547	9,973	17,808	20,905	244,233	46%
2032	120,849	10,173	18,164	20,905	170,091	50%

Source: Scion

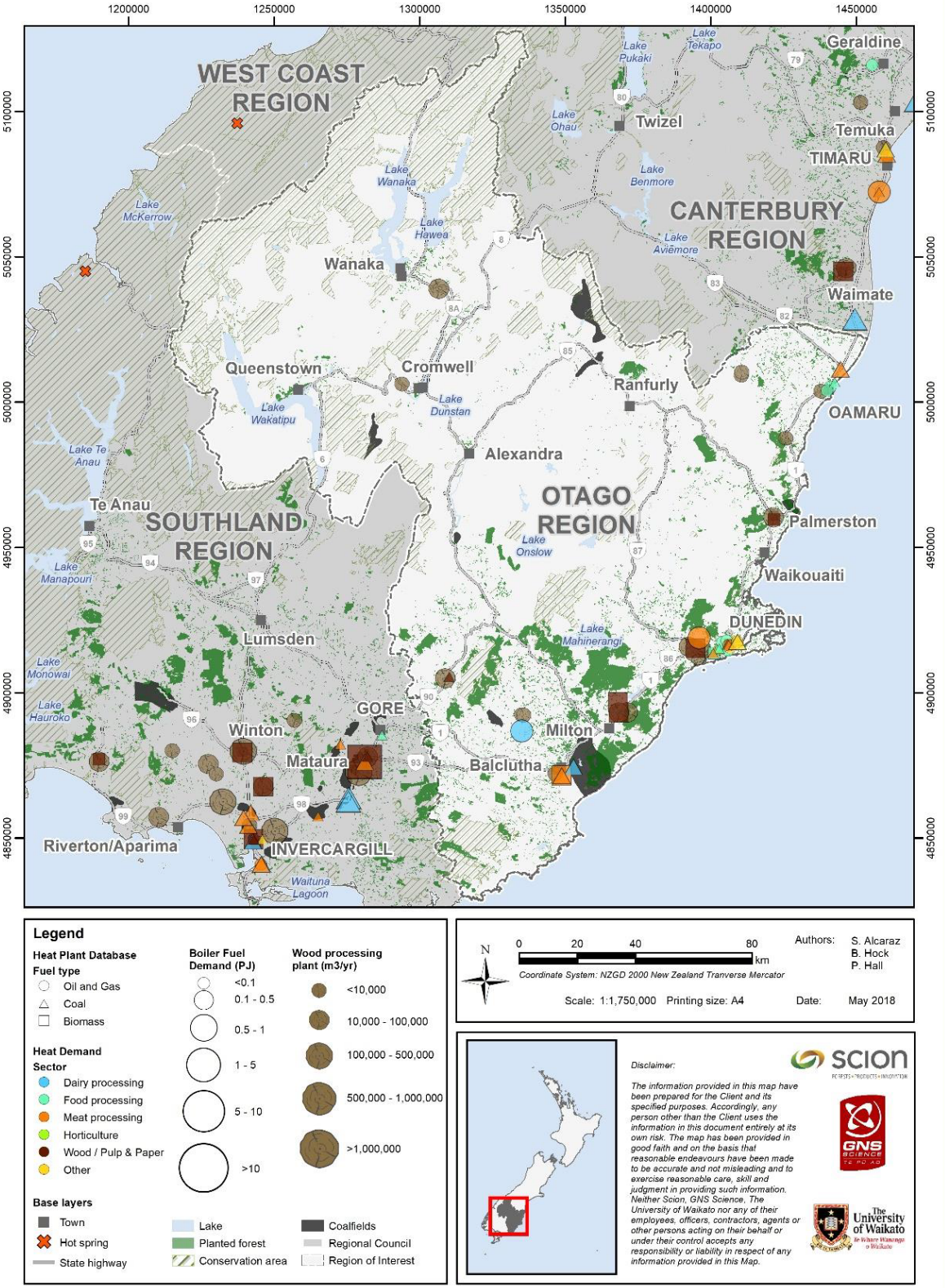
The above estimates suggest that around half of all woody waste are potentially practically recoverable, with the largest potential source being in-forest wastes (in

[12] Scion (2017) Residual biomass fuel projections for New Zealand - indicative availability by region and source. Report to BANZ / EECA

particular ‘cutover’ wastes which are the large branches left behind while harvesting timber).

The material is relatively unevenly distributed around the region with the majority of forestry in the Southern part of the region, and orchard residues in Central Otago.

The map below (Source: Scion) shows the distribution of forestry alongside existing facilities that could utilise recovered biomass for process heat.



4.7.2 Management

There are several sawmills in Otago including:

- Pan Pac, Milburn[13];
- Stuart Timber, Tapanui, West Otago[14];
- North Otago Sawmilling, Oamaru;
- Valley Lumber, Dunedin;
- Timber Direct, Dunedin; and
- Otago Lumber Company, Mosgiel.

The Daiken MDF plant in Mataura (Southland) utilises forestry waste, as well as the waste wood, bark, chips, branches, side parts, and sawdust from sawmills in Otago and Southland. Some sawmill and forestry waste not utilised in the Daiken plant is sold as firewood or is used in process heat. The quantities utilised by Daiken were not available at the time of writing.

In Otago, one million tonnes of low-grade logs are exported annually to China where they are used for concrete forming (boxing) then they are used as fuel in biomass boilers in China.

The bioenergy association database lists 36 suppliers and users of bioenergy in Otago. A breakdown of these is provided in the table below.

Table 27: Energy Recovery Facilities by Type

Facility Type	Count
Biogas	2
Electricity	0
Emerging technologies	2
Commercial heat	13
Industrial heat	1
Landfill gas	0
Liquid biofuel suppliers	1

[13] https://www.panpac.co.nz/Lumber.html. produces around 100,000 m3 per annum of green sawn output. Focused on the processing of small diameter sawlogs. Utility quality corewood is sold green sawn and the outerwood is kiln dried. Solid waste, including bark, sawdust, shavings from the planer mill, and effluent solids, is burnt in the site boilers to provide energy for drying lumber and wood pulp.
[14] https://www.stuarttimber.co.nz/

Facility Type	Count
Liquid biofuel users	0
Sawmill boilers	1
School boilers	13
Solid biofuel manufacturer	3
WTTP gas	0
TOTAL	**36**

Source: https://www.bioenergyfacilities.org/bioenergy-facility-list

Crop residues are generally not harvested for further use but are left in situ. Most of the biomass currently used as fuel is from sawmilling operations.

4.7.3 Trends and Drivers

Wood biomass, primarily from forestry slash and, to a lesser extent, sawmill by-products is the most commonly used biofuel in New Zealand. Despite this, industry sources suggest that New Zealand is behind in realising its potential. Pioneer Energy, who are a key player in this space, estimate that we are achieving about 20%-25% of the biomass energy potential so far. They report that there are tenders currently out for projects which will bring this figure to about 28%, and that other bigger projects in the pipeline (such as dairy factory conversions) could take this as high as 50% -60%. At this stage, however, industry sources suggest that a lack of local supply issues could start to make switching to wood biomass boilers uneconomic. There is a need to match capacity with viable supply, and forestry wastes are driven by regional factors and market conditions.

The 'Wood Energy Industrial Symbiosis' project[15] undertaken by Scion identifies wood processing clusters in regions with significant forestry resources co-located with other industries can make the best use of wood and energy supply and demand. Otago and Southland are regions of potential identified by the initiative.

The study identifies potential to expand wood processing with an integrated heat supply based on unused logs. Excess heat could also be provided to dairy factories and freezing works at several locations in the wider area. A processing cluster near Balclutha consisting of a sawmill providing feedstock for cross-laminated timber (CLT) and remanufacturing, plus an OEL™ plant would provide enough processing residues to

[15] Scion wood energy industrial symbiosis. From: https://www.scionresearch.com/science/bioenergy/towards-biorefining

replace coal at either the Stirling dairy plant or the Finegand meat works. Alternatively, the processing residues, together with forest and other biomass residues, could replace LPG as an energy source at the Clydevale dairy plant.

The Bioenergy Association, which promotes bioenergy uptake, notes that the use of some waste materials as feedstocks is restricted by regional air plan rules. These reportedly tend to place restrictions on the materials that can be used in boilers including some painted or treated timbers, rather than taking full account of the technical capability of boilers to combust that material while maintaining safe emission limits.[16] In its view, a more consistent national approach that takes better account of technical capabilities could result in greater utilisation of waste timbers. They also note that they would like to see standards for the production of wood pellets to ensure greater consistency and consumer confidence.

The announcement by Government in 2021 to phase out use of fossil fuels for process heat by 2037, and to transition all government owned heating facilities to using low emission fuels (biomass or electricity) by 2030 will provide a strong incentive for investment in biomass-fuelled plants. The timelines around the phase out mean that, in effect, any new plant installed from this point would likely to need to burn biomass to comply with the requirements.

4.8 Other Waste Streams

4.8.1 Tyres

4.8.1.1 National Situation

Historically the majority of New Zealand's end-of-life tyres (ELTs) have been landfilled (approximately 52,000 tonnes a year), stockpiled or illegally dumped (around 3,000 tonnes a year). ELTs are accepted at some (but not all) transfer stations and landfills (refer the landfill and transfer station section[s]). Roughly 35% of tyres have been repurposed or recycled. Repurposing of tyres mainly occurs on farms, where (whole or quartered) tyres are used to line pits and hold down silage. Tyres are also repurposed for temporary roading and erosion control. Tyre-derived medium (TDM) is used as an aggregate in roading, or as turf and matting. New Zealand also has tyre-derived fuel (TDF) capacity, as a facility in Northland (Golden Bay Cement) will be able to use up to 3.1 million tyres a year (about half of NZ's total annual tyre numbers) as a fuel source for the cement works. This is expected to significantly increase the quantities recovered. Some tyres are exported, either baled or shredded.

4.8.1.2 Otago Situation

There is very limited information on what happens to tyres locally. If national data is pro-rated on a per capita basis this implies there are an estimated 3,988 tonnes of ELT

[16] Personal communication, Brian Cox, Bioenergy Association

generated in Otago, annually. Currently there are no facilities to process these tyres in Otago. In Dunedin and Queenstown, tyres collected for processing are sent to Christchurch, where it is understood they are baled for export to India.

4.8.1.3 National Environmental Standard (NES) for Tyres[17]

From 20 August 2021, a new NES for storing tyres outdoors (enabled under sections 43-44 and 46A of the RMA) came into force. The NES deals with the effects of storing tyres outdoors that fall within the functions of regional councils under section 30 of the RMA. This is related to water quality, control of discharges of contaminants into land, air or water, and the mitigation of natural hazards. The NES sets certain thresholds for action:

- storing amounts under 20m3 is a permitted activity;
- storing amounts between 20m3 and 100m3 is permitted but with general conditions around the height and proximity to 'sensitive' areas (e.g. waterways, powerlines); and
- storing amounts over 100m is a regulated discretionary activity, and this will require a resource consent.

4.8.1.4 Product Stewardship

Tyres were declared a priority product in 2020. A proposed product stewardship scheme 'Tyrewise' has been accredited by the Minister for the Environment, and is currently in the process of establishment and awaiting enabling regulations. The Tyrewise scheme would impose a per tyre fee on import which would cover the end-of-life costs of collection, sorting, transport, processing and recovery. Establishing the Tyrewise scheme is expected to substantially resolve the current ELT issues.

4.8.2 Farm Plastics

Farm plastics and agrichemical containers are associated with almost all farming activities and include the packaging of products such as fertiliser, animal feed, wrapping material (hay and bailage/silage), various chemicals and veterinarian products. This material stream stands out due to its sheer size that arises over the entire region, and the fact that its disposal is mainly unregulated and likely to bypass formal collection systems. Available but incomplete data shows that less than 30% of material that is accepted through product stewardship schemes is recovered.

There are three organisations running voluntary accredited product stewardship schemes addressing silage wrap and agrichemical container waste streams: Plasback, Agrecovery and ChemCollect. Whereas Plasback and Agrecovery just deal with farm waste, ChemCollect also serves other markets.

[17] https://environment.govt.nz/acts-and-regulations/regulations/nes-storing-tyres-outdoors/

Plasback collects clean and packed silage wrap from farms, and stores these at regional hubs where material is compacted and condensed with balers and stored for transport and export.

ChemCollect collects chemicals, sprays, solvents, unknown liquids and powders and other hazardous materials. The nearest ChemCollect facility is in Canterbury. Collection services are available, although acceptance criteria can vary.

Agrecovery has developed (with WMF funding) a proposal for mandatory product schemes addressing farm plastics[18]. Silage/baleage wrap collected from farms is transported to a baler, where it will again be stored until a container is filled up. Since there are less balers than regional collection points, cross boundary movements occur. All the collected silage wrap is exported, mainly to Malaysia.

Small amounts of (clean) agrichemical containers can be dropped off at regional locations; or direct pickup can be arranged for larger quantities which are transported to the processing facility in Christchurch. Depending on the material type and additional processing needed, disposal occurs at a Class 1 landfill.

The vast majority (90%) of agrichemical containers are disposed to landfill; 2% of which are shipped to Europe due to the need to for a higher standard of landfill. The remaining 10% of containers is recycled by Astron in Auckland.

All operators acknowledge they are only capturing a fraction of the existing material streams. There is considerable uncertainty over the quantities of materials not being captured. Stakeholder estimates were that they are capturing less than 45%.

Farm plastics and agrichemicals are a part of farm operations. The fact that less than 50% is collected for recycling or safe disposal raises questions about how the remaining material is being disposed of.

Anecdotal information suggests that farms that do return and recycle their materials do so because:

- they want to do the “right thing”;
- they do so as a requirement of an accreditation scheme for commercial contracts (e.g., Fonterra and Synlait);
- there is a subsidised take back scheme through a local or regional council; or
- requirements to decontaminate the land upon sale or transfer of farm.

This is not an exhaustive list, as farmers have not been interviewed for this project.

Prior research showed that economic levers such as the accreditation schemes tied to commercial contracts stimulate farms to increase sustainable behaviour and practices.

[18] For example: Agrecovery’s project to process farm plastics: https://www.agrecovery.co.nz/wp-content/uploads/2020/09/Farm-Plastics-Materials-Flow-Analysis-web.pdf

These efforts are often supported by tools calculating GHG emissions (e.g., Overseer and Toitū)[19,20].

There may be mechanisms such as including waste management aspects in accreditation schemes and tools that could be used to improve data, and address waste issues, on farms.

Nationally there are 4,626 tonnes of farm plastics collected; made up of 4,067 tonnes of silage wrap and 559 tonnes of chemical containers. The quantities for Otago are show in the table below, alongside an estimate of the uncollected quantities.

Table 28: Otago Region Farm Plastics Collected and Uncollected (Estimates)

	Collected (tonnes per annum)	Uncollected (tonnes per annum)
Silage wrap	470	705 – 776
Agrichemical containers	25	38 – 64
Total	**495**	**743 – 840**

***based on National Resource Recovery Infrastructure and Services Stocktake and Gap Analysis (2021) Prepared for MfE, Eunomia**

The Office of the Prime Minister's Chief Science Advisor[21] estimates an annual usage of 0.25 tonnes of silage/baleage wrap, and ~0.04 tonnes of containers and drums per farm[22]. The Otago region counts 3,291 farms[23], which would equate to 823 tonnes of silage/baleage wrap and 132 tonnes of agrichemical containers, resulting in slightly lower estimates than provided in the table above by the service providers.

However, neither estimate takes into account legacy plastics on farms, nor farm plastics not covered by existing product stewardship schemes; for example, polypropylene feed and fertiliser bags, nets and twine.

[19] https://www.overseer.org.nz
[20] https://www.toitu.co.nz/what-we-offer/farm-certification
[21] Rethinking Plastics in Aotearoa New Zealand, 2019, Office of the Prime Minister's Chief Science Advisor
[22] https://www.pmcsa.ac.nz/2019/11/05/agricultural-plastic-waste/
[23] NZ Stat, Dataset: Geographic units by Industry and statistical area 2000-20, extracted on 1 July 2021

5.0

Issues and Opportunities

5.0 Issues and Opportunities

Investigations to date have revealed a range of opportunities to improve waste management and ultimately reduce waste in Otago. This section outlines these opportunities, first setting out the issue and then presenting high level options to address them as a region.

A cross-cutting theme is way the region splits into two parts: a coastal zone consisting of Waitaki, Dunedin and Clutha, and an inland zone with Central Otago and Queenstown Lakes. The synergies that exist are mainly within these zones. Queenstown Lakes, Central Otago and Clutha also have more natural transport connections with Southland than with Dunedin/Waitaki. These are important considerations for each of the discussions that follow.

5.1 Reprocessing Infrastructure

Issues: Several previous sections have highlighted the sheer distance from the Otago region to several key reprocessing facilities. For example, fibre, glass and soft plastics reprocessing options are almost completely located in Auckland. Other key reprocessing facilities are in other parts of the North Island, such as PET and PP recycling in Wellington and the Hawkes Bay. While these materials are often transported a long distance for reprocessing, the Otago region is one of the furthest from these facilities (along with Westland and Southland).

At present, there is almost a complete lack of reprocessing facilities for organic waste and construction and demolition waste – these are waste streams that do not lend themselves to being transported long distances.

The nearest shredders for metal recovery, and the only ones located in the South Island, are in Christchurch (although there is a logistics hub in Dunedin associated with one of those shredders).

Options: As a region, the councils may be able to lobby for better infrastructure provision in the lower South Island; particularly in partnership with Southland. If infrastructure can be located in the Otago region, there is potential for other regions that suffer from the same geographical issues as the Otago councils to become customers. For example, there is currently high demand for on-shore processing of #5 or PP plastics. This type of plastic has been included in the government's recent proposals to standardise kerbside recycling, and government funding has been allocated elsewhere for PP reprocessing facilities.

Distance to reprocessing could make reusables schemes more feasible in comparison. Active viticulture and brewing industries (in central Otago and Dunedin respectively) may be interested in the benefits of a refillable approach for local customers.

5.2 Organics

Issues: Organic waste was the predominant waste stream to emerge from the analysis to date in terms of both current tonnage to disposal, and in terms of a focus for action. Kerbside food waste is the largest single source of organic waste to landfill and has been targeted for action by both Dunedin and Queenstown Lakes. Biosolids is also a significant waste stream. Organic waste from commercial and industrial sources was found to be generally well managed but there are some exceptions such as animal skins and ash.

Options. There are a wide range of potential options for processing organic wastes. The most problematic organic wastes are putrescible materials with a high moisture content. These are likely to lend themselves to processing technologies, such as anaerobic digestion or vermicomposting, that do not require large quantities of carbon-rich feedstocks or 'bulking agents' to work.

There are a number of companies investigating the potential to establish operations in (or servicing) the region, and consequently it may be possible to leverage and coordinate these opportunities to achieve outcomes that align with the needs of the councils of the Otago region and beyond.

5.3 Construction and Demolition Waste

Issues: Construction and demolition waste is an issue in Queenstown Lakes, Central Otago and Dunedin. While some recovery is occurring, most construction and demolition waste appears to be sent to some form of landfill disposal. There are likely to be opportunities to divert significant quantities of material.

Options: Dunedin is planning to take measures to develop construction and demolition waste sorting and diversion. However, there are no significant planned activities in Queenstown Lakes and Central Otago. There may be opportunities to develop a consistent approach to construction and demolition sorting and diversion in the region. While sub-regional facilities may be most sensible there is potential to align standards, material acceptance, access and markets. It may also be possible to access central government funding to assist in the development of facilities.

5.4 Recovery (MRF) Infrastructure

Issues: Recycling processing infrastructure in Otago is currently problematic. As noted in the QLDC section, the Queenstown MRF is overdue for replacement, and there are issues with recovery of glass – particularly from Queenstown and Central Otago – which means some of this material is currently being sent to low value applications. In addition, the Dunedin MRF is due for an upgrade, which is expected to be included as part of the new council contracts due to commence in mid-2023.

Options: There may be potential to explore consistent provision of MRF infrastructure across the region (although this would have to be in the context of existing contract arrangements). This could take the form of a single provider, a single facility or greater alignment in terms of standards, material acceptance, access and markets.

5.5 Resource Recovery Parks

Issues: Most of the TAs of the Otago region expressed an intent to develop some form of resource recovery park. QLDC has identified a site near Queenstown that could potentially accommodate a full resource recovery park, new MRF, and small composting operation (termed a Resource Recovery Hub). It is currently exploring the consenting and site requirements. Dunedin is looking to expand the operations at Green Island to become a resource recovery park, including construction and demolition waste sorting Clutha DC are looking to develop a RRP on its Mt Cooee Landfill site; and Waitaki DC has noted the lack of local construction and demolition sorting, composting and MRF infrastructure.

Options: There is opportunity to coordinate and align RRP service provision to develop a high level of consistent service. Done well, developing a regional resource recovery network has the potential to catalyse a range of resource recovery activity. A network approach can enable product stewardship schemes to function effectively and efficiently; ensure consistency of service provision and messaging, which will help increase engagement and recovery rates; and potentially lower costs for recovery of a wider range of materials. It may also be possible to access central government funding to assist in the development of facilities.

5.6 Rural Waste

Issues: Nationally, rural wastes are estimated to account for up to 12% of unrecovered waste.[24] When discussing rural waste during interviews with the TAs, it became apparent that there is very little information available and no substantive intent in any of the WMMPs to address rural waste. Rural waste is highlighted here for this reason: it is an area that has not to date received the attention it most likely needs. Rural wastes are most commonly managed on-farm with material stockpiled, burned and buried. There are very few controls on what happens on farms, and much of the material which is currently managed casually could be recycled or recovered, or properly disposed of.

Further to this, the information from the Ernst & Young study on regional carbon emissions suggests that rural wastes may be a substantial source of emissions from the waste sector (although it is our view that this requires further investigation).

The key issue is that current management methods are essentially no-cost and relatively convenient for farmers. Services that collect non-natural materials for recovery or proper disposal are likely to be costly due to the distances involved and remoteness from processing and consolidation points.

[24] Ministry for the Environment. 2019. *Reducing waste: a more effective landfill levy – consultation document*. Wellington: Ministry for the Environment.

Current product stewardship programmes such as Agrecovery and Plasback apply charges to farmers who participate in the schemes.

Options: There have been a number of trials of farm waste collection services, and limited services occur in some areas (including Clutha District). In addition, there are steps being taken to develop regulated product stewardship schemes for farm plastics and agricultural chemicals and their containers, which will provide a more comprehensive approach with (potentially) no direct charges to the end-user at end of life. There is an opportunity to leverage these initiatives to create an on-farm collection service for non-natural rural wastes that offers a high-quality collection service at below cost.

5.7 Landfills

Issues: The landfill market is an important aspect of the picture. AB Lime recently received consent for receiving unlimited tonnage into its facility (although the facility footprint won't change); DCC is proceeding with plans to develop a landfill at Smooth Hill as a replacement for the Green Island landfill (although the scale of this may be smaller than initially announced); Clutha DC is pursuing a 30-year renewal of the resource consent for a landfill at Mt Cooee, with the existing consent due to expire during 2023; Waitaki DC is looking at options for Palmerston landfill, with a potential view to utilising more of the airspace at the facility before the consents expire. In addition, private operators are likely to consider options for disposal and send tonnages where it is going to be most cost effective. With the increase in the waste disposal levy and the increasing cost of carbon emissions through the ETS this is likely to change the current dynamic of where and how waste is disposed of.

Options: There is a range of possible options to consolidate disposal in the region. This could include a regional decision to focus on just two Class 1 facilities in the region (along with the option of AB Lime in Southland); with other facilities (such as in Waitaki and Clutha) being converted to Class 2 fills with organic waste diverted, and any non-compliant material transported to a Class 1 facility.

5.8 Soft Plastics

Issues: Although household soft plastics has not been identified as a significant issue, many of the non-household waste producers across the region mentioned that soft plastic-based waste items were one of the remaining waste management issues they had yet to solve. Although soft plastics are not a significant issue in landfill, either by weight or by environmental impact such as GHG emissions or leachate, the production of soft plastics does have an environmental impact and soft plastics escaping to the open environment is a significant wildlife risk.

Options: There are two organisations currently working proactively on soft plastics nationally and regionally. Future Post is an organisation focused largely on household soft plastics recovery to produce items such as vineyard posts, although it does incorporate pre-consumer feedstock in the process and other specific items such as

Fonterra HDPE milk bottles. Production is currently based in the North Island but Future Post is actively seeking a South Island location.

There are currently very few household soft plastics collection points in the lower South Island (usually located in supermarkets), largely due to the high cost of transporting collected plastics to the North Island.

The Otago region could proactively liaise with Future Post to explore the potential for a South Island processing site to be located in the region, which would naturally lead to a network of collection points.

SdE is also working on increasing processing capacity for soft plastics, although its focus is on industrial plastic sources. Once again, the Otago region could proactively work with SdE to ensure that Otago soft plastic waste streams are able to be incorporated in infrastructure capacity as far as is possible

A.1.0 Composition of General and Overall Waste to Class 1 Landfills

Composition of waste to Class 1 landfills - Tonnes/annum - 2020		General waste - excludes kerbside rubbish and special wastes		Overall waste - includes kerbside rubbish and special wastes	
Paper	Recyclable	5.4%	4,058	5.2%	7,407
	Cardboard	6.6%	4,985	3.7%	5,357
	Non-recyclable	1.8%	1,332	1.4%	2,022
	Subtotal	**13.8%**	**10,375**	**10.3%**	**14,787**
Plastics	Recyclable	0.9%	648	1.2%	1,756
	Non-recyclable	17.8%	13,363	11.9%	17,133
	Subtotal	**18.6%**	**14,011**	**13.2%**	**18,889**
Organics	Kitchen waste	4.6%	3,487	14.1%	20,314
	Compostable green waste	5.3%	3,983	8.8%	12,667
	Non-compostable green.	1.7%	1,273	1.6%	2,237
	Organics other	4.8%	3,639	3.8%	5,405
	Subtotal	**16.5%**	**12,381**	**28.3%**	**40,624**
Ferrous	Primarily ferrous	1.4%	1,021	1.0%	1,394
	Steel other	2.1%	1,562	1.5%	2,175
	Subtotal	**3.4%**	**2,582**	**2.5%**	**3,570**
Non-ferrous	**Subtotal**	**0.5%**	**404**	**0.6%**	**831**
Glass	Recyclable	0.9%	652	1.9%	2,661
	Glass other	1.1%	842	0.8%	1,161
	Subtotal	2.0%	1,495	2.7%	3,822
Textiles	Clothing/textiles	2.6%	1,973	2.2%	3,180
	Other textiles	5.0%	3,750	3.2%	4,543
	Subtotal	**7.6%**	**5,722**	**5.4%**	**7,724**
Sanitary paper	**Subtotal**	**3.0%**	**2,275**	**4.6%**	**6,614**
Rubble	Cleanfill	3.6%	2,714	1.9%	2,714
	New plasterboard	0.1%	84	0.1%	84
	Other	7.6%	5,720	5.3%	7,539
	Subtotal	**11.3%**	**8,518**	**7.2%**	**10,337**
Timber	Reusable	0.6%	441	0.3%	441
	Unpainted & untreated	2.9%	2,166	1.5%	2,166
	Non-recoverable	16.6%	12,495	9.4%	13,461
	Subtotal	**20.1%**	**15,101**	**11.2%**	**16,067**
Rubber	**Subtotal**	**1.6%**	**1,200**	**0.9%**	**1,356**
Potentially hazardous	**Subtotal**	**1.5%**	**1,121**	**13.2%**	**18,943**
TOTAL		**100.0%**	**75,185**	**100.0%**	**143,564**

A.2.0 Waste to Class 1 Landfills - By Activity Source - By % of Total

Composition of waste to Class 1 landfills - by activity source - By % of weight - 2020		Construction demolition	Industrial/ commercial/ institutional	Landscaping	Residential
Paper	Recyclable	0.1%	7.4%	0.0%	2.5%
	Cardboard	2.1%	8.6%	0.2%	5.6%
	Non-recyclable	0.3%	2.2%	0.0%	0.3%
	Subtotal	**2.6%**	**18.2%**	**0.3%**	**8.4%**
Plastics	Recyclable	0.1%	1.2%	0.0%	0.8%
	Non-recyclable	2.5%	23.3%	0.7%	6.9%
	Subtotal	**2.6%**	**24.6%**	**0.7%**	**7.7%**
Organics	Kitchen waste	0.0%	6.2%	0.1%	2.2%
	Compostable green waste	0.8%	2.2%	46.4%	9.0%
	Non-compostable green.	0.1%	0.7%	33.6%	1.1%
	Organics other	0.1%	5.9%	0.0%	0.1%
	Subtotal	**1.0%**	**15.0%**	**80.2%**	**12.4%**
Ferrous	Primarily ferrous	1.9%	1.2%	0.0%	3.2%
	Steel other	0.4%	1.7%	0.0%	8.0%
	Subtotal	**2.2%**	**2.9%**	**0.0%**	**11.2%**
Non-ferrous	**Subtotal**	**0.1%**	**0.6%**	**0.0%**	**0.8%**
Glass	Recyclable	0.0%	1.3%	0.0%	0.4%
	Glass other	0.4%	1.2%	0.0%	1.7%
	Subtotal	**0.4%**	**2.5%**	**0.0%**	**2.1%**
Textiles	Clothing/textiles	0.1%	3.1%	0.0%	2.7%
	Other textiles	2.2%	4.7%	0.2%	14.4%
	Subtotal	**2.3%**	**7.8%**	**0.2%**	**17.0%**
Sanitary paper	**Subtotal**	**0.0%**	**4.3%**	**0.0%**	**0.7%**
Rubble	Cleanfill	10.3%	0.3%	17.2%	0.6%
	New plasterboard	8.6%	0.0%	0.0%	0.2%
	Other	16.5%	5.7%	0.1%	2.2%
	Subtotal	**35.4%**	**6.0%**	**17.3%**	**2.9%**
Timber	Reusable	3.9%	0.4%	0.1%	0.9%
	Unpainted & untreated	7.0%	2.5%	0.2%	3.0%
	Non-recoverable	40.8%	11.5%	1.0%	31.8%
	Subtotal	**51.7%**	**14.5%**	**1.3%**	**35.7%**
Rubber	**Subtotal**	**1.0%**	**2.1%**	**0.0%**	**0.6%**
Potentially hazardous	**Subtotal**	**0.7%**	**1.6%**	**0.0%**	**0.4%**
TOTAL		**100.0%**	**100.0%**	**100.0%**	**100.0%**

A.3.0 General Waste to Class 1 Landfills - By Activity Source - By % of Total

Composition of waste to Class 1 landfills - by activity source - Tonnes/annum - 2020		Construction demolition	Industrial/ commercial/ institutional	Landscaping	Residential
Paper	Recyclable	32	2,891	1	190
	Cardboard	560	3,374	6	415
	Non-recyclable	90	851	1	24
	Subtotal	**682**	**7,117**	**8**	**629**
Plastics	Recyclable	23	477	0	58
	Non-recyclable	664	9,118	19	518
	Subtotal	**687**	**9,595**	**19**	**575**
Organics	Kitchen waste	0	2,418	3	164
	Compostable green waste	213	866	1,193	672
	Non-compostable green.	29	280	863	81
	Organics other	17	2,298	0	7
	Subtotal	**260**	**5,862**	**2,060**	**924**
Ferrous	Primarily ferrous	484	456	0	240
	Steel other	96	681	0	600
	Subtotal	**580**	**1,137**	**0**	**840**
Non-ferrous	**Subtotal**	**37**	**248**	**0**	**60**
Glass	Recyclable	3	491	0	29
	Glass other	108	484	0	126
	Subtotal	**111**	**974**	**0**	**155**
Textiles	Clothing/textiles	28	1,207	0	199
	Other textiles	563	1,839	4	1,076
	Subtotal	**591**	**3,046**	**4**	**1,275**
Sanitary paper	**Subtotal**	**0**	**1,686**	**1**	**49**
Rubble	Cleanfill	2,685	128	443	44
	New plasterboard	2,244	0	0	13
	Other	4,289	2,211	2	164
	Subtotal	**9,217**	**2,339**	**444**	**220**
Timber	Reusable	1,025	170	3	66
	Unpainted & untreated	1,817	984	4	228
	Non-recoverable	10,619	4,500	25	2,378
	Subtotal	**13,461**	**5,655**	**32**	**2,672**
Rubber	**Subtotal**	**258**	**805**	**0**	**48**
Potentially hazardous	**Subtotal**	**171**	**618**	**0**	**31**
TOTAL		**26,056**	**39,082**	**2,569**	**7,478**

A.4.0 General Waste to Class 1 Landfill – By Activity Source – By Tonnes

Composition of general waste to Class 1 landfills - by activity source - Tonnes/annum - 2020		Construction demolition	Industrial/ commercial/ institutional	Landscaping	Residential
Paper	Recyclable	32	2,891	1	190
	Cardboard	560	3,374	6	415
	Non-recyclable	90	851	1	24
	Subtotal	**682**	**7,117**	**8**	**629**
Plastics	Recyclable	23	477	0	58
	Non-recyclable	664	9,118	19	518
	Subtotal	**687**	**9,595**	**19**	**575**
Organics	Kitchen waste	0	2,418	3	164
	Compostable greenwaste	213	866	1,193	672
	Non-compostable green.	29	280	863	81
	Organics other	17	2,298	0	7
	Subtotal	**260**	**5,862**	**2,060**	**924**
Ferrous	Primarily ferrous	484	456	0	240
	Steel other	96	681	0	600
	Subtotal	580	**1,137**	**0**	**840**
Non-ferrous	**Subtotal**	37	**248**	**0**	**60**
Glass	Recyclable	3	491	0	29
	Glass other	108	484	0	126
	Subtotal	**111**	**974**	**0**	**155**
Textiles	Clothing/textiles	28	1,207	0	199
	Other textiles	563	1,839	4	1,076
	Subtotal	**591**	**3,046**	**4**	**1,275**
Sanitary paper	**Subtotal**	**0**	**1,686**	**1**	**49**
Rubble	Cleanfill	2,685	128	443	44
	New plasterboard	2,244	0	0	13
	Other	4,289	2,211	2	164
	Subtotal	**9,217**	**2,339**	**444**	**220**
Timber	Reusable	1,025	170	3	66
	Unpainted & untreated	1,817	984	4	228
	Non-recoverable	10,619	4,500	25	2,378
	Subtotal	**13,461**	**5,655**	**32**	**2,672**
Rubber	**Subtotal**	**258**	**805**	**0**	**48**
Potentially hazardous	**Subtotal**	**171**	**618**	**0**	**31**
TOTAL		**26,056**	**39,082**	**2,569**	**7,478**

A.5.0 Composition of Kerbside Rubbish

Composition of kerbside rubbish from Otago Region - 2020		Tonnes per annum	% of total
Paper	Recyclable	7.3%	3,721
	Non-recyclable	1.4%	690
	Subtotal	**8.6%**	**4,411**
Plastic	#1-7 containers	2.2%	1,108
	Plastic bags/film	4.4%	2,251
	Other non-recyclable	3.0%	1,519
	Subtotal	**9.5%**	**4,878**
Organics	Kitchen waste	32.9%	16,827
	Green waste	18.9%	9,649
	Other organic	3.5%	1,767
	Subtotal	**55.3%**	**28,243**
Ferrous	Steel cans	0.7%	373
	Other ferrous	1.2%	614
	Subtotal	**1.9%**	**987**
Non-ferrous	Aluminium cans	0.3%	165
	Other non-ferrous	0.5%	262
	Subtotal	**0.8%**	**427**
Glass	Glass bottles & jars	3.9%	2,009
	Non-recyclable	0.6%	319
	Subtotal	**4.6%**	**2,327**
Textiles	Clothing/textiles	2.4%	1,208
	Multimaterial/other	1.6%	794
	Subtotal	**3.9%**	**2,002**
Sanitary paper	**Subtotal**	**8.5%**	**4,339**
Rubble	**Subtotal**	**3.6%**	**1,819**
Timber	**Subtotal**	**1.9%**	**966**
Rubber	**Subtotal**	**0.3%**	**156**
Potentially hazardous	**Subtotal**	**1.1%**	**556**
TOTAL		**100.0%**	**51,112**

A.6.0 Activity Source Definitions

ACTIVITY SOURCE	Generally, the type of activity that generates the waste being recorded. The Activity Sources for use in National Waste Data Framework are listed below and defined in the following rows: • Domestic Kerbside • Residential • ICI • Landscape • C&D • Special • VENM
Construction and Demolition (C&D)	Waste produced directly or incidentally by the construction and demolition industries. This includes building materials such as insulation, nails, plasterboard and timber, roofing materials, as well as waste originating from site preparation, such as dredging materials, tree stumps, and rubble.
Domestic Kerbside	Domestic-type waste collected from residential premises by the local council (or by a contractor on behalf of the council), or by private waste collections (through kerbside or similar collection).
Industrial/commercial/ institutional (ICI)	Waste from industrial, commercial and institutional sources (ie supermarkets, shops, schools, hospitals, offices). For the purposes of these protocols Illegal dumping and litter should be classified under ICI
Landscaping	Waste from landscaping activity and garden maintenance (including public gardens), both domestic and commercial, as well as from earthworks activity, unless the waste contains only VENM, or unless the earthworks are for purposes of construction or demolition of a structure.
Residential	All waste originating from residential premises, other than that covered by any of the other Activity Source categories. For example, a person arriving with a trailer

	load after cleaning out the garage would classify as residential waste.
Special	Waste that fits into significant, identifiable waste streams, usually from a single generator. Special wastes are those that cause particular management and/or disposal problems and need special care. This includes, but is not restricted, to hazardous and medical wastes (including e-wastes). It also includes any substantial waste stream (such as biosolids, infrastructure fill or industrial waste) that significantly affects the overall composition of the waste stream, and may be markedly different from waste streams at other disposal facilities.
Virgin Excavated Natural Material (VENM)	Material that when discharged to the environment will not have a detectable effect relative to the background and comprising virgin excavated natural materials, such as clay, soil, and rock that are free of: • manufactured materials such as concrete and brick, even though these may be inert •combustible, putrescible, degradable, or leachable components • hazardous substances or materials (such as municipal solid waste) likely to create leachate by means of biological breakdown; • any products or materials derived from hazardous waste treatment, stabilisation or disposal practices; • materials such as medical and veterinary waste, asbestos, or radioactive substances that may present a risk to human health if excavated; • contaminated soil and other contaminated materials; • liquid waste.