Climate Change Sub-Committee Meeting

30 January 2024

This Report relates to Item 1 in the Agenda

"Climate Change - Emissions Inventory Report 2022/23"

Marlborough District Council

GREENHOUSE GAS INVENTORY

FINANCIAL YEAR 2023

5-MB111.00

CONFIDENTIAL

GREENHOUSE GAS INVENTORY
FINANCIAL YEAR 2023

Marlborough District Council

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5-MB111.00

15 November 2023

Richard Coningham

Manager – Assets & Services

Marlborough District Council
15 Seymour Street, PO Box 443
Blenheim 7240, New Zealand

Dear Richard,

MDC Greenhouse Gas (GHG) emissions inventory for FY23

This summary report describes the greenhouse gas (GHG) emissions inventory for FY23 completed for Marlborough District Council. The report includes the scope and boundary of the emissions inventory, activity data and sources, methodology, results, and a discussion and recommendations for the Council.

The purpose of the report is to present the results of the emissions inventory assessment for reporting of emissions from 1 July 2022 to 30 June 2023 (FY23). The report shows in detail the calculated emissions of activities that contribute to MDC's direct and indirect greenhouse gas emissions from its operations. This provides MDC with a breakdown of emissions from direct and indirect sources (Scope 1, 2 and 3), and a comparison of emissions between different activity sources and scopes, and from the previous results of FY19 and FY20 inventories.

The report includes recommendations to Council for decision-making from an emissions perspective. The recommendations align with MDC's Climate Change Action Plan, and can be used to further develop emissions reporting, target setting, and action planning for emissions reduction.

Yours Sincerely,

Javier Aylwin
Senior Sustainability Consultant

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GLOSSARY

Key Terms	Definition
Activity data	Data on the magnitude of human activity resulting in emissions or removals taking place during a given period
AR5	The IPCC Fifth Assessment Report
Base year	The first year in the reporting series
BOD	Biological oxygen demand, the amount of dissolved oxygen needed by micro-organisms to break down biological organic matter in water
Carbon sequestration	Any reservoir that absorbs more carbon than it releases, thereby lowering the overall concentration of carbon dioxide in the atmosphere. Examples include forests, vegetation, peatland, and the ocean.
CH_4	Methane
Climate change	Describes longer term trends and patterns in a specific location – for instance, Northland tends to be warmer and drier than the West Coast of the South Island. Climate often describes expectations for each season, such as expected amounts of rain, temperatures, humidity, predominant wind speeds and directions, and frequency of extreme events such as cyclones.
CO_2	Carbon dioxide
CO_2-e	Carbon dioxide equivalent
COD	Chemical oxygen demand
Direct emissions	Direct greenhouse emissions refer to the impact of a (Council) project. For example, this includes the emissions embodied in the materials and emitted from the building works of constructing a road.
Emissions	Greenhouse gases emitted into the atmosphere.
Fugitive emissions	The emission of gases from pressurised equipment due to leaks or unintended releases of gases, usually from industrial activities
Greenhouse gases (GHGs)	Atmospheric gases that trap heat and contribute to climate change. The gases covered by the Climate Change Response Act 2002 are carbon dioxide (CO), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF6).

GHG inventory	A quantification of an organisation's greenhouse gas sources, sinks, emissions and removals
GHG report	A standalone report to communicate an organisation's GHG-related information to intended users
Inventory	A formal measure of total emissions, calculated within a specific time period for an organisation activity/-ies or geographic boundary, usually reported in tonnes of carbon dioxide equivalent (tCO^2e).
IPCC	Intergovernmental Panel on Climate Change
MfE	Ministry for the Environment
Mitigation	Mitigation is doing what we can to stop producing emissions and reduce the impacts of climate change.
N_2O	Nitrous oxide
pkm	Passenger-kilometre (unit of measure for transport)
Refrigerants	A substance or mixture used in a heat pump and refrigeration cycle
Reporting boundary	The emission sources included within an organisation's operations, including direct and indirect emission sources. It includes choosing which indirect emission sources to report
Scope	Emission sources are categorised by Scope to manage risks and impacts of double counting. There are three scopes in greenhouse gas reporting: Scope 1 (direct emissions), Scope 2 (energy indirect emissions) and Scope 3 (other indirect emissions)
Stationary combustion fuel	Fuel used in an unmoving engine eg, a power plant or boiler
Sustainability	Ensuring the wise use and management of all resources within a framework in which environmental, social, cultural, and economic wellbeing are integrated, balanced, and considered
Unique emission factor	A value given to an activity based on how emissions intensive it is. Experienced professionals must verify a unique emission factor. See Climate Change (Unique Emission Factors) Regulations 2009 for further information

EXECUTIVE SUMMARY

A corporate GHG Inventory estimates the total amount of emissions emitted over a specific period, presenting those emissions that are under the direct control of the organization and those that are indirectly linked to its operations. As such, it is possible to breakdown emissions and their sources to understand their contribution to the total allowing to identify improvement opportunities for the organization going forward.

This report was compiled to present the results of the Corporate Greenhouse Gases Inventory (GHG Inventory) for Marlborough District Council, for the financial year 2023 (1st July 2022- 30th June 2023 - FY23). Organizational and operational boundaries were established, and GHG emission sources were defined within, considering sources where Council has direct control (Scope 1), indirect control (Scope 2 and 3). GHG emissions were calculated based on activity data provided by MDC representatives, specific emission factors and global warming potential from renown sources.

Results presents a corporate GHG emissions inventory largely dominated by emissions generated at the local landfill, followed by emissions generated by the wastewater treatment system, as expected. These two sources account for almost an 89% of the whole inventory for the FY23, following FY19-20 trends.

From an environmental and economic perspective, it makes sense to focus resources and capacities on those sources that contribute the most to the total inventory, identifying opportunities to mitigate/reduce GHG emissions as part of a wider Climate Strategy, contributing, at the same time, to meet goals within the Councils' Climate Change Action Plan. Significant improvements can be achieved by addressing GHG emissions from the main sources within this inventory. In general terms, reductions of volumes (waste and wastewater) together with reductions on consumption level (fuel, energy) will have a direct effect on total emissions generated. In saying this, it is important to recognize the intrinsic connection between mitigation and adaptation, where the design and implementation of mitigations initiatives within the Council's scope of operations and control (arising from this report) will contribute to adapt and become more resilient to current and future climate impacts.

The alignment of initiatives arising from this study with those existing actions within the Climate Change Action Plan is crucial to execute the Plan over time, meeting existing goals. Prioritizing actions, defining targets, allocating resources (budget and staff) and establishing dates are key steps going forward.

This report provides valuable information for decision making in terms of climate action going forward allowing Council to contribute to New Zealand's efforts to reduce GHG emissions and to inform the Marlborough community of climate change actions, showing leadership on climate change issues.

PROJECT BACKGROUND

This report was compiled to present the results of the Corporate Greenhouse Gases Inventory (GHG Inventory) for Marlborough District Council, for the financial year 2023 (1st July 2022- 30th June 2023). This study was carried out by WSP New Zealand to estimate all of the GHG emissions as a result of the activities under the control of Marlborough District Council (MDC).

This report presents GHG emissions results for MDC, which serves to compare emissions sources and to identify potential reduction opportunities for the council going forward, while also demonstrating its commitment to measure, monitor and manage emissions, as part of a broader climate action strategy.

SCOPE AND BOUNDARIES

In setting organizational boundaries, an organization selects an approach for consolidating GHG emissions and then consistently applies the selected approach to define those businesses and operations that constitute the organization for the purpose of accounting and reporting GHG emissions.

Following the Greenhouse Gas Protocol, under the control approach, a company accounts for 100 percent of the GHG emissions from operations over which it has control, excluding GHG emissions from operations in which it owns an interest but has no control.

ORGANIZATIONAL BOUNDARY

For the purpose of this study, Operational Control has been defined, considering that an organization has operational control over an operation if the former or one of its subsidiaries has the full authority to introduce and implement its operating policies at the operation. This criterion is consistent with the current accounting and reporting practice of many organizations that report on emissions from facilities, which they operate.

Given this, the organizational boundary considered for this study is represented in the following diagram:

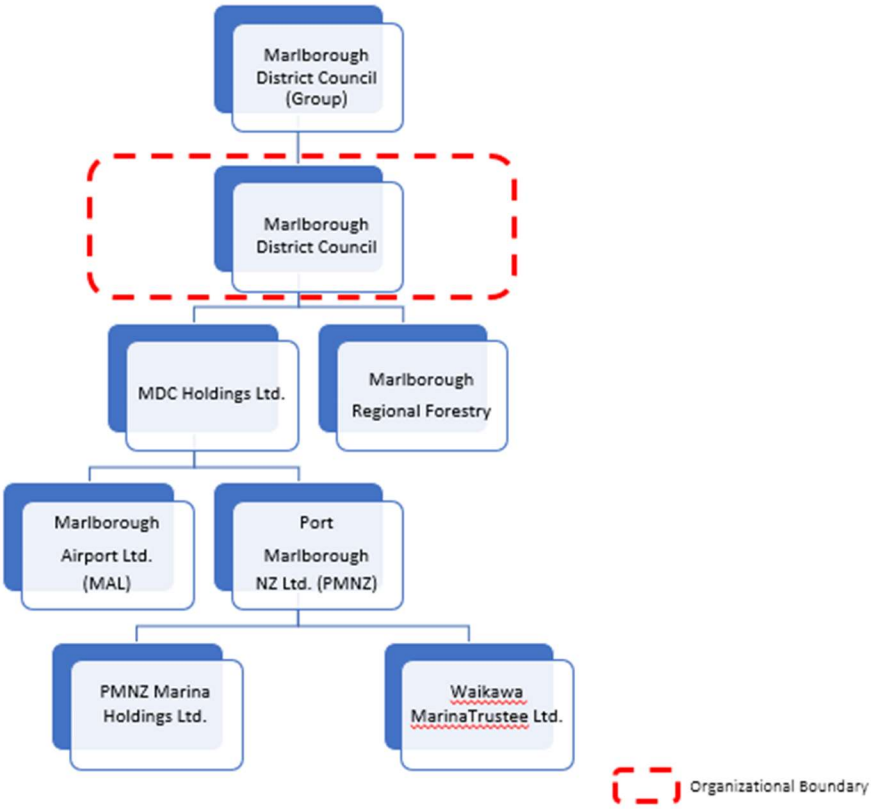

Figure 1 - MDC Organizational Boundary

OPERATIONAL BOUNDARY

Operational boundaries relate to the GHG emission sources and the extent to which the organization can control them. In terms of the operational boundaries this study considers emissions under scope 1, 2 and 3, as per the following:

Scope 1: Direct GHG emissions

Direct GHG emissions occur from sources that are owned or controlled by the organization. These can be stationary, mobile or fugitive emissions. For example, emissions from combustion in owned or controlled boilers, furnaces, vehicles, air conditioning equipment, etc.; emissions from chemical production in owned or controlled process (i.e., wastewater treatment plants).

Scope 2: Electricity indirect GHG emissions

Scope 2 accounts for GHG emissions from the generation of purchased electricity consumed by the organization. Purchased electricity is defined as electricity that is purchased or otherwise brought into the organizational boundary of the company. Scope 2 emissions physically occur at the facility where electricity is generated.

Scope 3: Other indirect GHG emissions

Scope 3 is an optional reporting category that allows for the treatment of all other indirect emissions. Scope 3 emissions are a consequence of the activities of the organization but occur from sources not owned or controlled directly by the company. Some examples of scope 3

activities are extraction and production of purchased materials; transportation of purchased fuels; and use of sold products and services.

For this study the following sources where consider under each of the scope afore mentioned:

Table 1 – Scope of emissions assessment

SCOPE	DEFINITION	SOURCES
Scope 1: Direct Emissions	Direct emissions that occur from sources owned or controlled by MDC	• Landfill • Wastewater Treatment • Stationary/mobile Fuel consumption • Rental (long-term) • Fugitive emission (refrigerants)
Scope 2: Indirect Emissions	Emissions associated with the generation of electricity that is purchased by MDC	• Electricity consumed in MDC buildings and facilities
Scope 3: Other Indirect Emissions	Emissions that are a consequence of MDC's activities, from sources they do not own or have direct control (but can influence)	• Capital goods • Purchase goods & Services • Fuel and Energy (transport, transmission & distribution losses) • Upstream distribution and transportation • Business travel

SCOPE 1 DIRECT EMISSIONS

Wastewater Treatment

Marlborough District Council operates a wastewater collection and treatment system for treating domestic and industrial wastewater. The operation of these treatment plants results in direct emissions, from the biological processes, of greenhouse gases (GHG) such as carbon dioxide (CO2), methane (CH_4), and nitrous oxide (N_2O).

WSP estimated the wastewater treatment emissions using treatment site data, flow data, and concentrations of nutrients, BOD, and COD. Emissions were calculated using WSP's internal wastewater treatment emissions calculator and methodology aligning with the Carbon Accounting Guidelines for wastewater treatment: CH_4 and N_2O [1]. This is further described in Section 2.2, and attached in Appendix A.

Landfill

The Bluegums Regional Landfill is operated and controlled by Marlborough District Council, thus GHG emissions generated by degradation of organic matter within the facility must be accounted for under Scope 1.

Emissions were estimated using the total tonnes of waste recorded for FY23 and provided to WSP by MDC. The emission factor used for calculating the total emissions from landfill operations (kgCO2e) was sourced from the unique emission factor (UEF) report prepared for MDC in 2022: Application for UEF for Bluegums Regional Landfill 2022 prepared by Tonkin & Taylor. The report assesses the efficiency of the landfill gas capture, and the resulting calculation is a UEF which was utilised for the purposes of this FY23 inventory.

There are also emissions generated by the transport of waste from kerbside collection to Bluegums Landfill, not accounted for in the landfill processing emissions. To calculate a high-level estimate of transport emissions, WSP used the total weight of waste and the distance between each collection point. Once the total tonnes and kms were calculated, these were multiplied with

[1] https://www.waternz.org.nz/Attachment?Action=Download&Attachment_id=4872

the emission factor from the MfE Measuring Emissions workbook 2022. These have been accounted for in Scope 3 emissions for Purchased Goods & Services. A detailed calculation can be found in the FY23 emissions workbook.

Stationary Fuel Combustion (LPG)

The combustion of fossil fuel generates GHG emissions. LPG is used at Marlborough District Council facilities for water and space heating.

There was no data provided to WSP by MDC for sources of stationary fuel combustion using LPG fuel. Therefore, this was not included in the FY23 inventory.

Mobile Fuel Combustion

The combustion of mobile fuels (e.g., petrol, diesel) result in emissions related to transport activities. Data was provided to WSP by MDC for transport activities from the fleet vehicles used by MDC.

To calculate the emissions associated with these transport activities, the monthly reporting by MDC's fleet provider, FleetPartners, was used. The total litres of fuel were tracked for Regular Petrol, Premium Petrol, and Diesel. A total of each fuel was calculated for FY23 and multiplied by the relevant emission factor from MfE Measuring Emissions workbook 2022.

Rental Car

The combustion of fuels (e.g., petrol, diesel) on mobile sources result in emissions related to transport activities. Data was provided to WSP by MDC for transport activities from car rentals used by MDC. This data was provided to WSP by MDC in a spreadsheet containing the total kms driven by MDC per rental car for FY23.

To calculate the emissions associated with rental car activities, the MfE Measuring Emissions workbook 2022 emission factor for 'Rental car default (engine size 1600 -<2000cc) assumed to be 2010 -2015 fleet' was multiplied by the total kms travelled by rental car.

Fugitive Emissions

Refrigeration systems and Heating, Ventilation and Cooling (HVAC) systems operates with refrigerants which has a high Global Warming Potential, hence small amounts of them can account for large volume of GHG emissions. Although these systems are conceived to be hermetic, they have losses during normal operations that must be accounted for.

The activity data provided to WSP by MDC was the quantity of refrigerants used for FY23; 1.7kg of R32 and 25kg of R410a refrigerants. The emission factors specific to each type of refrigerant were sourced from MfE Measuring Emissions workbook 2022. The emission factors under *AR5 Global* Warming *Potential in a 100-year period (kg CO2-e)* was used, as this is considered best practice and recommended by the IPCC[2].

[2] https://www.ipcc.ch/site/assets/uploads/2018/02/SYR_AR5_FINAL_full.pdf

SCOPE 2 INDIRECT EMISSIONS

Purchased Electricity

Emissions from the use of electricity physically occur at the facility where electricity is generated, hence they are considered as indirect emissions to the organization. Marlborough District Council uses electricity in all council offices, water pumps and wastewater treatment system generating GHG emissions that needs to be accounted for.

To calculate the emissions from purchased electricity activities, the MDC provided WSP with a Power Consumption and Costs FY2022-23 workbook. This includes Overall Electricity (kWh and costs), TOU Meter Breakdown (kWh and costs by month), and non-TOU (kWh and costs). The total kWh figure from Overall electricity was used to estimate emissions with the emission factor for purchased electricity sourced from MfE's Measuring emissions: A guide for organisations 2023 summary of emission factors. While this guide was published on 30 July 2023, it provides an updated 2022 emission factor for purchased electricity. The emission factor in the MfE Measuring emissions workbook 2022 uses a 2020 emission factor for purchased electricity. Therefore, the inventory uses the updated 2022 emission factor.

SCOPE 3 OTHER INDIRECT EMISSIONS

Purchased Goods and Services – Category 1

This category considers Bus Contract services as the only purchased goods and services undertaken by MDC in FY23. Data was provided to WSP by MDC for the Service location (Blenheim, Picton, and Renwick), the kilometres travelled, and the number of passengers per service. The available information did not allow for an accurate emissions estimation, thus a spend figure on bus services for FY23 was considered, after discussion with MDC representative. The spend figure was used with the road transport spend-based emission factor from Motu NZ 2014 spend factor study source. The emissions from this are considered sufficient to provide a high-level estimate for the inventory.

Under this category and given the available data we have considered a high-level estimation of emissions from waste-to-landfill transportation. The total volume of waste and the distance (kms) of transport between Bluegums landfill and the waste[3] were considered. This was calculated based on the proportion of waste sent to the landfill from transfer stations in different location, which was also sourced from MDC's website.

Capital Goods – Category 2

This category considers capital goods expenditure from MDC for projects carried out in FY23. This data was provided to WSP by MDC including a breakdown of expenditure per project and service. These include structural and civil/roading projects for Council-owned assets. The expenditure for structural projects uses the 'Construction services' emission factor from the Motu NZ 2014 spend factor study source. The expenditure for civil/roading projects uses the 'Heavy and civil engineering construction' emission factor from the Motu NZ 2014 spend factor study source.

The total emission figure combines the emissions associated with construction services and the emissions associated with civil/roading projects.

[3] https://www.marlborough.govt.nz/services/refuse/transfer-stations

Fuel and Energy-Related Activities – Category 3

The emissions associated with the transport of fuel to the point of use/combustion; together with the additional energy required to account for losses due to transmission and distribution of the electricity should be accounted for.

The well-to-tank (WTT) fuel emissions associated with the fleet fuel use were calculated using the DEFRA UK Government GHG Conversion Factors for Company Reporting (2022) emission factor for WTT liquid fuels. This emission factor is considered best practice when there is no local or national emission factor to account for WTT fuel emissions.

The transmission and distribution (T&D) losses from the generation of electricity are accounted for in scope 3. The total kWh sourced data was used with the emission factor for T&D losses (kWh) from the MfE Measuring Emissions workbook 2023, as this contains an updated emission factor for 2022 and is considered more accurate than the emission factor for 2020 in the MfE Measuring Emissions workbook 2022. This also maintains consistency with the source of emission factor for the purchased electricity scope 1 emissions.

Upstream Transportation and Distribution – Category 4

The upstream transportation and distribution activities considered in this category are post and courier services. MDC provided WSP with a spend total for FY23 for Postal service – general, Mail service rates, and Courier costs. The emission factor for 'Postal and courier pickup and delivery services' from the Motu NZ 2014 spend factor study was used to calculate emissions based on spend data.

Business Travel – Category 6

Air Travel – Details on location and passengers for domestic and international flights were provided to WSP by MDC from an internal spreadsheet tracker. To estimate the emissions associated with air travel, the kilometres travelled were calculated for domestic flights and international flights. The number of passengers and kms travelled were used with the appropriate emission factor (domestic flight – economy, or international – short-haul (<3,700km) from the MfE Measuring Emissions workbook 2022.

Accommodation – Details on accommodation location and number of nights were provided within MDC's internal spreadsheet tracker. The total nights per country were used with the corresponding 'Hotel stay' emission factor (provided per country) from the MfE Measuring Emissions workbook 2022.

EXCLUSIONS

The following emission sources have been excluded from this study:

Table 2 - Emission sources excluded from FY23 inventory.

Emission Source	Reason for Exclusion
Fugitive emissions from vehicles (Scope 1)	Consumption data unavailable. (<1%).
Waste generated in operations (Scope 3, Cat 4)	Included in Landfill emissions (Scope 1).
Employee Commuting (Scope 3, Cat 7)	Deemed to have no operational control.
Upstream leased assets (assets leased by 3rd parties - Scope 3, Cat 8)	No operational control. Outside scope.
Downstream transportation and distribution (Scope 3, Cat 9)	Consumption data unavailable. (<1%).
Processing of sold products (Scope 3, Cat 10)	Not applicable
Use of sold products (Scope 3, Cat 11)	Not applicable.
End-of-life treatment of sold products (Scope 3, Cat 12)	Not applicable.
Downstream leased assets (assets leased 3rd parties – Scope 3, Cat 13)	Not applicable.
Franchises (Scope 3, Cat 14)	Not applicable.
Investments (Scope 3, Cat 15)	No operational control. Outside scope.

METHODOLOGY

The present study considered a staged approach to developing the GHG inventory for Marlborough District Council, following the direction of, and alignment with the Greenhouse Gas Protocol. This contemplated the following stages:

Boundary Setting and Sources

Business operations vary in their legal and organizational structures; they include wholly owned operations, incorporated and non-incorporated joint ventures, subsidiaries, and others. Therefore, organizational and operational boundaries, were agreed selecting a consolidating GHG emissions approach to define those operations and sources that constitute the Council's boundaries for the purpose of accounting and reporting GHG emissions.

Inventory Framework

Based on information provided by MDC team we drafted the inventory framework and the method for accounting for each inventory emissions source within the boundary. This framework will help structuring and integrating MDCs monthly emissions reporting system alongside business units and contracts.

Confirm Base Year

Financial year 2023, beginning on 1 of July 2022 to 30th June 2023 was defined as the base year for the purpose of this study.

Calculations

The process begins with a thorough data collection process, compiling activity data for each emission source considered within the defined boundary. Emission Factor from relevant sources specific for each source were identified and linked to each relevant source. Unit conversions were considered where needed. Global warming potentials were also considered were applicable to transform greenhouse gases into CO2 equivalent.

Reporting

This report consolidates the methodology followed the results and recommendations going forward. This considers an internal technical and quality management review.

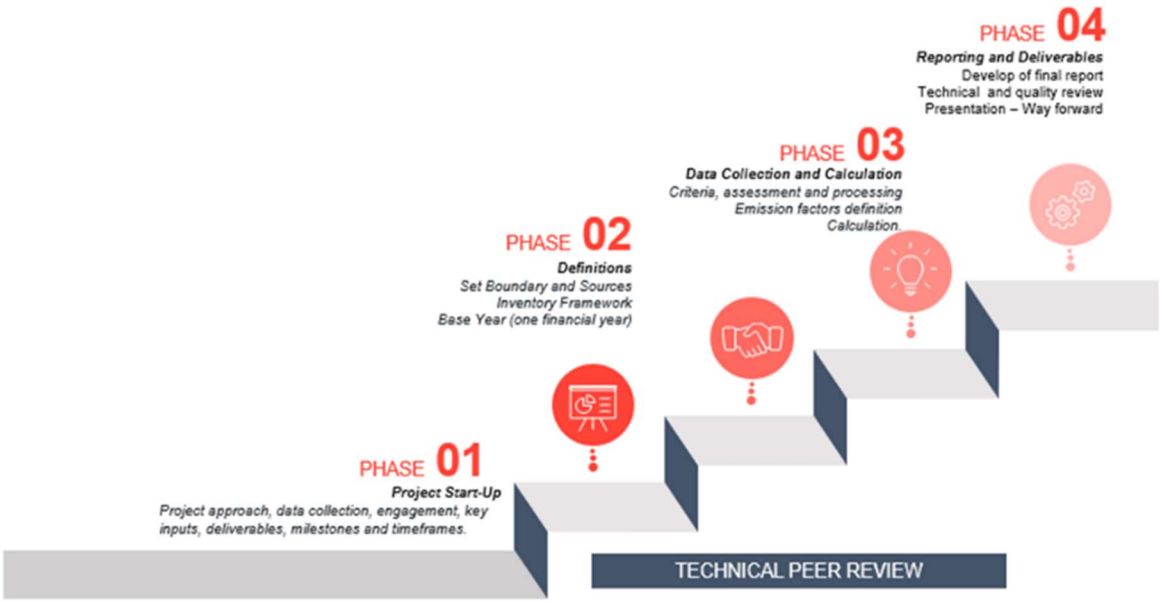

Figure 2 - Methodology of emissions inventory

RESULTS

GENERAL

The total emissions for MDC for FY23 have been estimated for Scope 1 (direct), Scope 2 (indirect – purchased electricity), and Scope 3 (other indirect) emissions. The total emissions for FY23 are **38,761 tonnes of CO_2-e** (carbon dioxide equivalent).

The emissions have been calculated based on the data provided for direct and indirect activity sources from MDC. The data required to estimate emissions includes the quantities, frequency and types of activities undertaken by MDC's operational organisation within the defined scope and boundaries. Where the activity data could be matched to the activity data emission factors in the MfE Emission Factor workbook 2022, these emission factors were used. Where the activity data could not be matched and only the expenditure data was available, a spend based factor was used from the Motu NZ 2014 spend factor study, and the DEFRA UK factors.

The emissions associated with each activity source calculated for the inventory, and the percentage of the activity source of the total emissions, is shown in Table 3 below.

Table 3 - GHG by source activity (tCO2-e)

GHG by Source - activity	t CO_2-e	% of total
Waste - Landfill	30,425.60	78.495%
Wastewater Treatment	3,997.67	10.314%
Mobile Fuel - Fleet	294.69	0.760%
Mobile Fuel - Car rental	1.64	0.004%
Stationary Fuel - Combustion	3.44	0.009%
Fugitive Emissions (Refrigerants)	53.35	0.138%
Purchased Electricity	1,046.35	2.699%
Capital goods	1,965.14	5.070%
Purchased goods and services	684.00	1.765%
Fuel and energy-related activities	188.18	0.485%
Business travel - flights	48.82	0.126%
Business travel - accommodation	6.37	0.016%
Upstream Transportation & Distribution	46.01	0.119%
TOTAL	38,761.26	100%

The largest activity source of emissions is from waste-to-landfill processing (30,425.60 tonnes of CO_2e), which accounts for 78.5% of the total emissions.

The second largest activity source of emissions is wastewater treatment processes (3,997.67 tonnes of CO_2e), which accounts for 10.3% of the total emissions.

The third largest activity source is Capital Goods (1,965.14 tonnes of CO2e), which accounts for 5.1% of the total emissions.

All other sources account for less than 5% of the total emissions for the FY23 inventory.

The source activities by tCO2e are shown below in Figure 3.

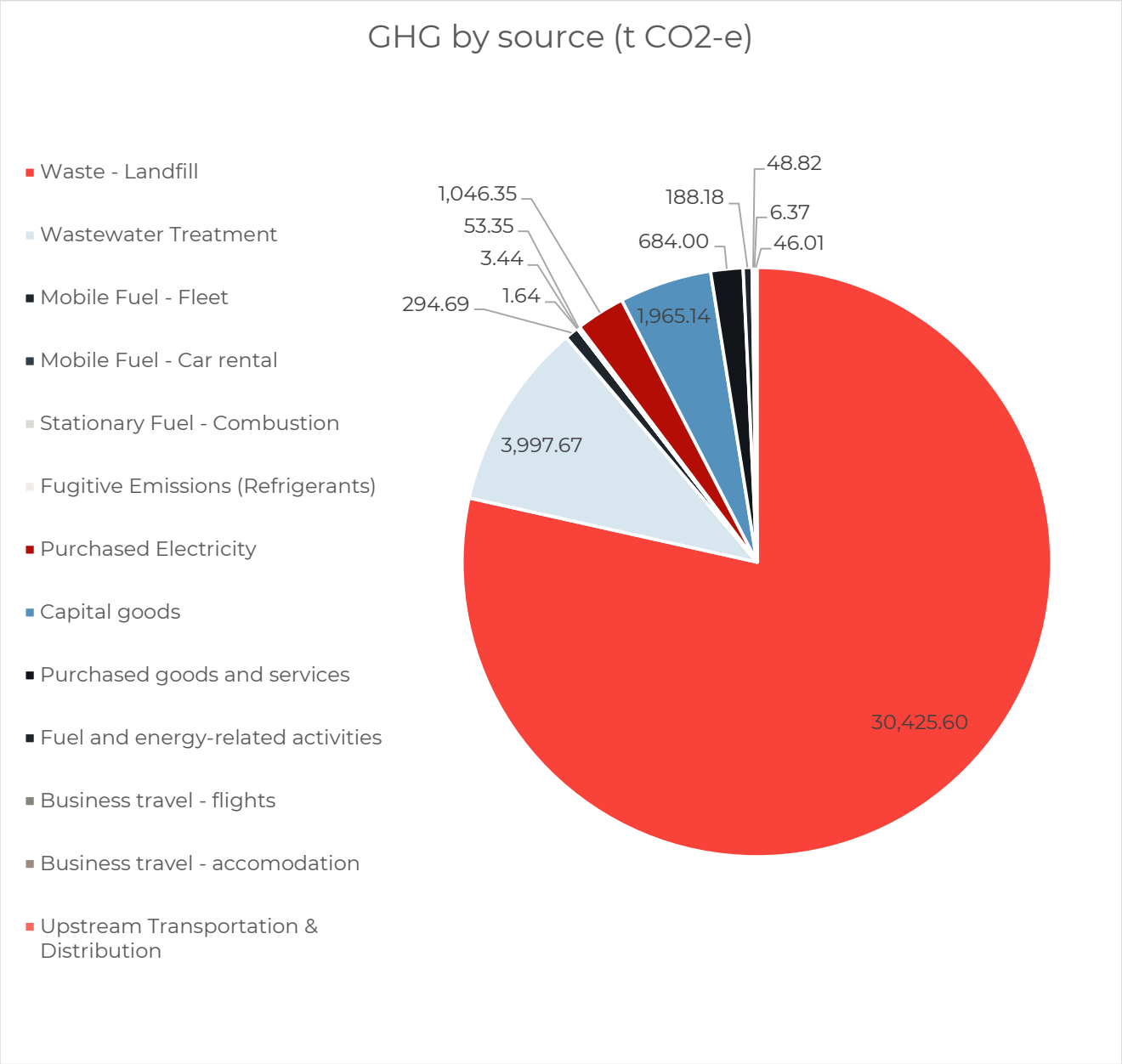

Figure 3 - GHG by source (tCO2e)

When looking at emission sources by scope, is clear that Scope 1 sources account for the largest portion of emissions comprising the FY23 inventory (89,7%), as shown below in Figure 4. Scope 2 accounts for 2,7% and Scope 3 represents 7,6%. This is discussed in more detail in the following section.

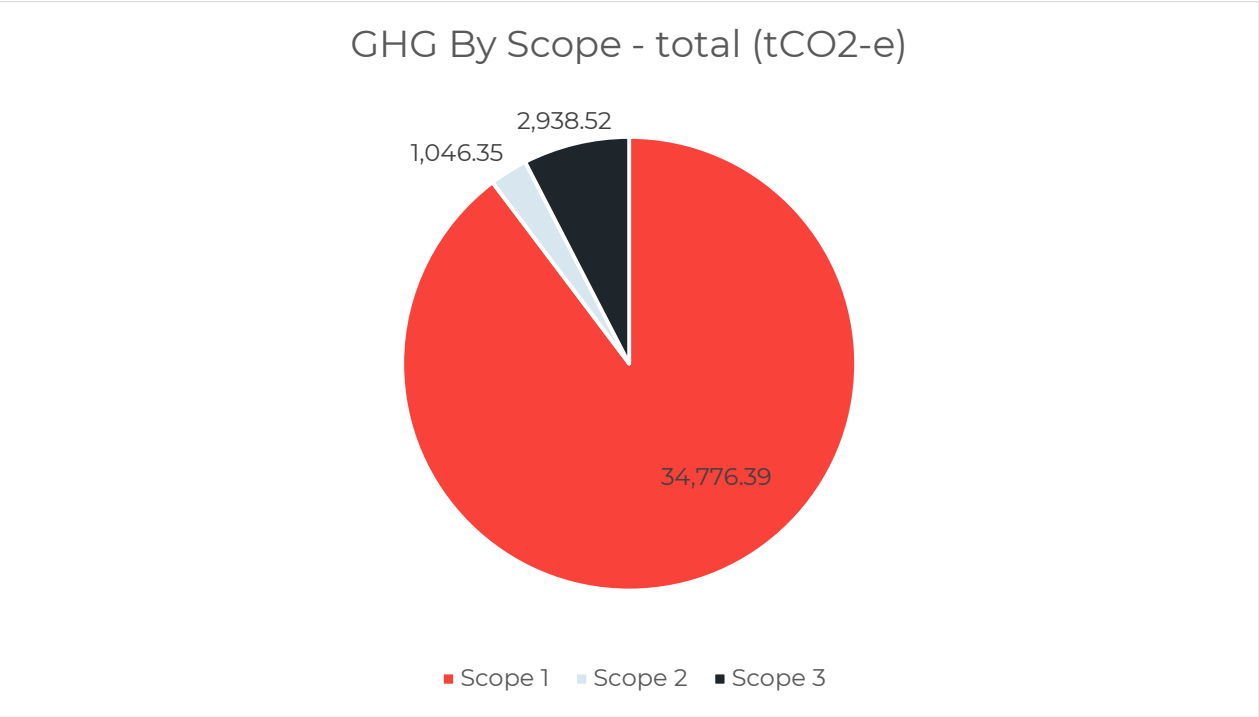

Figure 4 - GHG by Scope - total (tCO2e)

BY SCOPE AND GASES

Scope 1 emissions:

Overall, scope 1 emissions make up the largest proportion of the total emissions inventory. The results show that highest emissions are associated with waste-to-landfill activities (87.5% of scope 1), as shown below in Figure 5.

The waste sent to landfill is comprised of approximately 30 categories of waste measured by type and weight. General refuse accounts for 44% of the total waste, and waste from transfer stations accounts for 4.5% of the total.

The quantity of waste sent to landfill has decreased by approximately 8,000 tonnes since FY19. This offers further opportunity to set waste reduction targets using year-on-year waste quantity data. Waste type segregation, alternative processing, and waste minimisation strategies could play a key role in achieving emission reductions from waste-to-landfill activities.

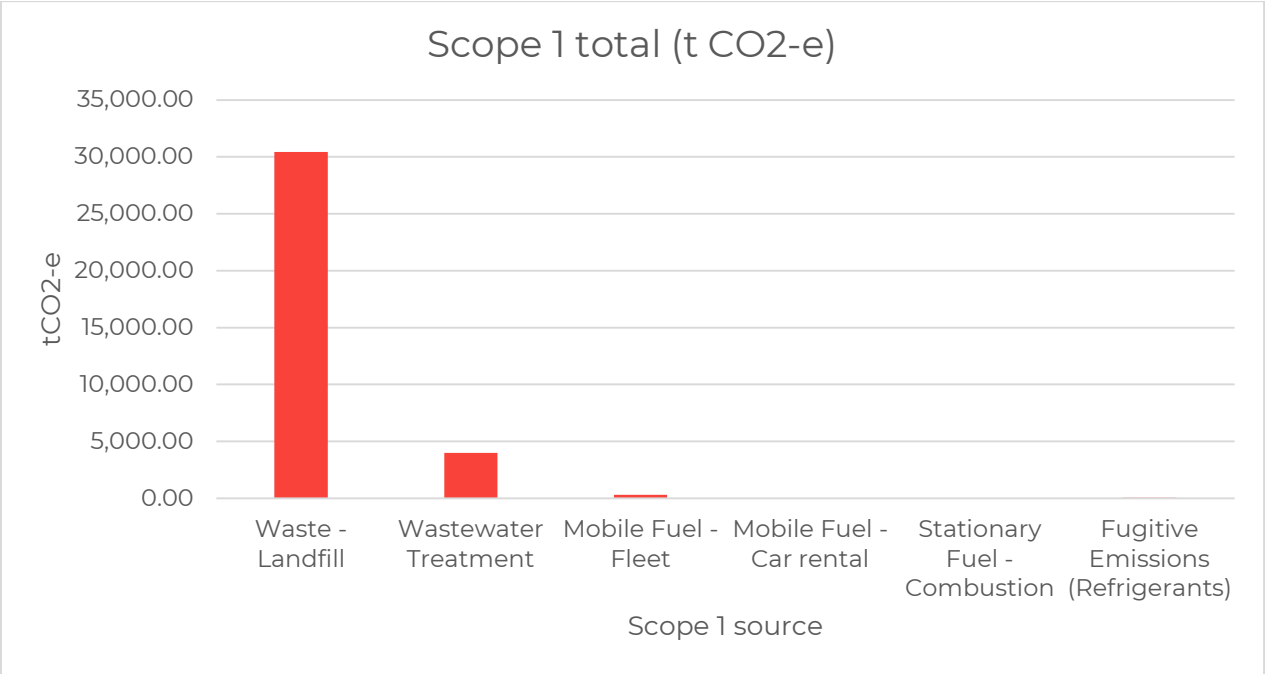

Figure 5 - Scope 1 total emissions (tCO2-e)

Wastewater treatment makes up 11.5% of Scope 1 emissions, considering that MDC operates four Wastewater Treatment plants at Havelock, Seddon, Picton and Blenheim. This review considers the operational emissions from Nitrous Oxide and Methane arising from wastewater treatment.

As described in the Carbon Accounting Guidelines for wastewater treatment: CH_4 and N_2O [4], the global warming potential of methane and nitrous oxide are used to calculate MDC's wastewater treatment emissions. It is recommended that the latest values are used (Assessment Report -AR5), following best practice as per the Intergovernmental Panel on Climate Change (IPCC) 5th report[5].

Table 4 - Global warming potentials from IPCC for methane (CH4) and nitrous oxide (N2O)

GHG	AR4 GWP100	AR5 GWP100	AR5 GWP100*
CH_4	25	28	**34**
N_2O	298	265	**298**

* Includes climate carbon feedback

MDC provided WSP with internal activity data to calculate the emissions associated with each wastewater treatment plant, including:

- A description of treatment configuration and stages (e.g. pond systems)
- Flow data (where available)
- Concentrations of COD, BOD, nitrogen and ammonia (where available)
- Population data
- Fuel supply (e.g. backup generator)

[4] https://www.waternz.org.nz/Attachment?Action=Download&Attachment_id=4872
[5] https://www.ipcc.ch/site/assets/uploads/2018/02/SYR_AR5_FINAL_full.pdf

- Confirmation of sludge (none for the sites)
- Irrigation (confirmed not available)

Based on the data available and the assumptions identified above, the flow load and efficiency of each plant has been used to calculate the wastewater treatment plant emissions. This calculation follows the method set out in the Carbon Accounting Guidelines for wastewater Treatment: CH_4 and N_2O, Water NZ, 2021. The emissions summary for MDC's four wastewater treatment plants is shown in Table 5 below.

Table 5 - Summary of CH_4 and N_2O emissions for MDC's wastewater treatment emissions

Plant	Methane Emission $kgCO_2$-e/yr	Nitrous Oxide Emission $kgCO_2$-e/yr	Total $kgCO_2$-e/yr
Seddon	40,321	7,291	47,612
Havelock	100,539	34,603	135,142
Picton	98,944	61,621	160,565
Blenheim Domestic	1,242,829	427,569	1,670,399
Blenheim Industrial	1,763,039	220,907	1,983,947
Total	**3,245,674**	**751,992**	**3,997,665**

Scope 2 emissions:

The total emissions from Scope 2 purchased electricity activities is 1,046.35 tonnes of CO_2-e. Scope 2 emissions are comprised of emissions from purchased electricity (kWh) for MDC owned and operated sites. Data from meter readings was provided by MDC, which included time-of-use (TOU) and non-time-of-use (TOU) sources. The total kWh for TOU site meter readings is 11,007,549.22 kWh. The top six sites with the highest electricity consumption are shown in Table 6 below.

Table 6 - kWh and emissions per site

Site	Quantity (kWh)	Emissions (tCO2e)
Blenheim Sewerage Treatment Plant	1,313,904.24	97.46
Blenheim Water Treatment Plan	1,274,898.17	94.57
Blenheim Sewerage Treatment Plant	979,354.21	72.65
Public Street Lighting Blenheim	940,988.47	69.80
Southern Valleys Irrigation Scheme	917,501.65	68.06
Blenheim Sewerage Treatment Plant	912,197.86	67.66

There are multiple meter readings for electricity use at Hardings Rd, which is where the Blenheim Sewage Treatment Plant is located.

The total kWh for non-TOU site meter readings is 3,098,414.52 kWh. Together, the TOU and Non-TOU sites make up a total of 14,105,963.75 kWh.

Scope 3 emissions:

Scope 3 emissions were calculated for the categories shown in Figure 6 below. Scope 3 emissions make up 7.6% of the total emissions inventory.

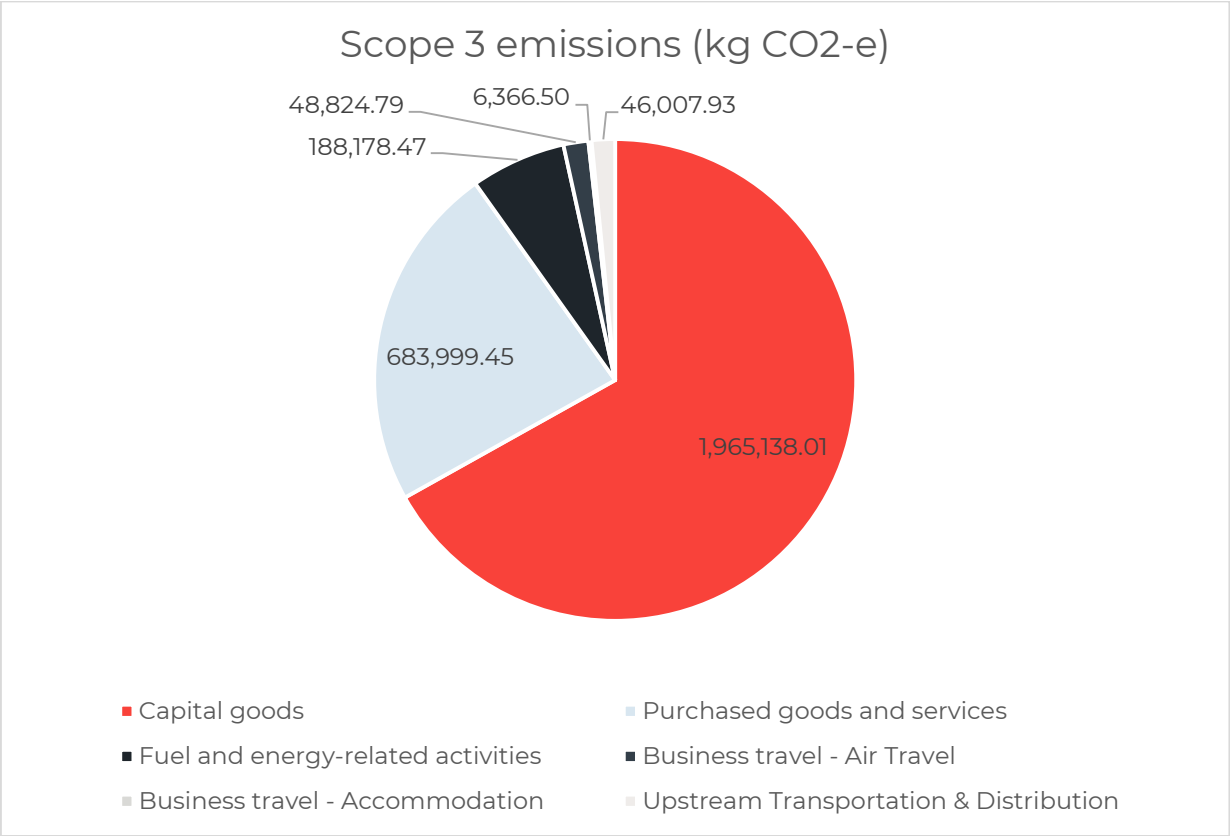

Figure 6 - Scope 3 emissions by activity (kgCO2-e)

Capital Goods represented the largest portion of scope 3 emissions, making up 66.9% of scope 3 total emissions. The activity data sources included in the FY23 Capital Goods emissions are capital expenditure on structural and civil/roading projects.

Purchased Goods and Services represent the second largest source of scope 3 emissions, making up 23.3% of scope 3 total emissions. The Bus contract services that make up part of the purchased goods and services emissions were calculated using a spend-based factor. However, it is considered this calculation could be refined in future as more information on this activity is procured.

Additionally, WSP calculated the emissions associated with the transportation of waste to Bluegums landfill for FY23, as part of scope 3 Purchased goods and services category.

DISCUSSION AND RECOMMENDATIONS

DISCUSSION

Results presents a corporate GHG emissions inventory largely dominated by emissions generated at the local landfill, followed by emissions generated by the wastewater treatment system. These two sources account for almost an 89% of the whole inventory for the FY2023, following FY2019-2020 trends.

To have a better understanding of the evolution of emissions over time, a comparison of this FY23 inventory with the previous FY19 and FY20 inventories is shown below. It is important to note that given the available information for previous inventories, a comparison is only possible considering emissions and not activity data which supports these estimates.

Table 7 - Comparison of emissions FY19, 20, 23

Source	FY19 tCO_2e	FY20 tCO_2e	Change FY19-20	FY23 tCO_2e	Change FY20-23
Scope 1					
Waste - Landfill	29,329.80	34,340.80	17.1%	30,425.60	-11.4%
Wastewater Treatment	4,437.10	4,728.00	6.6%	3,997.67	-15.4%
Transport Fuels	231.9	210.1	-9.4%	296.33	41.0%
Stationary Fuels	3.17	3.58	13.1%	3.44	-3.9%
Fugitive Emissions (Refrigerants)	67.2	0		53.35	
Scope 1 Total	*34,069.17*	*39,282.48*		*34,776.39*	
Scope 2					
Purchased Electricity	1,326.00	1,444.90	9.0%	1,046.35	-27.6%
Scope 2 Total	*1,326.00*	*1,444.90*		*1,046.35*	
Scope 3					
Capital goods	3,966.30	2,962.80	-25.3%	1,965.14	-33.7%
Purchased goods and services	1,517.60	1,446.40	-4.7%	684.00	-52.7%
Fuel and energy-related activities	155	159.2	2.7%	188.18	18.2%
Business travel	135.3	97.3	-28.1%	55.19	-43.3%
Upstream Transportation & Distribution	44.2	49.1	11.1%	46.01	-6.3%
Scope 3 Total	*5,818.40*	*4,714.80*		*2,938.52*	
Total tCO_2e	41,213.57	45,442.18		38,761.26	

Note: Results from FY2020 and FY2019 are from the report Corporate GHG Emissions for FY2019-2020 prepared by CarbonEES, May 2021.

As stated above, the largest sources of emissions are consistent with the previous FY19 and FY20 emissions inventories, with waste-to-landfill emissions considerably larger than all other sources. The total emissions from Bluegums Landfill for FY23 are 30,425.60 tonnes of CO2-e, which makes up 78.5% of the whole inventory, and 87.5% of Scope 1 emissions. This figure is associated with the emissions from processing waste at the landfill including gas recovery.

Although total landfill emissions in FY23 are lower than those emissions from FY20, they do represent a larger percentage of the total inventory (almost 3% more). With the available information it is not possible to determine the cause of this reduction. This could be a result of multiple factors, including potential population demographics changes, waste volumes and composition, an increase in efficiency of landfill gas capture at Bluegums Landfill, or a combination of the above.

A reduction of wastewater treatment emissions for FY2023 can be appreciated in comparison to previous years. This could be explained, again, by different factors, such as volumes, wastewater composition, wastewater treatment efficiency, or by the calculation methodology.

Capital goods represents the third largest source of emission (5%). As mentioned above, this category under scope 3 is estimated based on spent data. Results present a consistent reduction over time, which is the reflection of lower expenditure on projects carried out. During FY23 emissions from Capital Goods have decreased by 33.7% in comparison to FY20.

A similar situation can be appreciated in total emissions associated to electricity consumption, including transmission and distribution losses. Total emissions for FY2023 are lower than previous periods (-27.6% against FY2020). This can be explained by a variation in the total amount of or energy consumed and by a variation on the emission factor considered for the period, in line with best practice. Emission factor for purchased electricity reflects the amount of carbon emissions emitted when generating energy across New Zealand (national grid) for the particular year. The updated emission factor for 2022 for purchased electricity saw a reduction from previous years.

RECOMMENDATIONS

A corporate GHG Inventory estimates the amount of emissions emitted over a specific period of time, presenting those emissions that are under the direct control of the organization and those that are indirectly linked to its operations. As such, it is possible to breakdown emissions and their sources in order to understand their contribution to the total allowing to identify improvement opportunities for the organization going forward.

We can identify two main lines of opportunities for MDC going forward. On one side, opportunities come from potential carbon mitigation initiatives, which could directly contribute to reduce (mitigate) and manage carbon emission over time, contributing to achieve Councils' Climate Change Action Plan goals. On the other, opportunities will come from refining and strengthening future emission calculations and inventories, based on procuring and generating more and more robust data to calculate emissions over time.

In this line, the more robust tracking available data, the more accurately the emissions can be estimated. With targeted, frequent data tracking of emission source activities, fewer assumptions are required to estimate emissions, reducing uncertainty. Targeted data tracking based on activity sources offers the opportunity to assess the different factors contributing to the emissions for each activity. For example, the use of spent data is a good high level initial approach, however more accurate information could be provided by service providers, refining and strengthening total emissions estimated for the Capital Goods and Purchase Goods and Services.

Significant improvements can be achieved by addressing GHG emissions from the main sources within this inventory. In general terms, reductions of volumes (waste and wastewater) together with reductions on consumption level (fuel, energy) will have a direct effect on total emissions generated. Other alternatives can consider the following.

Waste to Landfill (processing)

There are multiple ways to reduce landfill emissions, including at the operational and community level. Consistent and robust tracking of landfill quantities, gas recovery efficiency, and operational details will provide a better basis to identify factors contributing to changes in emissions from landfill operations. This will help identify opportunities for improved efficiency and potential innovations.

Council is currently carrying out an investigation for power generation from gases recovered from landfill, which will make process more efficient, allowing for future GHG emission reductions.

Additionally, reducing quantities sent to landfill could include developing alternative solutions for organics and green waste, which could be used as a resource for composting at alternate locations. It is recommended that MDC set waste reduction targets (or link existing ones to GHG emissions) and identify opportunities for reduction at the organisational level, while tracking this on a per annum basis to determine the actions associated with reductions, and where improvements can be made.

At the community level, Council could continue to lead waste-minimisation and resource recovery programmes, engagement, and activities to educate and get the community involved in reducing waste send to landfill. Home and community composting through local facilities could also help drive community engagement and a reduction of compostables sent to landfill. Council is currently leading waste minimisation initiatives throughout the district (e.g.: Community Composting) to help reduce the volumes of waste sent to landfill by encouraging reuse recycling and resource efficiency, which will have an impact on the amount of emissions generated.

These recommendations align with the goals and actions within Council's Climate Change Action Plan (2020):

- Goal 1. Council contributes to NZ's efforts to reduce GHG emissions.
- Actions 2021-2024+
    - Implement emissions reduction programme.
    - Develop further programmes to support waste reduction.
    - Review programmes for reducing green waste to landfills and composting.
- Goal 3. The Marlborough community is informed of climate change actions and options for response.
- Actions 2021-2024+
    - Establish and lead Forum.
    - Incentivise and support ideas for innovation from the community.
- Goal 4. Council shows clear leadership on climate change issues.
- Actions 2021-2024+
    - Promotion of innovations, changes and initiatives that individuals and businesses can take to reduce emissions, benefit from climate changes and improve resilience.
    - Liaison and collaboration with local government agencies, iwi, central government and others to provide clear and consistent messaging and directions for change.

- Climate Change Working Group continues to champion implementation of this Action Plan.
- Annual reporting.

Waste to Landfill (procurement)

A gap of information has been identified in terms of available information around rubbish trucks. Truck operation consumes fossil fuels (unless electric vehicles are used) and this should be monitored closely. Given that waste to landfill operations are outsourced, there is an opportunity from a procurement perspective, where MDC could request contractors information on GHG emissions for the services provided. Alternatively, contractors could provide data to estimate emissions more accurately, such as fuel consumption, distances travelled, weight transported, number of trips, etc. This would enable accurate data collection and reporting to be used in MDC's Scope 3 (indirect) emission inventory and shape future reduction target setting.

Tracking the transport emissions associated with waste-to-landfill activities would enable council to track these specific emissions year-on-year, set targets to reduce emissions, and identify potential opportunities to reduce emissions. This could be through analysis of trip routes and efficiencies or sourcing fuel-efficient landfill collection trucks. The recommendations align with the goals and actions within Council's Climate Change Action Plan (2020):

- Goal 1. Council contributes to NZ's efforts to reduce GHG emissions.
- Actions 2021-2024+
    - Regular monitoring of emissions and review targets
    - Implement emissions reduction programme.
    - Implement reviewed Procurement Policy (if service provider used for landfill trucks)
    - Develop further programmes to support waste reduction.
    - Review programmes for reducing green waste to landfills and composting.
    - Investigate ways to incentivise use of alternative transport modes, such as ride sharing and EVs.

Wastewater treatment

It is recommended that MDC continue to track data associated with wastewater treatment processes and emissions and ensure sampling data is recorded as frequently as possible. The more sampling data available, the more accurate the emissions can be calculated.

Purchased Electricity

Based on MDC's emissions inventory, it is apparent that most site operations use purchased electricity, with a small amount using stationary fuel combustion (diesel generator). Council has looked at renewable energy solutions previously and given the intrinsic seasonal characteristics of the operations, these were considered not viable. Nonetheless, as technology evolves, and prices become more affordable, MDC could consider options for using renewable energy in the future. This may include either retrofitting their existing facilities, or sourcing renewable energy as part of the procurement process for their new and proposed facilities. These recommendations align with the goals and actions within Council's Climate Change Action Plan (2020):

- Goal 1. Council contributes to NZ's efforts to reduce GHG emissions.
- Actions 2021-2024+
    - Implement energy efficiency and renewable energy generation actions (e.g., solar panels on Council's buildings)

Finally, it is important to consider that results from the present study provide relevant information for decision making in terms of Climate Change Action, creating opportunities to develop a more robust inventory in the future, while mitigating MDC's GHG emissions.

LIMITATIONS

This report ('Report') has been prepared by WSP New Zealand Limited ('WSP') exclusively for Marlborough District Council ('Client') in relation to estimating the Corporate Greenhouse Gas Inventory for the financial year 2023 (FY2023) ('Purpose') and in accordance with the Continuing Service Agreement C315-18-005-14; Service order No 060] ('Agreement'). WSP accepts no liability whatsoever for any use or reliance on this Report, in whole or in part, for any purpose other than the Purpose or for any use or reliance on this Report by any third party.

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APPENDIX A

Wastewater Greenhouse Gas Estimation

MDC operate 4 Wastewater Treatment plants at Havelock, Seddon, Picton and Blenheim. The treatment plants will create several greenhouse gas emissions. These include.

- Waste to landfill (screening)
- Energy
- Chemicals (although not continuously)
- Nitrous Oxide
- Methane
- Transport
- Maintenance related emissions

This review considers the operational emissions from Nitrous Oxide and Methane arising from treating the wastewater. Other emissions are considered elsewhere in this report.

Seddon

A rural community with no commercial waste served by a facultative pond followed by 5 maturation ponds. Discharge is to stream.
Insufficient data is available to characterize the flow and quality into the plant and from the effluent of the plant. Therefore, emissions are estimated using resident population figures provided by MDC, and theoretical flows.
Pond sludge remains in the pond, so no additional emissions are associated with sludge on this site.

Havelock

A small town that shows significant seasonal variation due to being a popular tourism location and significant input from shellfish related industries. The treatment process is a facultative pond followed by 2 maturation ponds before discharge to tidal estuary.
Regular monitoring of the influent and effluent enables a robust estimation of loading and removal.
Pond sludge remains in the pond, so no additional emissions are associated with sludge on this site.

Picton

A medium township that has some commercial wastes. The process consists of activated sludge secondary treatment with river discharge. Waste activated sludge Is stored in two of storage basins where the sludge is subject to biological reduction. Limited data for the influent and effluent mean the estimates are based on population estimates and assumed performance.

Sludge is removed from site periodically using portable dewatering equipment and then sent to landfill. No data is available on the loading to the sludge basins and removal efficiency, nor the activities associated with dewatering. Sludge management is excluded from this estimate. This sludge dewatering activity may not have occurred in the 2022/23 window, but any sludge produced will be accounted for in the landfill emissions elsewhere in this report.

A period of missing flow meter information, shown by zero readings of flow were omitted from calculations.

Blenheim.

This larger plant is operated as two parallel streams that merge into one stream for discharge. There is a domestic stream and industrial stream. Due to high strength wastes of seasonal nature the industrial stream is treated separately through an aerated basin activated sludge system before joining the domestic wastewater stream at pond 5 outlet.
The energy required for industrial treatment is reported elsewhere in this report.

The Blenheim discharge is largely to estuary, although a proportion is discharged to land when possible. The data previously reviewed by WSP (2021) for MDC indicated that the land discharge is around 5 % of the total discharge, so unlikely to have significant variance on this estimate.

Data is provided that enables annualized average loadings to each stream and estimation of the overall emissions.
Sludge is infrequently removed from the pond system. It is uncertain whether sludge has been removed from the ponds in the year 2022/23, so no allowance for sludge emissions is made. Normally when desludging of a pond is undertaken the emissions associated with the sludge are determined, and reported on the year of desludging, even though the Geobags may be on site for many years and have potential to generate emissions.

Other Wastewater Emissions.

A proportion of Marlborough District's population is served by on site wastewater systems, mostly consisting of septic tanks and local land soakage areas. The waste sludge from this treatment (septage) is transported by contractors to the Blenheim WWTP and introduced into the inlet of the municipal stream. No additional allowance has been made for the septic tanks and septage haulage in this estimate as not directly operated by MDC.

Emissions Estimation.

Based on the data available and the assumptions identified above the flow load and efficiency of each plant has been used to calculate the wastewater treatment plant emissions. This calculation follows the method set out in the Carbon Accounting Guidelines for wastewater Treatment: CH_4 and N_2O, Water NZ, 2021.

The results are given below.

Emissions summary

Plant	Methane Emission $kgCO_2$-e/yr	Nitrous Oxide Emission $kgCO_2$-e/yr	Total $kgCO_2$-e/yr
Seddon	40,321	7,291	47,612
Havelock	100,539	34,603	135,142
Picton	98,944	61,621	160,565
Blenheim Domestic	1,242,829	427,569	1,670,399
Blenheim Industrial	1,763,039	220,907	1,983,947
Total ($kgCO_2$-e/yr)	**3,245,674**	**751,992**	**3,997,665**

APPENDIX B

DATA QUALITY

The emission sources have been assessed under the following data quality categories:

Measured = Data directly provided by a service provider, contractor or directly obtained from a monitoring device. For example, electricity invoices, contractor receipts, emissions monitoring equipment, incident reports, consultant reports etc.

Derived = Data obtained from calculations, mass balances, use of physical/chemical properties, use of coefficients and emission factors etc., for example, converting cubic meters of waste into tonnes.

Estimated = Usually, where there is no other available method for obtaining the data. Such data could be prorated on previous results, use of precedents or historical data, or even a calculated guess.

Robust = Evidence of sound, mature and correct reporting system, where room for error is negligible. Examples would include use of spreadsheets, databases and on-line reporting.

Satisfactory = Examples would include manual, but structured keeping of records, files and results. Some potential for error or loss of data.

Questionable = No logical or structured approach to data or record keeping. High potential for error and/or loss of data. Data may appear to differ from those initially reported.

Unsatisfactory = No data available or existing data may be incomplete, of poor quality, or in need of supplementation.

	Data Collection		
Data Management	**Measured**	**Derived**	**Estimated**
Robust	M1	D1	E1
Satisfactory	M2	D2	E2
Questionable	M3	D3	E3
Unsatisfactory	M4	D4	E4

Table 8 below shows the data quality rating given to each emissions source based on the available data.

Table 8 - Data Quality rating per emission source

Emissions Source	Data Management	Data Collection
Waste - Landfill	Robust	M1
Wastewater Treatment	Satisfactory	M2
Transport Fuels	Robust	M1
Stationary Fuels (diesel)	Satisfactory	M2
Fugitive Emissions (Refrigerants)	Robust	M1
Purchased Electricity	Robust	M1
Capital goods	Satisfactory	M2
Purchased goods and services	Satisfactory	E2
Fuel and energy-related activities	Robust	M1
Business travel - Air Travel	Robust	M1
Business travel - Accommodation	Robust	M1
Upstream Transportation & Distribution	Satisfactory	M2

INFO / DATA PROVIDED TO THE CONSULTANT

Data was discussed and provided to WSP by MDC from online meetings and via emails. Most of the data was provided in spreadsheets from MDC's internal activity tracking. Some of the activity data sent to WSP was directly from

Data provided	Source
Waste-to-landfill • Waste type • Waste quantities • Total tonnes / yr • Total trips /yr	Spreadsheet via MDC email: • Copy of LTP Weighbridge Export 2022-23
Wastewater treatment • Flow data • Nutrient data • BOD, COD • Treatment system types	Spreadsheets and details via MDC email: • Picton Flow Data July 2022-June 2023 s/s • Picton WWTP Inlet & Outlet Data 2022-2023 s/s • Email info in PICTON WWTP- _ MDC GHG inventory data and contacts • Havelock Ponds Flows 2022-2023 s/s • Havelock WWTP Sampling Data 2022-2023 s/s • Email info in Havelock WWTP- _ MDC GHG inventory data and contacts • Seddon WWTP Samples 2022-2023 s/s • Email info in Seddon WWTP- _ MDC GHG inventory data and contacts
Purchased electricity consumption. • kWh for TOU and Non-TOU sites	Spreadsheets and details via MDC email: • MDC Power Consumption and Costs FY2022-23 s/s
Fleet • Litres of Regular Petrol, Premium Petrol, and Diesel per month	Spreadsheets and details via MDC email: • Data in FleetPartners export – Monthly Customer Detailed report s/s
Car rental • Kms travelled	Spreadsheet and details via MDC email: • Internal tracking data for flights, accommodation and rental cars – 2022-23 s/s

Stationary fuel combustion • Litres of diesel (bi-monthly) for generator	Details of generator fuel consumption via MDC email from Office Service Supervisor
Fugitive Emissions (Refrigerants) • Type of refrigerant • Quantity (kgs) of refrigerant	Details of type and quantity of refrigerants via MDC email from Office Service Supervisor
Capital Goods • Capital project $ spent per project • Type of capital project	Details of capital projects expenditure • 2022-23 - Carbon Emissions - Capital Spend for Projects undertaken in 23A Financial Year s/s
Purchased goods and services • Bus contract service kms travelled and number of passengers • Estimate of $ spent on bus services	Details of bus contractor services provided via email and phone call with Assets and Service Supervisor
Fuel and energy-related activities • Data used from scope 1 and 2 sources	Fleet fuel quantities - Details used from data in FleetPartners export – Monthly Customer Detailed report s/s Total electricity kWh - Details used from MDC Power Consumption and Costs FY2022-23 s/s
Business travel – flights • Departure and arrival details	Spreadsheet and details via MDC email: • Internal tracking data for flights, accommodation and rental cars – 2022-23 s/s
Business travel – accommodation • Number of nights stay	Spreadsheet and details via MDC email: • Internal tracking data for flights, accommodation and rental cars – 2022-23 s/s
Upstream Transportation & Distribution • $ spent on mail services, mail service rates, and courier services	Cost of mail and courier services provided via email from Office Service Supervisor

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