WAITAKI DISTRICT COUNCIL
Greenhouse Gas Emissions
2018/19 Financial Year

Contents

Introduction

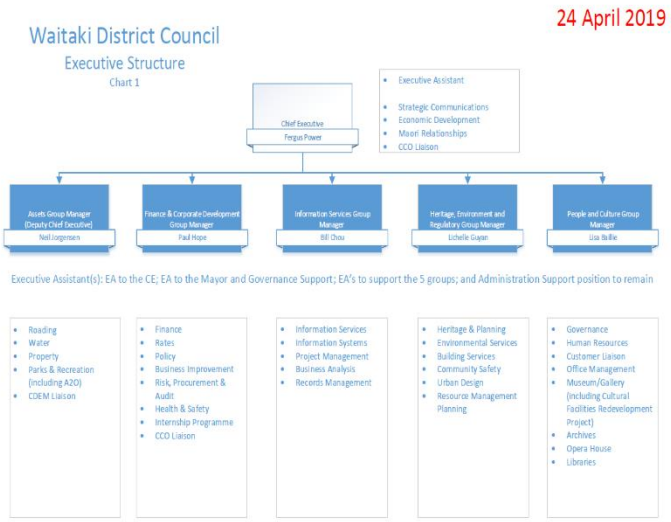
Organisation Description

Waitaki District Council is a territorial authority in the South Island of New Zealand. The Waitaki District Council was created in 1989 when the former Waitaki County, Waihemo County, Palmerston Borough and Oamaru Borough councils were amalgamated. The Waitaki District lies within two regions due to the Waitaki River, which forms a political boundary between Canterbury and Otago. As such the District has two regional authorities, the Otago Regional Council and the Canterbury Regional Council. The Waitaki District has a land area of 7,151.94 kilometres squared, of which 59.28% is in the Canterbury Region and 40.72% in the Otago Region. According to the 2018 census the District's population is approximately 23,200 with the majority of people living in Oamaru.

The purpose of the Waitaki District Council is to meet the current and future needs of communities for good quality local infrastructure, local public services, and performance of regulatory functions in a way that is most cost-effective for households and businesses. To meet this purpose Waitaki District Council provides the following key services:

- Local roads and footpaths
- Water supply
- Wastewater treatment
- Rubbish, recycling and landfills
- Cemeteries
- Recreation centres, libraries and pools
- Community housing
- Parks, reserves and sports fields
- Forestry and agricultural land
- Building and consents
- Planning and resource consents
- Properties and rates
- Animal control
- Alcohol licensing
- Food and environmental health
- Parking
- Emergency management and civil defence

The Council headquarters are in Oamaru (108 staff), with a Service Centre in Palmerston (2 staff). Other facilities under the Councils control include: Aquatic Centre Oamaru (41 staff) Library Oamaru (16 staff); Tees Street Oamaru office (22 staff); Oamaru Museum (2 staff); Oamaru Gallery (11 staff); Oamaru Opera House (30 staff); and, Oamaru Abacus House (4 staff).



Statement of Intent

A greenhouse gas (GHG) inventory is a comprehensive analysis of an organisation's applicable GHG emissions and removals within a defined boundary, over a specified period of time. This is the first annual GHG emissions inventory undertaken by the Waitaki District Council. This report provides details of this baseline inventory and associated analysis. The Council has no reporting obligations and this inventory has been undertaking on a voluntary basis, with the following key aims:

- Provide a base year for data, which will allow Waitaki District Council to understand their emission profile and track and compare GHG emissions/ removals over subsequent years.
- Provide a starting point for action, which enables Waitaki District Council to prepare a strategy and individual initiatives to reduce or offset future emissions.

Waitaki District Council recognises the importance of territorial authorities in reducing emissions from their own estate and operations, in order to meet carbon budgets and in lowering operational costs through emissions reductions.

Approach

This report follows guidance given by the New Zealand Government, *Guidance for Voluntary Greenhouse Gas Reporting* (MfE 2019). This approach includes adopting the methodology outlined by *GHG Protocol Corporate Accounting and Reporting Standard* (World Business Council & World Resources Institute 2001) and *ISO 14064-1: 2018 standard* (International Standards Organisation 2018).

A GHG is a gaseous constituent of the atmosphere, both natural and anthropogenic. There are six GHGs listed in the Kyoto Protocol: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6). Each gas absorbs and emits radiation at different wavelengths, within a specific atmospheric residence time. These differences result in different global warming potentials (GWPs). In order to make comparisons between the different gases, GHG emissions are typically expressed as carbon dioxide equivalent ($CO_{2\text{-}e}$).

Under the reporting requirements of *ISO 14064-1:2018* and the *GHG Protocol*, GHG emissions should be reported in tonnes of $CO_{2\text{-}e}$. However, some emissions are too small to be reported meaningfully in tonnes, so this report utilises emission factors in kilograms of $CO_{2\text{-}e}$ per unit. To help with the reader's comprehension, this report refers to overall carbon dioxide equivalent emissions in both tonnes (rounded up) and kilograms.

The quantification methodology in this report uses calculations based on GHG activity data multiplied by GHG emission or removal factors. Activity data relates to a measure of activity that results in a GHG emission or removal (e.g. litres of diesel fuel from vehicle travel). Emissions factors are calculated from activity data to estimate GHG emissions. These emission factors have been calculated using GWPs sourced from the IPCC's Fourth Assessment Report (2007). The calculations in this report predominantly use actual activity data, which has been accurately recorded throughout the reporting period.

Organisational Boundaries

Organisational boundaries have been determined as required by the methodology in the *ISO 14064-1: 2018 standard*, which allows for two approaches:

- ***Control***: the organisation accounts for all quantified GHG emissions and/or removals from facilities over which it has financial or operational control; or
- ***Equity share***: the organisation accounts for its portion of GHG emissions and/or removals from respective facilities.

This report takes an operational control consolidation approach to account for emissions, which is recommended as best practice. This approach allows Waitaki District Council to focus on all of the emission sources over which the organisation has day-to-day control and can consequently implement management decisions.

Reporting Boundaries & Exclusions

This report has undertaken analysis of all of Waitaki District Council's services and facilities. The *ISO 14064-1: 2018 standard* allows exclusions of direct or indirect emissions, which are not material or whose quantification would not be technically feasible or cost effective. This includes emissions that are estimated to be *de minimus*, being well below the 5% threshold of the entire inventory.

In line with the operational control consolidation approach, emissions that result from operations that are completely outside of the Council's day-to-day management are excluded. This exclusion helps avoid the potential for double counting of emissions. Double counting refers to the possibility of two separate entities including the same emissions in their respective inventories.

In taking *de minimus* and the operational control consolidation approach into account, this report excludes emissions from refrigerants, freight, and livestock on leased land owned by the Council.

Reporting Period: Financial Year 2018/19

Organisations can choose to report on a calendar or financial year basis. This focuses on the financial year, covering the period from 1 July 2018 to 30 June 2019, which will be established as a base year for comparative purposes within future reports.

Scope

The GHG Protocol identifies three different scopes of emissions, to help delineate direct and indirect emission sources. Scopes 1 and 2 are required under the GHG Protocol. Scope 3 is optional, providing organisations with an opportunity to be innovative in GHG management. Scopes 1 and 2 are carefully defined to ensure that two or more organisations will not account for emissions in the same scope. The activities that occur in Scope 3 for some organisations will fall under Scope 1 for others, if the pertinent emission sources are owned or controlled by the company (as defined under the organisational boundaries). It is for this reason that this report identifies waste to landfill, water supply, and wastewater treatment as a Scope 1 emissions, as opposed to Scope 3 emissions, which would be the case for many other organisations. This is in reference to the fact that Waitaki District Council is responsible for the day-to-day management of these facilities. Conversely, office waste from the Council is treated differently and is deemed Scope 3. The different emission sources under the three scopes in this report are defined as follows:

Scope 1 Direct GHG emissions: defined as 'direct GHG emissions from sources that are owned or controlled by the organisation'.

- Stationary combustion
- Transport fuels
- Wastewater treatment
- Water supply
- Waste to landfill

Scope 2 Indirect GHG emissions: defined as 'emissions from the consumption of electricity, steam, or other sources of energy generated upstream from the organisation'.

- Purchased electricity

Scope 3 Other indirect GHG emissions: defined as 'emissions that are a consequence of the operations of an organisation, but are not directly owned or controlled by the organisation'.

- Transmission and distribution losses from purchased electricity
- Air travel (domestic and international)
- Rental cars
- Taxis
- Office waste

The calculations in this report are for gross and net GHG emissions, thereby including GHG removals.

Report Layout

This report is in two sections:

- **Section 1:** Outlines the GHG emissions and removals, with explanatory details on the activity data and emissions factors.
- **Section 2:** Provides more technical details on the methodology of how the activity data has been calculated and details the figures relating to calculations.

Gross Emissions

This total gross carbon dioxide equivalents for Waitaki District Council are **2,876 tonnes**.

Scope	Activity	Tonnes				Percentage
		Total $CO_{2\text{-}e}$	$CO_{2\text{-}e}$	CH_4	N_2O	
Scope 1	Stationary Combustion	127.0	126.5	0.3	0.1	4%
Scope 1	Transport Fuels	149.0	144.3	1.0	3.7	5%
Scope 1	Wastewater Treatment	1,036.9	178.6	350.3	505.7	36%
Scope 1	Water Treatment	155.5	148.4	7.0	1.4	5%
Scope 2	Landfill	380.0	n/a	380.0	n/a	13%
Scope 2	Purchased Electricity	871.4	831.3	39.2	7.7	30%
Scope 3	Transmission & Distribution Losses	80.4	76.7	3.6	0.1	3%
Scope 3	Rental Vehicles	0.4	0.4	0.0	0.0	0%
Scope 3	Taxis	0.3	0.3	0.0	0.0	0%
Scope 3	Domestic Air Travel	49.8	48.8	0.2	0.7	2%
Scope 3	International Air Travel	10.2	10.2	0.0	0.1	0%
Scope 3	Accommodation	6.8	n/a	n/a	n/a	0%
Scope 3	Office Waste	7.8	n/a	7.8	n/a	0%
	Totals	**2,876**	**1,566**	**789**	**519**	

The most significant emissions are associated with wastewater treatment (36% of all emissions), purchased electricity (30%), and landfill (13%). Scope 1 emissions account for the largest proportion of emissions.

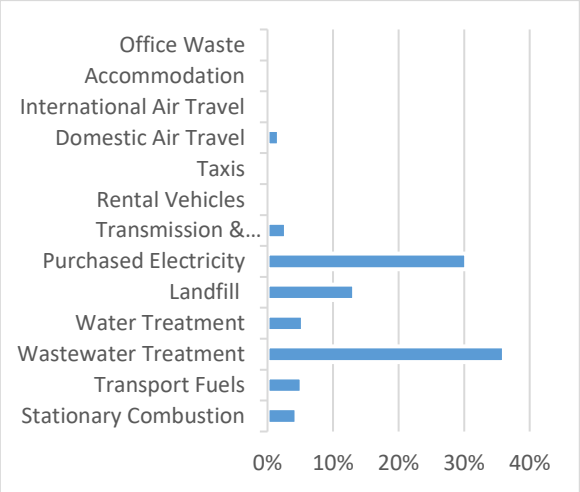


Figure 1 Emissions by Percentage

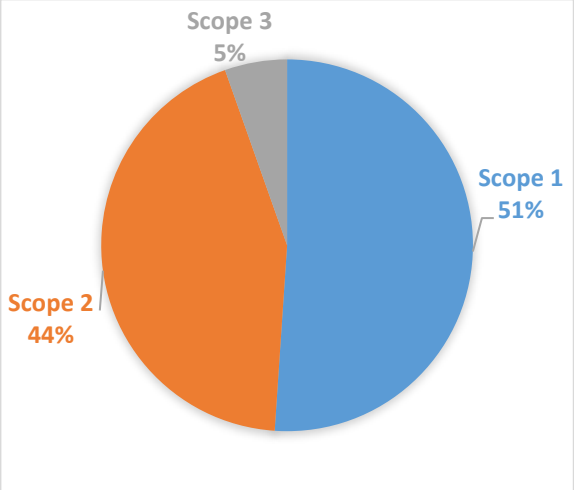


Figure 2 Emissions by Scope

Net Emissions

Waitaki District Council has a total of 165 hectares of forest. Emissions under the Land Use and Land use Forestry sector total **-4,902 tonnes**, meaning that forests act as 'net sink'. Taking into account Waitaki District Council's gross emissions of 2,876 tonnes and removals of -4,902 tonnes results in net emissions of **-2,026 tonnes**. This means that the Council is making a positive contribution overall towards climate change.

Emission Source Methodology

This following table provides a summary of the methodology and data sources for calculating GHG emissions. For full details see Section 2.

Scope	Category	Emissions Source	Data Source	Methodology
1	Stationary Combustion of Fuels	Three facilities (Waihemo Service Centre; Oamaru Opera House; Waitaki Aquatic Centre)	Fuel summary (LPG; diesel)	Litres of diesel; kilograms/ kilowatt hours of LPG.
1	Transport Fuels	Fleet of 31 vehicles (12 diesel; 19 petrol)	Fuel summary invoices (litres of diesel/ petrol); Kilometres travelled	Calculations used fuel data for 29 vehicles. Two vehicles utilised kilometres travelled.
1	Wastewater Treatment	7 treatment plants; 1 septic tank	Cubic metres of water sent to treatment; per capita data	Annual average dry weather discharge utilised for most facilities. Per capita figures utilised for two facilities.
1	Water Supply	17 water intakes, 41 storage facilities and 34 pump stations	Genesis and Contact invoices for purchased electricity	Actual energy use: kilowatt hours.
1	Waste to Landfill	Palmerston Landfill – tonnes of general waste	Weighbridge data	Tonnes of general waste (unknown composition).
2	Purchased Electricity	Electricity consumed	Genesis and Contact invoices	Actual energy use: kilowatt hours. Electricity use associated with water supply and wastewater treatment is excluded.
3	Transmission and Distribution Line Losses	Electricity consumed	Genesis and Contact invoices	Actual energy use: kilowatt hours.
3	Air Travel	Domestic and international flights	Flight invoices	Passenger kilometre and class of travel.
3	Rental Cars	Kilometres travelled	Avis invoice records	Kilometres travelled and assumed engine size.
3	Taxis	Average between the Diesel 1600–2000 cc and the 2000–3000 cc classes within the 2010-2015 fleet range	Invoice records	Cost of journey converted to kilometres, using $3/ kilometre.
3	Accommodation	Nights' accommodation	Invoice records	Number of people and nights staying in hotels.
3	Office Waste	Default office waste emission factor	Number of bins sent to landfill	Estimated kilograms of office waste.
Removals	Forestry	145 hectares of planted forest; 20 hectares of natural forest	Hectares of forest	Hectares of planted and natural forest. No harvesting undertaken.

SECTION 1: Greenhouse Gas Emissions

The following sections provide results for each greenhouse gas emission across each scope, along with initial recommendations that Waitaki District Council may consider in order to reduce emissions further. Overall recommendations to the District Council are to:

- ✓ Develop an internal low-carbon management plan, including targets, for managing and reducing emission drivers over which Waitaki District Council has significant control or influence. This should include a low-carbon procurement strategy, which will allow the council to identify the carbon footprint of its supply chain for products and services.
- ✓ Establish training opportunities (including staff inductions) and communications to ensure that all staff are aware of their impact on the organisation's emissions.
- ✓ Make data and this report available to staff, so that they can understand Waitaki District Council's emissions inventory and their own contribution to it.
- ✓ Undertake future GHG emissions inventories to track and compare progress over time.

Scope 1. Emissions

Stationary Combustion of Fuels

Stationary combustion emissions result when fuels are burnt in a fixed unit or asset, such as heaters, generators, and boilers, which generate heat, energy and hot water. Waitaki District Council used stationary combustion in the following facilities:

- The Waihemo Service Centre.
- The Oamaru Opera House used 21,000 kilograms (kg) of Liquefied Petroleum Gas (LPG).
- The Waitaki Aquatic Centre in Oamaru used 7,425 kg of LPG.

The stationary combustion of fuel resulted in **127 tonnes** of carbon dioxide equivalent:

Emission Source: Stationary Combustion of Fuels	Activity Data	Emissions (kg)			
		Total $CO_{2\text{-}e}$	CO_2	CH_4	N_2O
Waihemo Service Centre	15,360 litres diesel	40,858	40,704	139	100
Oamaru Opera House	21,000 kg LPG	63,630	63,420	125	29
Waitaki Aquatic Centre	7,425 kg LPG	22,498	22,424	44	10
Stationary Combustion Total		**126,985**	**126,548**	**308**	**140**

This emission factor does not incorporate emissions associated with the full fuel-cycle including extraction, production and transport of the fuels. Note that the reason that the emission weight is higher than the starting weight of the diesel fuel, is that through the combustion process oxygen is added to carbon to create carbon dioxide.

Recommendations:

- ✓ Undertake an energy audit to ensure that operations are operating efficiently and are utilising the most appropriate fuels.

Transport Fuels

Greenhous gas emissions from vehicles depend on the amount of fuel that is consumed. When fuel is burnt in a vehicle the reaction results in the release of carbon dioxide, along with other compounds that include nitrous oxides and sulphide. Different fuels have different Global Warming Potentials, with the District Council's vehicles using both petrol and diesel.

Waitaki District Council has a fleet of thirty-one vehicles. A total of twenty-nine vehicles generated emissions through the consumption of 21,918 litres of diesel (10 vehicles) and 33,884 litres of petrol (19 vehicles). Fuel data for a further two diesel vehicles was not available, so kilometres travelled was utilised as a substitute factor in calculations. This resulted in total emissions of **149 tonnes** of carbon dioxide equivalent for transport fuels.

Emission Source: Transport Fuels	Activity Data	Emissions (kg)			
		Total $CO_{2\text{-}e}$	CO_2	CH_4	N_2O
10 diesel vehicles	21,918 litres diesel	58,958	58,081	78	925
2 diesel vehicles	29,788 km	83,015	79,287	935	2,704
19 petrol vehicles	33,884 litres petrol	7,060	6,941	9	119
Transport Fuels Total		**149,033**	**144,310**	**1,022**	**3,748**

As with the fuels for stationary combustion, these emission factors are not full fuel-cycle emission factors and do not incorporate the indirect emissions associated with the extraction, production and transport of the fuel.

Recommendations:

It is noted that vehicles will continue to be necessary for the council to undertake aspects of work, including the use of 4WD drive vehicles in challenging terrains. Clearly, face-to-face meetings will continue to be an important way to effectively reach organisational goals. Nevertheless, the following actions will help reduce the emissions from transport fuels:

- ✓ Encourage staff to use alternative, low carbon, transport options for travelling to work and for work journeys, where appropriate. This may include cycling, walking and public transport, pool cars, installation of bike racks, route optimisation, teleconferencing, and wherever possible moving away from singe occupancy vehicle journeys.
- ✓ Develop a strategy for transitioning the fleet to small engine vehicles, electric cars and hybrids.
- ✓ Introduce electric bikes/ scooters for staff members to use for appropriate local journeys.

Wastewater Treatment

Emissions from the supply of wastewater treatment are indirect (Scope 3) if the organisation does not own or control the facilities. However, in this case these facilities are deemed to be Scope 1, due to Waitaki District Council's ownership/ control of these facilities. Waitaki's public wastewater system serve a population of 14,015 and comprise of eight facilities, which include seven treatment plants and one septic tank.

Supply	Details	Population
Oamaru Wastewater	Aeration lagoon; multiple oxidation ponds; land disposal	12,228
Duntroon Wastewater	Septic tank	90
Kurow Wastewater	Oxidation pond	312
Lake Ohau Wastewater	Oxidation pond	20
Moeraki Wastewater	Oxidation pond; wetlands	117
Omarama Wastewater	Oxidation ponds; wetlands	267
Otematata Wastewater	Primary and secondary treatment	186
Palmerston Wastewater	Oxidation pond	795

Domestic wastewater treatment plant emission factors are derived from the total energy use emissions in the wastewater treatment plants, and the gases emitted during the treatment process. There are no direct carbon dioxide emissions from wastewater treatment itself, only methane and nitrous oxide. The treatment of wastewater in these facilities resulted in total emissions of **1,037 tonnes** of carbon dioxide equivalent:

Emission Source: Wastewater Treatment	Activity Data	Emissions (kg)			
		Total $CO_{2\text{-}e}$	CO_2	CH_4	N_2O
7 Treatment Plants	2,317,385 Litres water[1]	1,036,841	n/a	350,253	n/a
1 Septic Tank	90 per capita	18	n/a	18	n/a
Wastewater Total		**1,036,859**	**178,607**	**350,271**	**505,664**

Recommendations:

- ✓ Undertake an energy audit to ensure that operations are operating efficiently.

[1] Lake Ohau Treatment Plant has no water data. Consequently a per capita emissions factor was utilised.

Water Supply

Emissions from the supply of water are indirect (Scope 3) if the organisation does not own or control the facilities. However, in this case these facilities are deemed to be Scope 1, due to Waitaki District Council's ownership/ control of these facilities. Emissions result from energy use in water supply. In the interests of displaying all aspects of Waitaki District Council's emissions profile, the electricity use for water supply has been separated from Scope 2 calculations on purchased electricity.

The Council supplies water to over 95% of the District's population through 17 water intakes, 41 storage facilities, and 34 pump stations. The total length of reticulation is 1,641 kilometres. The supply of urban and restricted water resulted in total emissions of **156 tonnes** of carbon dioxide equivalent:

Emission Source: Water Supply	Activity Data (kWh)	Emissions (kg)			
		Total $CO_{2\text{-}e}$	CO_2	CH_4	N_2O
Water Supply Total (electricity used)	**1,591,846**	**155,523**	**148,360**	**6,988**	**1,371**

Recommendations:

- ✓ Undertake an energy audit to ensure that operations are operating efficiently.

Waste to Landfill

Waitaki District Council currently operates one landfill, a 1.8 hectare site at Palmerston, located approximately 60 kilometres south of Oamaru. The Oamaru landfill closed on 21 April 2017 and has been replaced by a new refuse transfer station. The Palmerston landfill received 329,000 kilograms of waste during 2018/ 19. This figure has been slightly adjusted, removing the 4,212 kilograms of Waitaki District Council's office waste (detailed under scope 3), to avoid double counting.

The biological decomposition of waste in anaerobic conditions within landfills results in the production of landfill gases. The main gases produced are carbon dioxide (CO_2) and methane (CH_4). Methane is of particular concern, being a potent greenhouse gas that has a global warming potential that is over 21 times that of carbon dioxide (IPCC 2007). Only organic waste produces methane. Plastics, metals and glass are considered inert, as their decomposition does not directly produce GHG emissions. Methane can be destroyed through combustion, with some landfills recovering, flaring or combusting methane for energy. Consequently, there is an adjustment for the emissions factors for organisations that send their waste to landfills with landfill gas collection systems. The general waste emissions associated with the Palmerston landfill are deemed to be Scope 1 emissions, since they are from a source that is owned or controlled by the organisation. No surveys of the types of waste received at the site have been undertaken at the Palmerston landfill. The facility does not have any mechanisms for landfill gas recovery, flaring, or combustion for energy.

Emission Source: Landfill Emissions (without landfill gas recover)	Activity Data (tonnes)	Emissions (kg)			
		Total $CO_{2\text{-}e}$	CO_2	CH_4	N_2O
Landfill Emissions Total	**324,788**	**380,002**	**n/a**	**380,002**	**n/a**

Since 2013, disposal facility operators have had an obligation to report their landfill emissions and surrender New Zealand Units (NZUs) under the New Zealand Emissions Trading Scheme (ETS). As such, Waitaki District Council provides an annual emission's return and covers the emissions from Palmerston landfill by surrendering purchased NZUs, which correspond to the methane produced from the gross tonnage of waste disposed of every year.

Recommendations:

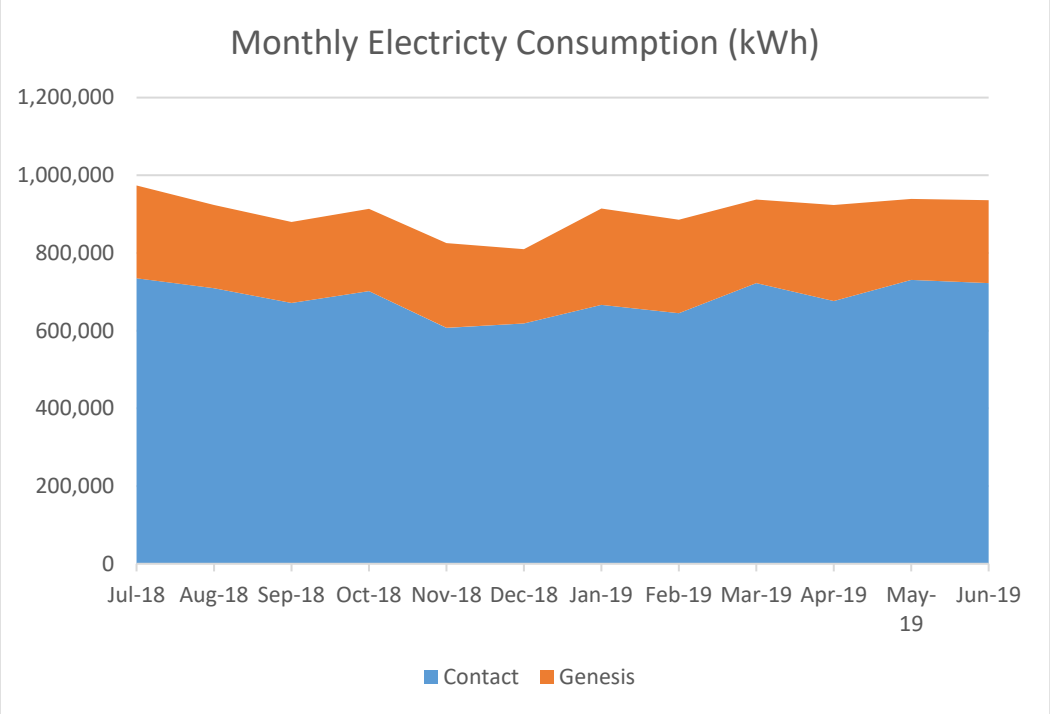
- ✓ Undertake a survey using the Solid Waste Analysis Protocol, in order to determine the types of waste being disposed of at Palmerston landfill.
- ✓ Continue to encourage waste prevention and diversion of waste, particularly organic waste, from landfill through recycling and composting.

Scope 2. Emissions

Purchased Electricity

These are indirect emissions from energy, consumed in owned or controlled equipment by Waitaki District Council, but generated by another company. The District Council utilises two different suppliers of electricity, Contact Energy and Genesis Energy. Contact Energy is the main supplier, providing approximately three-quarters of the Council's total electricity requirements.

The total amount of electricity utilised during the year by Waitaki District Council was 10,861,525 kilowatt hours (kWH). Electricity is used by the Council for a variety of purposes including street lighting, powering buildings, and the operation of plant and equipment.



10,861,525 kWH results in **1,061 tonnes** of carbon dioxide equivalent. The single largest user of electricity was in relation to water supply facilities, which consumed a total of 1,591,846 kWH (which alone amounts to 156 tonnes of carbon dioxide equivalent emissions). Water treatment facilities are also a major consumer of energy, with 350,171 kWh (34 tonnes of carbon dioxide equivalent emissions). The emissions associated with water supply and treatment have been accounted for separately under Scope 1 emissions. Consequently, the kilowatt hours associated with these facilities (1,942,017 kWh) have been removed to avoid double counting in emission calculations. Genesis Energy primarily provides energy for the water supply and wastewater treatment facilities.

The adjusted total amount of electricity consumed of 8,919,508 kWh resulted in emissions of **871 tonnes** of carbon dioxide equivalent:

Emission Source: Purchased Electricity	Activity Data (kWh)	Emissions (kg)			
		Total $CO_{2\text{-}e}$	CO_2	CH_4	N_2O
Contact	8,206,826	801,807	764,876	36,028	7,066
Genesis	712,682	69,629	66,422	3,129	614
Electricity Total	**8,919,508**	**871,436**	**831,298**	**39,157**	**7,680**

As with fuels for stationary combustion emission factors, this emission factor does not incorporate emissions associated with the extraction, production and transport of the fuels used in the production of electricity.

Recommendations:

- ✓ Undertake energy audits across different parts of the Council's operations.
- ✓ Determine which energy providers have the least GHG intensive sources of electricity.
- ✓ Develop awareness raising initiatives to make staff and the public more energy aware, including training, communication and general encouragement.
- ✓ Supporting energy efficiency in community housing, including the installation of insulation and ensuring that boilers are energy efficient, and raising awareness amongst tenants.
- ✓ Develop a strategy for lowering energy requirements from buildings, street lighting, and other facilities that are within the Council's control/ ownership.

Scope 3. Emissions

These indirect emissions are a consequence of the activities of Waitaki District Council, but are not owned or controlled by the organisation.

Transmission and Distribution Line Losses for Purchased Electricity

This emission factor accounts for emissions from the additional generation, which is needed to compensate for electricity lost in the transmission and distribution network, resulting from inefficiencies in the grid. The calculations in this report were based on a total of 10,861,525 kWh (thereby, including emissions associated with wastewater treatment and water supply) and resulted in a total of **80 tonnes** of carbon dioxide equivalent.

Emission Source: Transmission Losses	Activity Data	Emissions (kg)			
		Total $CO_{2\text{-}e}$	CO_2	CH_4	N_2O
Electricity used	kWh	0.0074	0.00706	0.000333	0.00000653
Contact	8,206,826	60,731	57,940	2,733	54
Genesis	2,654,699	19,645	18,742	884	17
Transmission Losses Total	**10,861,525**	**80,375**	**76,682**	**3,617**	**71**

*This emission factor does not incorporate the emissions associated with the extraction, production and transport of the fuels burnt to produce the electricity.

Air Travel

Air travel emissions are based on the total distance travelled and on the area of the plane that each passenger occupies. If a plane is comprised totally of business-class seats, as opposed to more densely packed economy class seats, this means that fewer passengers can fly. Therefore, business class travel incurs higher emissions. However, all flights undertaken by Waitaki District Council were in economy class.

International: The District Council only undertook two long-haul return international flights (to Italy and India). These international flights resulted in a total of **10 tonnes** of total carbon dioxide equivalents.

Domestic: Council staff undertook a total of 291 domestic flights, to a total of 14 different destinations. Wellington Airport was the most popular destination (with 34% of domestic flights), followed by Dunedin (23%), Timaru (13%), Christchurch (11%), and Auckland (11%). These domestic flights resulted in a total of **50 tonnes** of total carbon dioxide equivalents.

Emission Source: Air Travel	Activity Data (Passenger Km)	Emissions (kg)			
		Total $CO_{2\text{-}e}$	CO_2	CH_4	N_2O
International flights (4)	62,698	10,220	10,157	1	63
Domestic Flights (291)	164,918	49,805	48,816	165	660
Air Travel Total	**227,616**	**60,025**	**58,973**	**166**	**722**

Recommendations:

- ✓ Use video conferencing as an alternative to face-to-face meetings whenever possible.
- ✓ Evaluate and where possible reduce the number of staff that need to travel to meetings in other parts of the country.

Rental Cars

Rental cars are primarily used by staff when working outside of the region. Rental vehicles are not utilised regularly, with only eight instances of use during the year. These business trips incurred 2,014 kilometres of travel, which resulted in **0.4 tonnes** of carbon dioxide equivalent.

Emission Source: Rental Cars	Activity Data (km)	Emissions (kg)			
		Total $CO_{2\text{-}e}$	CO_2	CH_4	N_2O
Rental Cars Total	**2,014**	**415**	**396**	**4**	**13**

Recommendation:

- ✓ When booking rental vehicles opt for smaller and efficient models whenever possible, noting that smaller engines typically emit less emissions.

Taxis

Taxis are predominantly used for staff to travel to and from domestic airports. A total of 105 individual trips were made by taxi during 2018/19. Taxi trips within Wellington were the most common, equating to 67% of all trips, followed by Auckland with 22% of all trips. Taxis were also utilised to much lesser amounts in Christchurch, Dunedin, Hamilton, Napier, Queenstown, Rotorua, and Tauranga.

These trips resulted in a financial cost of $4,649, an estimated 1,550 kilometres travelled, and emissions totalling **0.3 tonnes** of carbon dioxide equivalent.

Emission Source: Taxis	Activity Data (dollars spent)	Emissions (kg)			
		Total CO_{2-e}	CO_2	CH_4	N_2O
Taxis Total	**4,649**	**348.69**	**339.39**	**0.46**	**4.65**

Recommendations:

- ✓ Ensure that staff members coordinate travel and share taxis whenever possible.
- ✓ Utilise taxi companies with low emission policies whenever possible.

Accommodation

According to the United Nations World Tourism Organization, the hotel industry accounts for approximately 1% of global emissions and this is set to increase as the demand continues to grow. Waitaki District Council requires accommodation for staff when they visit other parts of New Zealand or travel internationally. A total of 484 nights of accommodation within New Zealand, plus an estimated 14 nights in other countries, were utilised during the reporting period. Emissions were calculated using the Cornell Hotel Sustainability Benchmarking Index (CHSB) Tool (Ricaurte and Jagarajan 2019), which is the hotel industry's largest annual benchmarking of energy, water, and carbon.

Emission Source: Taxis	Activity Data	Emissions (kg)
		Total CO_{2-e}
Nights' Accommodation Total	**498 nights**	**6,849**

Recommendations:

- ✓ Use video conferencing as an alternative to face-to-face meetings whenever possible.
- ✓ Evaluate and where possible reduce the number of staff that need to travel to meetings in other parts of the country.

Office Waste

Waitaki District Council sends three 240 litre wheelie bins per week to landfill, as well as 640 litres of recycling. In determining accurate solid waste emission factors, it is preferable to know the composition. However, the composition of the general waste is unknown.

These emissions are deemed scope 3, as the production of these wastes is deemed to be a consequence of the operations of the organisation. Office waste is estimated to have resulted in **7.8 tonnes** of total carbon dioxide equivalents.

Emission Source: Office Waste	Activity Data (kgs)	Emissions (kg)			
		Total $CO_{2\text{-}e}$	CO_2	CH_4	N_2O
Office Waste Total	**4,212**	**7,750**	**n/a**	**7,750**	**n/a**

It must be noted that these figures relate only to office waste and do not include any waste generated by the Council through its wider operations. These other wastes include any construction and demolition waste generated in any renovation or building work undertaken on offices and other facilities.

Recommendations:

- ✓ Undertake a Solid Waste Analysis Protocol to determine the composition of office waste.
- ✓ Consider installing separate systems for collecting and composting office food waste.

Removals

Land Use, Land-Use Change and Forestry (LULUCF)

The LULUCF sector is responsible for both emitting GHG to the atmosphere (through deforestation) and removing GHG from the atmosphere (through forest growth and increasing organic carbon stored in soils). When emissions exceed removals, LULUCF is a 'net source' and emissions are positive. When removals exceed emissions, LULUCF is a 'net sink' and emissions are deemed negative.

Forests can act as carbon sinks, by trees absorbing carbon from the atmosphere through photosynthesis, which is then deposited in the tree's biomass (roots, trunk, branches and leaves) and in soils. This process is referred to as carbon sequestration. The exact amount of sequestration by a forest will depend on a range of attributes, including species type and age. Conversely, forests can be carbon sources, with carbon released into the atmosphere when tress burn or decay after dying.

Waitaki District Council has 145 hectares of planted forests (predominant comprised of species such as *pinus radiata*) and 20 hectares of natural forests. There has been no harvesting or deforestation during the reporting period. The planted and natural forests resulted in **-4,918 tonnes** of carbon dioxide equivalents.

Emission Source: LULUCF (Forest Growth)	Activity Data (hectares)	Emissions (kg)			
		Total $CO_{2\text{-}e}$	Carbon	CH_4	N_2O
Planted Forest	145	-4,902,015	-1,336,900	n/a	n/a
Natural Forest Average	20	-16,310	-4,448	n/a	n/a
LULUFC Total	**165**	**-4,918,325**	**-1,341,348**	**n/a**	**n/a**

It is also useful to understand the determine the estimated carbon stored in forests, in order to help Waitaki District Council understand the potential impact of some forestry activities (harvesting) on emissions, and how to manage land use for carbon. In this regard the total carbon dioxide equivalents for all from forestry is estimated to be **154,231 tonnes**, amounting to **42,063 tonnes** of carbon.

Emission Source: LULUCF (Land Use Change)	Activity Data (hectares)	Emissions (kg)			
		Total $CO_{2\text{-}e}$	Carbon	CH_4	N_2O
Planted Forest	145	137,257,725	37,433,925	n/a	n/a
Natural Forest Average	20	16,973,000	4,629,000	n/a	n/a
LULUFC Total	**165**	**154,230,725**	**42,062,925**	**n/a**	**n/a**

Waitaki District Council participates in the Emissions Trading Scheme (ETS). The ETS puts a price on GHG emissions and encourages landowners to establish and manage forests in a way that increases carbon storage.

Recommendation:

- ✓ Continue to sustainably manage forestry in order to provide a carbon sink and reduce Waitaki District Council's GHG footprint.

Summary of Recommendations

Scope	Recommendation
General	✓ Develop an internal low-carbon management plan, including targets, for managing and reducing emission drivers over which Waitaki District Council has significant control or influence. This should include a low-carbon procurement strategy, which will allow the council to identify the carbon footprint of its supply chain for products and services. ✓ Establish training opportunities (including staff inductions) and communications to ensure that all staff are aware of their impact on the organisation's emissions. ✓ Make data and this report available to staff, so that they can understand Waitaki District Council's emissions inventory and their own contribution to it. ✓ Undertake future GHG emissions inventories to track and compare progress over time.
Stationary Combustion	✓ Undertake an energy audit to ensure that operations are operating efficiently and are utilising the most appropriate fuels.
Transport Fuels	✓ Encourage staff to use alternative, low carbon, transport options for travelling to work and for work journeys, where appropriate. This may include cycling, walking and public transport, pool cars, installation of bike racks, route optimisation, teleconferencing, and wherever possible moving away from singe occupancy vehicle journeys. ✓ Develop a strategy for transitioning the fleet to small engine vehicles, electric cars and hybrids. ✓ Introduce electric bikes/ scooters for staff members to use for appropriate local journeys.
Wastewater Treatment	✓ Undertake an energy audit to ensure that operations are operating efficiently.
Water Supply	✓ Undertake an energy audit to ensure that operations are operating efficiently.
Waste to Landfill	✓ Undertake a survey using the Solid Waste Analysis Protocol, in order to determine the types of waste being disposed of at Palmerston landfill. ✓ Continue to encourage waste prevention and diversion of waste, particularly organic waste, from landfill through recycling and composting.
Purchased Electricity	✓ Undertake energy audits across different parts of the Council's operations. ✓ Determine which energy providers have the least GHG intensive sources of electricity. ✓ Develop awareness raising initiatives to make staff and the public more energy aware, including training, communication and general encouragement. ✓ Supporting energy efficiency in community housing, including the installation of insulation and ensuring that boilers are energy efficient, and raising awareness amongst tenants. ✓ Develop a strategy for lowering energy requirements from buildings, street lighting, and other facilities that are within the Council's control/ ownership.
Air Travel	✓ Use video conferencing as an alternative to face-to-face meetings whenever possible. ✓ Evaluate and where possible reduce the number of staff that need to travel to meetings in other parts of the country.

Rental Cars	✓ When booking rental vehicles opt for smaller and efficient models whenever possible, noting that smaller engines typically emit less emissions.
Taxis	✓ Ensure that staff members coordinate travel and share taxis whenever possible. ✓ Utilise taxi companies with low emission policies whenever possible.
Accommodation	✓ Use video conferencing as an alternative to face-to-face meetings whenever possible. ✓ Evaluate and where possible reduce the number of staff that need to travel to meetings in other parts of the country.
Office Waste	✓ Undertake a Solid Waste Analysis Protocol to determine the composition of office waste. ✓ Consider installing separate systems for office food waste and the development of composting.
LULUFC (Forestry)	✓ Continue to sustainably manage forestry in order to provide a carbon sink and reduce Waitaki District Council's GHG footprint.

SECTION 2: Methodology

This section provides an audit trail of how emissions have been calculated across each emissions source. This information will be important for any future GHG inventories that Waitaki District Council undertakes. The consistent application of accounting approaches, inventory boundary, and calculation methodologies are essential for tracking, assessing and reporting on GHG emissions over time. If there are any future changes in the inventory boundary, methods, data or any other factors affecting emission estimates, they need to be transparently documented and justified

GHG emissions sources were identified with reference to the methodology described in the GHG Protocol and ISO 14064-1: 2018 standards. In line with the reporting requirements for Scope 1 emission sources, the GHG emissions for carbon dioxide, methane and nitrous oxide are reported separately, as well as the total carbon dioxide equivalent. Carbon dioxide emission factors are based on the carbon and energy content of a fuel. Therefore, these emissions remain constant irrespective of how a fuel is combusted. Non-carbon dioxide emissions (methane and nitrous oxide) and emission factors depend on the way the fuel is combusted. To reflect this variability uncertainties are provided, which have been sourced from the Ministry for the Environment (2019).

Identification of emissions sources was undertaken via communications with Waitaki District Council staff, using established databases and information sources. Emission Factors have been sourced using best available recommendations, predominantly obtained from the Ministry for the Environment, in order to ensure that they are the most applicable for a New Zealand context.

Notes: All emissions in this section are in kilograms, unless otherwise stated. Numbers associated with emission factors are rounded to three decimal places, unless the number is significantly small. Consequently, numbers may not always add up due to rounding. The kg CH_4 and kg N_2O figures are expressed in kg $CO_{2\text{-}e}$.

Scope 1. Methodology

Stationary Combustion of Fuels Methodology

Waitaki District Council uses stationary combustion in the following facilities:

- The Waihemo Service Centre used 15,360 litres of diesel, which equates to emissions of 40.9 tonnes of carbon dioxide equivalent.
- The Oamaru Opera House used 21,000 kilograms of Liquefied Petroleum Gas (LPG), which equates to emissions of 63.6 tonnes of carbon dioxide equivalent.
- The Waitaki Aquatic Centre in Oamaru used 100,982 kilowatt hours (kWh) of LPG. To covert kilowatt hours to kilograms a conversion rate of 1 kg = 13.6 kWH of energy was utilised, which resulted in 7,425 kilograms of LPG. This equates to emissions of 22.5 tonnes of carbon dioxide equivalent.

Calculations utilised emissions factors under the commercial use component.

Emission Source: Stationary Combustion of Fuels (Commercial Use)	Activity Data	Emission Factors/ Emissions (kg)				Uncertainty kg $CO_{2\text{-}e}$/unit
		Total $CO_{2\text{-}e}$	CO_2	CH_4	N_2O	
Diesel	*Litre (L)*	2.66	2.65	0.00907	0.0065	0.50%
Diesel (1 facility)	15,360 L	40,858	40,704	139	100	0.50%
LPG	*Kilograms (kg)*	3.03	3.02	0.00594	0.0014	0.50%
LPG (2 facilities)	*28,425 kg*	*86,128*	*85,844*	*169*	*40*	0.50%
Total (facilities)		**126,985**	**126,548**	**308**	**140**	

Transport Fuels Methodology

Waitaki District Council has a total of 31 vehicles within the fleet. The majority of individual vehicles have records on the total litres of fuel consumed, for both petrol and diesel vehicles. However, these records do not show the specific type of petrol used, with respect to regular or premium petrol fuel grades. Consequently, for petrol the calculations use the default petrol emission factors. The default petrol factor is a weighted average of regular and premium petrol based on 2016 sales volume data from Energy in New Zealand 2016 (MBIE 2016).

The $CO_{2\text{-}e}$ per activity unit emission factors are derived by the Ministry of Business, Innovation and Employment using calorific values, and incorporate relevant oxidation factors sourced from *The IPCC Guidelines for National Greenhouse Gas Inventories* (2006).

Emission Source: Transport Fuels (Fuels)	Activity Data	Emission Factors/ Emissions (kg)				
		Total $CO_{2\text{-}e}$	CO_2	CH_4	N_2O	Uncertainty kg $CO_{2\text{-}e}$/unit
Diesel	*Litre (L)*	*2.69*	*2.65*	*0.00354*	*0.0422*	*0.90%*
Diesel (10 vehicles)	21,918 L	58,958	58,081	78	925	*0.90%*
Petrol – Default	*Litre (L)*	*2.45*	*2.34*	*0.0276*	*0.0798*	*1.80%*
Petrol – Default (19 vehicles)	33,884 L	83,015	79,287	935	2,704	*1.80%*
Total (29 vehicles)	**55,801 L**	**141,973**	**137,369**	**1,013**	**3,629**	

Two vehicles do not have data on total fuel used, with only records for total kilometres travelled being available. It must be noted that kilometre-based estimates of carbon dioxide equivalent emissions are less accurate than calculating emissions based on fuel-use data, due to variations in vehicle fuel efficiency and driving efficiency.

Emission Source: Transport Fuels (Post-2015 vehicle fleet emissions per km travelled)	Activity Data	Emission Factors/ Emissions (kg)			
		Total $CO_{2\text{-}e}$	CO_2	CH_4	N_2O
Diesel vehicle 2001 -<3000 cc	Kilometres	0.237	0.233	0.0003	0.004
Total (2 vehicles: Mitsubishi Outlander diesel)	**29,788 km**	**29,788**	**7,060**	**6,941**	**9**

This results in a total of 149 tonnes of total carbon dioxide transport fuel emissions.

Emission Source: Transport Fuels (Total)	Activity Data	Emission Factors/ Emissions (kg)			
		Total $CO_{2\text{-}e}$	CO_2	CH_4	N_2O
Diesel (10 vehicles)	21,918 L	58,958	58,081	78	925
Petrol – Default (29 vehicles)	33,884 L	83,015	79,287	935	2,704
Diesel (2 vehicles)	29,788 km	29,788	7,060	6,941	9
Transport Fuels Total (31 vehicles)		**149,033**	**144,310**	**1,022**	**3,748**

Wastewater Treatment Methodology

Domestic wastewater treatment plant emission factors are derived from the total energy use emissions in the wastewater treatment plants (kWH), and the gases emitted during the treatment process. As the wastewater emissions include electricity emissions, the same electricity emissions uncertainties carry through. The gas emissions are calculated using equations in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Some industries (such as meat, poultry, pulp and paper, wine and dairy) produce wastewater that is high in biological oxygen demand, requiring different emission factors. However, this level of wastewater data was not available, and these industries were not assessed separately.

Emission Source	Unit	$CO_{2\text{-}e}$	CO_2	CH_4	N_2O
Treatment Plant	M^3 Water	0.447	0.077	0.151	0.218
Treatment Plant	Per Capita	48.5	8.4	16.4	23.7
Septic Tank	Per Capita	0.202	n/a	0.202	n/a

Data was available for the majority of facilities in respect to discharges (peak, average, consented). The emissions calculations in this report utilised average dry weather flow. For two sites (Duntroon and Lake Ohau) there was no average data available. Consequently, for these sites per capita factors were utilised.

Emission Source		Population	Daily volume of water treated (m^3)	Annual volume (m^3)	Emissions (kg)			
Facility	Type				CO_2e	CO_2	CH_4	N_2O
Oamaru	Treatment Plant	12,228	5,344	1,950,560	871,900	150,193	294,535	425,222
Duntroon	Septic Tank	90	No data	No data	18	n/a	18	n/a
Kurow	Treatment Plant	312	122	44,530	19,905	3,429	6,724	9,708
Lake Ohau	Treatment Plant	20	No data	No data	970	168	328	474
Moeraki	Treatment Plant	117	39	14,235	6,363	1,096	2,149	3,103
Omarama	Treatment Plant	267	185	67,525	30,184	5,199	10,196	14,720
Otematata	Treatment Plant	186	267	97,455	43,562	7,504	14,716	21,245
Palmerston	Treatment Plant	795	392	143,080	63,957	11,017	21,605	31,191
Totals		**14,015**	**6,349**	**2,317,385**	**1,036,859**	**178,607**	**350,271**	**505,664**

Water Supply Methodology

The Ministry for the Environment guidance uses a weighted average of participant energy use and water supply data to calculate the emission factors. This approach drew on the Water NZ 2016/17 National Performance Review survey, which obtained information on the energy use of water systems to calculate national averages (WaterNZ 2017). This equates to a median energy intensity of 1.2 MJ of energy per cubic metre of water supplied and 3.0 MJ of energy per cubic metre of water treated. This approach utilises either cubic metres of water supply or per capita data. Data on the volume of water supplied is not available, so calculations utilised per capita data:

Emission Source	Activity Data	Emission Factors/ Emissions (kg)			
		Total CO_{2-e}	CO_2	CH_4	N_2O
Water Supply	Per Capita	4.07	3.89	0.183	0.0036
Water Supply Total (population)	**20,050**	**81,604**	**77,995**	**3,669**	**72**

Data on the Council's electricity consumption (from the supplier Contact Energy) can be broken down into specific service areas. This data shows that 1,591,846 kilowatt hours were utilised by the infrastructure associated with water supply. Using electricity used emission factors in emissions calculations for water supply results in significantly higher emissions than using the per capita factors. Consequently, it is recommended that electricity used emission factors are utilised and the higher emission volumes are adopted.

Emission Source	Activity Data	Emission Factors/ Emissions (kg)			
		Total CO_{2-e}	CO_2	CH_4	N_2O
Electricity used	kWh	0.0977	0.0932	0.00439	0.000861
Water Supply Total (electricity used)	**1,591,846**	**155,523**	**148,360**	**6,988**	**1,371**

Waste to Landfill Methodology

The Palmerston landfill received a total of 329,000 kilograms (329 tonnes) of waste during 2018/ 19. The waste disposed of at landfill by the council's offices are accounted for separately under Scope 3. In order to avoid double counting, 4,212 kilograms of waste from the Council have been deducted from the total waste, resulting in an adjusted figure of 324,788 kilograms of landfill waste. In determining accurate solid waste emission factors, it is preferable to know the composition of the waste. However, no surveys of the types of waste received at the site have been undertaken. The Palmerston facility does not have any mechanisms for landfill gas recovery, flaring, or combustion for energy.

Landfill Emissions (without landfill gas recovery)	Activity Data	Emission Factors/ Units			
		Total CO_{2-e}	CO_2	CH_4	N_2O
Waste (unknown composition)	Kilograms (kg)	1.17	n/a	1.17	n/a
Waste (unknown composition) Total	**324,788 kg**	**380,002**	**n/a**	**380,002**	**n/a**

Scope 2. Methodology

Purchased Electricity Methodology

Waitaki District Council has monthly records for electricity usage across its two suppliers, Contact Energy and Genesis Energy. The total amount of electricity consumed was as follows:

Supplier	Total kWh	Percentage
Contact	8,206,826	76%
Genesis	2,654,699	24%
Total	**10,861,525**	

The emission factors for wastewater treatment and water supply facilities include electricity consumption, which has been accounted for under Scope 1. In order to avoid double counting these kilowatt hours have been removed from purchased electricity calculations, resulting in a total of 8,919,508 kWh within this scope.

Source	Total kWh	Associated $CO_{2\text{-}e}$
Wastewater Treatment	350,171	34,212
Water Treatment	1,591,846	155,523

The electricity emission factor covers purchased electricity from a supplier who sources its electricity from the national grid. The emission factor for purchased electricity is derived from the net electricity generation data in *Energy in New Zealand* (MBIE 2016). This grid-average emission factor is based on the average grid mix of generation types. The emission factor accounts for the emissions from fuel combustion at thermal power stations and fugitive geothermal emissions. Renewable generation such as hydro, wind and solar has no associated combustion or fugitive GHG emissions, so these are considered to be carbon neutral. This emission factor also does not reflect the real-world factors that influence the carbon intensity of the grid such as time of year, time of day and geographical area.

Emission Source: Purchased Electricity	Activity Data	Emission Factors/ Emissions (kg)			
		Total $CO_{2\text{-}e}$	CO_2	CH_4	N_2O
Electricity Used	kWh	0.0977	0.0932	0.00439	0.000861
Contact	8,206,826	801,807	764,876	36,028	7,066
Genesis	712,682	69,629	66,422	3,129	614
Electricity Used Total	**8,919,508**	**871,436**	**831,298**	**39,157**	**7,680**

Scope 3. Methodology

Transmission and Distribution Line Losses for Purchased Electricity Methodology

The emissions factor is an average figure that makes no allowance for location of the end-user within the national grid, or other factors that may vary between individual consumers. The calculation in this report was based on the total electricity consumed (including use associated with water supply and wastewater treatment facilities).

Emission Source: Transmission Losses	Activity Data	Emission Factors/ Emissions (kg)			
		Total $CO_{2\text{-}e}$	CO_2	CH_4	N_2O
Electricity Used	kWh	0.0074	0.00706	0.000333	0.00000653
Contact	8,206,826	60,731	57,940	2,733	54
Genesis	2,654,699	19,645	18,742	884	17
Transmission Losses Total	**10,861,525**	**80,375**	**76,682**	**3,617**	**71**

Air Travel Methodology

To calculate emissions for domestic air travel, this report utilises data on the departure and destination airports of each journey. The distance travelled has been calculated using an online calculator (https://airport.globefeed.com).

For air travel emission factors, multipliers or other corrections may be applied to account for the GWP of emissions arising from aircraft transport at altitude. Radiative forcing helps organisations account for the wider climate effects of aviation, including water vapour and indirect GHGs. This is an area of active research, although the IPPC estimate that these other climate change impacts of aviation may be up to two to four times those of carbon dioxide alone. This report applies a recommended radiative forcing multiplier of 1.9 (Sausen et al 2005; CCC 2009).

Domestic flights: Since the size of the aircraft associated with each journey is not known, the calculations in this report utilise a national average emission factor. The national average was calculated by the Ministry of Transport using a 'Domestic aviation projection model'. This model utilised the details of types of aircrafts running domestic flights in 2016. As emission factors are based on fuel delivery data, it was not necessary to apply a distance uplift factor to account for delays/circling and non-direct routes.

Emission Source: Domestic Air Travel (With Radiative Forcing)	Activity Data	Emission Factors/ Emissions (kg)			
		Total $CO_{2\text{-}e}$	CO_2	CH_4	N_2O
National Average	Passenger Kilometres	0.302	0.296	0.001	0.004
Domestic Air Total (291 flights)	164,918	49,805	48,816	165	660

International flights: The emission factors utilised in this report follow those published by the UK Department for Business, Energy & Industrial Strategy, which are deemed by the Ministry for the Environment to be the most suitable emission factors currently available (MfE 2016). The calculations in this report incorporate a circle distance uplift factor to take into account non-direct routes between airports and delays/ circling. The UK Department for Business, Energy & Industrial Strategy applies an eight percent uplift factor, based on analysis of UK flights. It must be noted that the figure of eight percent, is based on the analysis of flights arriving and departing from the UK. This figure is likely to be overstated in New Zealand (initial estimates from Airways New Zealand is that this figure is likely to be less than five per cent). However, in the absence of a New Zealand-specific figure these calculations take a conservative approach.

Emission Source: International Air Travel (With Radiative Forcing)	Activity Data	Emission Factors/ Emissions (kg)			
		Total $CO_{2\text{-}e}$	CO_2	CH_4	N_2O
Economy Class	Passenger Kilometres	0.163	0.162	0.00001	0.001
International Air Total (4 long-haul flights >3,700 km)	**62,698**	**10,220**	**10,157**	**1**	**63**

Rental Cars Methodology

As with transport fuels, the most accurate way to calculate emissions is based on fuel consumption data. Factors such as individual vehicle fuel efficiency and driving efficiency mean that kilometre-based estimates of carbon dioxide equivalent emissions are less accurate than calculating emissions based on fuel-use data. However, this data is not available for business travel in rental cars, so calculations have been based on kilometres travelled.

It was assumed that most rental cars would be relatively new, so calculations used the post-2015 fleet emission factors, which are based on the average fuel consumption data from vehicles produced from 2015 onwards. The likely engine size of each vehicle was determined based on model type.

Emission Source: Rental Cars	Activity Data	Emission Factors/ Emissions (kg)			
		Total $CO_{2\text{-}e}$	CO_2	CH_4	N_2O
1350 -<1600 cc	Km	0.179	0.171	0.002	0.006
1 Vehicle	10	1.79	1.71	0.02	0.06
1600 -<2000 cc	Km	0.196	0.187	0.002	0.006
6 Vehicles	1,700	333.2	317.9	3.4	10.2
≥3000 cc	Km	0.262	0.251	0.003	0.009
1 Vehicle	304	79.648	76.304	0.912	2.736
Rental Cars Total	**2,014**	**415**	**396**	**4**	**13**

The data used to prepare these emissions factors come from a report by Emission Impossible Ltd (2016). The report includes a dataset of projected real-world fuel consumption rates from 1970 to 2018.

Taxis Methodology

As with direct (Scope 1) emissions from transport fuels, the most accurate way to calculate carbon dioxide equivalent emissions is to utilise fuel consumption data. Kilometre based estimates of emissions do not take into account factors such as individual vehicle fuel efficiency and driving efficiency. Waitaki District Council keeps records on all taxi journeys, outlining the origin and destination of all trips and costs. However, the available data does not provide exact kilometres for each journey. Therefore, calculations in this report were undertaken based on known total dollars spent ($4,649) and estimated kilometres, which utilised the price of $3/ kilometre (estimated 1,550 kilometres). Taxicharge have advised that since 2014 the price per kilometre has remained stable at $3. Calculations on both dollars spent and kilometres travelled resulted in similar emissions. However, this report takes a conservative approach, utilising the slightly higher emission figure based on dollars spent.

According to the Motor Industry Association, the most common taxi vehicles are diesel, with the majority (62%) being in the <2000 cc and <3000 cc class and the average age of the taxi fleet being 8.6 years. Emission factors for taxis by distance use an average between the Diesel 1600–2000 cc and the 2000–3000 cc classes within the 2010-2015 fleet range.

Emission Source: Taxis	Activity Data	Emission Factors/ Emissions (kg)			
		Total $CO_{2\text{-}e}$	CO_2	CH_4	N_2O
Distance Travelled	Kilometres	0.224	0.220	0.0003	0.004
Distance Travelled Total	**1,550 km**	**347.14**	**340.94**	**0.46**	**6.20**
Dollars Spent	Dollars	0.075	0.073	0.0001	0.001
Dollars Spent Total	**$4,649**	**348.69**	**339.39**	**0.46**	**4.65**

Accommodation Methodology

Emission factors for accommodation are obtained from the Cornell Hotel Sustainability Benchmarking Index (CHSB) Tool (Ricaurte and Jagarajan 2019). The factors are in $CO_{2\text{-}e}$ and are not available by gas type. The CHSB notes limitations with the unverified dataset, which include the fact that it is skewed towards upmarket and chain hotels, and that the results do not distinguish hotel amenities such as swimming pools. Although forty-eight nations were involved in the research, although the majority of the dataset is focused on the United States. Records show that a total of 484 nights of accommodation were utilised within New Zealand. There are no available records for international travel, so a conservative estimate of one week's accommodation per trip was utilised for calculations.

Emission Source: Accommodation	Activity Data	Emission Factors/ Emissions (kg) Total $CO_{2\text{-}e}$
New Zealand	Room per night	12.3
New Zealand	484	5,953
Italy	Room per night	24.9
Italy	7	174.3
India	Room per night	103.1
India	7	721.7
Accommodation Total	**498**	**6,849**

Office Waste Methodology

Waitaki District Council utilises three 240 litre wheelie bins per week. The exact weight of waste disposed of each week is unknown. Therefore, the calculations in this report assumed an average weight of waste of 27 kilograms per wheelie bin (Jaeger 1984). This amount equates to 4,212 kilograms of office waste per year. This waste is sent to Palmerston landfill, a facility which does not utilise landfill gas recovery measures.

In determining accurate solid waste emission factors, it is preferable to know the composition of the waste. However, the composition of these waste streams is unknown. Although paper/ carboard is collected separately for recycling, these greenhouse gas producing materials may still be present in the Council's general waste. Furthermore, these waste streams are likely to include organic material in the form of food waste. As such, the calculations in this report have used the default 'office waste' emission factor, which is higher than the default 'general waste' factor. The default office waste factor assumes office waste to comprise of 53.6% paper; 20.8% organic; and 25.6% inert (plastic and metals).

Emission Source: Office Waste	Activity Data	Emission Factors/ Emissions (kg)			
		Total $CO_{2\text{-}e}$	CO_2	CH_4	N_2O
Office Waste (unknown composition)	Kilograms	1.84	n/a	1.84	n/a
Office Waste Total	**4,212**	**7,750**	**n/a**	**7,750**	**n/a**

The offices also utilise 640 litres of bin space for recyclables every week. It is possible to account for emission associated with the distance travelled by these materials to waste transfer stations or recycling plants, using freight emission factors. However, an examination of these sources concluded that any emissions would be negligible. Therefore, these emissions are not included in this report.

Removals Methodology

Land Use, Land-Use Change and Forestry (LULUCF) Methodology

This report only provides emissions related to forestry, which is under the Council's ownership. Other emissions from LULUCF relate to agriculture. Waitaki District Council leases out 1,926 hectares of agricultural land for sheep grazing. Based on an average of ten sheep per hectare this amounts to an estimated 19,260 sheep, which would result in 5,778 tonnes of carbon dioxide equivalents per year. However, since livestock on leased land is not owned or under direct control of the council, these emissions are not within the scope of this inventory.

Forest land is defined as woody vegetation with a tree crown cover of more than 30 per cent in a given hectare (ha) area, in which the trees could reach a minimum height of 5 metres at maturity. Ministry for the Environment guidance refers to three forests types:

- ***Planted forests:*** comprise of forest species including Radiata Pine, Douglas Fir and other planted species. The emission factors are based on the Land Use and Carbon Analysis System (LUCAS) national sample. They represent the average annual increment over 28 years, accounting for both the gains from forest growth and losses from any forest management activities up until the point of harvest. Waitaki District Council has 145 hectares of forests, which meet this definition. There has been no harvesting or deforestation during the reporting period.
- ***Natural forests:*** have emission factors across two types of forest. Tall natural forests predominantly comprise of mature indigenous forest. Regenerating natural forest contains indigenous and naturally occurring vegetation and has the potential to reach forest under its current management. Waitaki District Council has a total of 20 hectares of natural forests. In the absence of data on the exact proportion of natural forests types, this report applies the national average (16 per cent regenerating: 84 per cent tall) to the activity data.

Emission Source: LULUCF (Forest Growth)	Activity Data	Emission Factors/ Emissions (kg)				
		Total $CO_{2\text{-}e}$	Carbon	Uncertainty (95% CI)	CH_4	N_2O
Planted Forest	ha	-33,807	-9,220	±30%	n/a	n/a
Planted Forest	145	-4,902,015	-1,336,900	±30%	n/a	n/a
Natural Regenerating Forest	ha	-5,097	-1,390	±50%	n/a	n/a
Natural Regenerating Forest	3.2	-16,310	-4,448	±50%	n/a	n/a
Tall Natural Forest	ha	0	0	n/a	n/a	n/a
Tall Natural Forest	16.8	0	0	n/a	n/a	n/a
Forest Growth Total	**165**	**-4,918,325**	**-1,341,348**			

The estimated carbon stored in forests has been calculated using the following factors:

LULUCF (Land Use Change)	Activity Data	Emission Factors/ Emissions (kg)				
		Total $CO_{2\text{-}e}$	Carbon	Uncertainty (95% CI)	CH_4	N_2O
Planted Forest Harvest & Deforestation	ha	946,605	258,165	±30%	n/a	n/a
Planted Forest Harvest & Deforestation	145	137,257,725	37,433,925	±30%	n/a	n/a
Natural Forest Harvest & Deforestation	ha	848,650	231,450	±50%	n/a	n/a
Natural Forest Harvest & Deforestation	20	16,973,000	4,629,000	±50%	n/a	n/a
Land Use Change Total	**165**	**154,230,725**	**42,062,925**			

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