BEFORE THE INDEPENDENT HEARINGS PANEL

UNDER	the Resource Management Act 1991
AND	
IN THE MATTER OF	the submissions of B & A Stokes on the Waimakariri Proposed District Plan (#214) and Variation 1 (#29)

PRIMARY EVIDENCE OF PAUL FARRELLY ON BEHALF OF B AND A STOKES

(Greenhouse Gas Emissions)

4 March 2024

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1 EXECUTIVE SUMMARY

1.1 When considering the greenhouse gas (**GHG**) impacts of a potential land use change for housing, it is important to evaluate both the emissions from the existing land use and the anticipated emissions arising from the new land use compared to other potential developments.

1.2 GHG emissions are currently occurring on the subject site (being 81 Gressons Road and 1375 Main North Road, Waikuku) (the **Site**)) because of the livestock (cows) that are grazing there. These emissions occur primarily from methane, which is known to have a much greater impact on global warming than carbon dioxide.

1.3 New Zealand has targets to reduce emissions from biogenic methane by 2030 (10% below 2017 levels) and 2050 (22-47% below 2017 levels), therefore removal of livestock from the land supports a reduction in GHG emissions.

1.4 Development of the Site in accordance with the proposed rezoning (referenced in this evidence as the **Proposal**) will result in new emissions from the building of infrastructure and housing, the construction and operation of approximately 1,500 dwellings, and from travel undertaken by residents. However, it is reasonable to assume that these emissions would occur elsewhere in New Zealand if this development does not proceed, as these people would simply choose to live elsewhere.

1.5 Based on my understanding, the typical buyer targeted in this development is a buyer who wishes to purchase a relatively affordable, modern property, relatively close to a major metropolitan centre.

1.6 The Site is located approximately 27km north of the centre of Christchurch City (assumed to be the Riverside Market), which is a similar distance to central Christchurch as other locations of significant greenfield development in the Greater Christchurch area such as Rolleston (25km), but less than Rangiora (33km) and West Melton (29km).

1.7 A key advantage of this Site (in GHG emissions terms) relative to other greenfield sites is its close proximity to Ravenswood (1km away), which

is on the way to being the 3rd largest commercial centre in the Waimakariri district.

1.8 The Site is planned to be well-connected to Ravenswood with separated cycleways and walkways connecting to the main commercial area. This will make it easy for residents to access day to day services and employment opportunities via active travel modes (cycling and walking), which I expect to result in lower travel-related emissions for residents compared to other greenfield sites.

1.9 The Proposal would enable a density of 12 households per hectare across most of the Site, with some areas of lower density proposed for the northern most part of the area.

1.10 The submitter has indicated that greater density is likely to be provided in the southern end of the Proposal, closer to the commercial area of Ravenswood, which will help to minimise travel distance of residents and ensure maximum use of active transport modes. Increased density is advantageous from a GHG perspective in comparison to lower density developments because the infrastructural emissions required to develop the area are lower on a per resident basis (for example less km of roading is required to be developed per resident compared to larger lots). As such, I am supportive of the proposed zoning change from Large Lot Residential to General Residential / Medium Density Residential.

1.11 Over a 90-year life cycle, energy usage is currently the most significant source of emissions that occurs in residential housing in New Zealand, followed by the embodied carbon of building materials (the emissions associated with producing the building materials).

1.12 Stand alone or detached housing emissions have lower lifetime emissions on a per m^2 basis,[1] excluding transport, than the emissions of multi-storey apartments. This is because high embodied carbon materials (concrete and steel) are typically used to build multi-storey apartments compared to stand alone houses (like those envisaged in in the Proposal) that are likely to be primarily constructed of timber.

[1] https://iopscience.iop.org/article/10.1088/1755-1315/588/2/022064/pdf

1.13 Lifetime energy usage emissions from stand-alone homes can be minimised through the specification of energy efficient homes, the elimination of fossil gas/LPG in developments, and encouraging a high uptake of solar PV panels.

1.14 The potential for solar PV uptake is much greater on stand-alone homes (compared to multi-storey apartments or medium density multi-level homes) due to the much greater ratio of usable roof to floor area.

1.15 Whilst the Site is not currently directly served by public transport (which is to be expected given the lack of people currently resident in the Site), there are bus routes to Rangiora and Christchurch that already service the Waikuku and Pegasus areas.

1.16 As Ravenswood grows to be a Key Activity Centre,[2] it is anticipated that more public transport services will serve the area. Development of the Site in accordance with the Proposal would help to support the introduction of more services to the area, as more residents would live within easily accessible range of a Ravenswood bus station.

1.17 The Site is also well located for cycling, with excellent off-road cycling access provided all the way to Rangiora (approx. 8km away) by way of the Woodend-Rangiora cycleway that is connected to Ravenswood off Bob Robertson Drive. The cycleway is separated from the road and is flat, smooth, and well maintained.

1.18 There is limited existing tree coverage across the Site, therefore limited carbon sequestration is currently occurring. The outline development plan (**ODP**) for the Site provides for significant green space, including an extensive stormwater treatment area to the east of the Site. These areas are anticipated to be planted with trees, wetland planting and other indigenous planting. I would also expect that more trees will be planted in residential properties given the size of sections anticipated. Overall, I expect that more carbon sequestration will occur as a result of the Proposal compared to the current land use.

1.19 Although the Site is not currently within walking distance of any schools, there are preschool options within Ravenswood already. I understand

[2] Defined as a commercial centre identified as a focal point for employment, community activities, and the transport network.

the submitter has engaged the Ministry of Education (**MOE**) and that provision for a school is not precluded by the ODP. Should a school be developed on the Site, this would reduce the emissions associated with travelling to school.

1.20 The removal of dairy cows from the land (resulting from the land-use change) also directly supports a reduction in GHG emissions. In light of these features/considerations, it is my opinion that development of the Site enabled under the Proposal likely compares favourably in terms of GHG emissions relative to other greenfield development opportunities available in the Greater Christchurch area.

2 QUALIFICATIONS AND EXPERTISE

2.1 My full name is Paul Michael Farrelly.

2.2 I have a BE Civil Engineering (Hons) from the University of Canterbury. I started my career as a traffic and road safety engineer and have subsequently had over 25 years commercial experience working across a number of industries. Over the past 10 years I have worked in the energy and carbon field.

2.3 For the past four years I have worked for Lumen, an engineering consultancy, as a Principal Consultant in their dedicated energy and carbon team. In this capacity I have developed GHG inventories for a significant number of organisations, in a broad range of sectors. This includes infrastructure companies, an airport, several electricity distribution businesses, manufacturers, consulting firms and retail businesses. Through this work, I am well versed in calculating GHG emissions. I have previously provided GHG evidence for several plan changes in Greater Christchurch.

2.4 I have been engaged on behalf of B & A Stokes (the **submitter**) to provide this evidence in respect of their submissions on the proposed Waimakariri District Plan (**PDP**).

3 CODE OF CONDUCT

3.1 While this is not an Environment Court proceeding, I confirm that I have read the Code of Conduct for Expert Witnesses set out in the Environment Court Practice Note 2023. I have complied with the Code

of Conduct in preparing this evidence and will continue to comply with it while giving oral evidence. Except where I state that I am relying on the evidence of another person, this written evidence is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed in this evidence.

4 SCOPE OF EVIDENCE

4.1 My evidence addresses the extent to which the Proposal will contribute to a reduction in GHGs.

4.2 In preparing this evidence, I have:

(a) reviewed the submissions of the submitter on the PDP (#214) and Variation 1 (#29);

(b) reviewed the proposed ODP for the land involved in the submission (the Site); and

(c) visited the general area of the proposed land change (on 19 November 2023).

5 THE PROPOSAL

5.1 The submission proposes to rezone 144ha at 81 Gressons Road and 1375 Main North Road, Waikuku from Large Lot Residential and Rural Lifestyle (as notified) to General Residential / Medium Density Residential, with a small commercial centre.

5.2 If the submission is accepted, the Proposal would enable delivery of between 1200 – 1500 lots in accordance with the ODP (**Figure 1**).

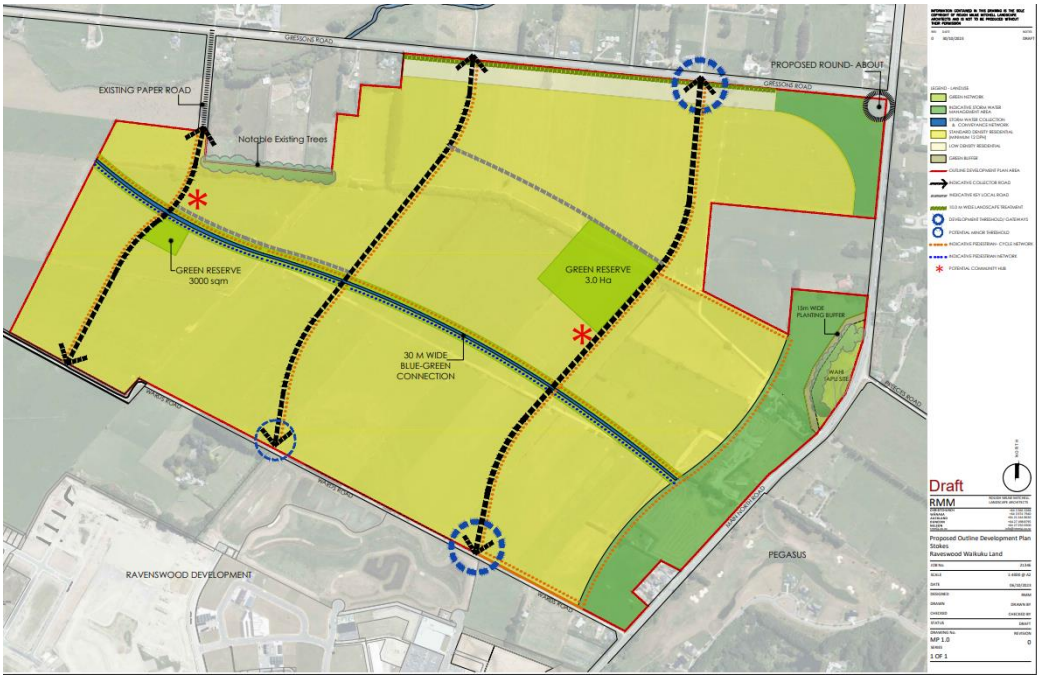

Figure 1: Proposed Outline Development Plan

5.3 This Site is located on the West side of State Highway 1, just to the north of the developing Ravenswood area and south of Waikuku, as shown in orange in **Figure 2**, below.

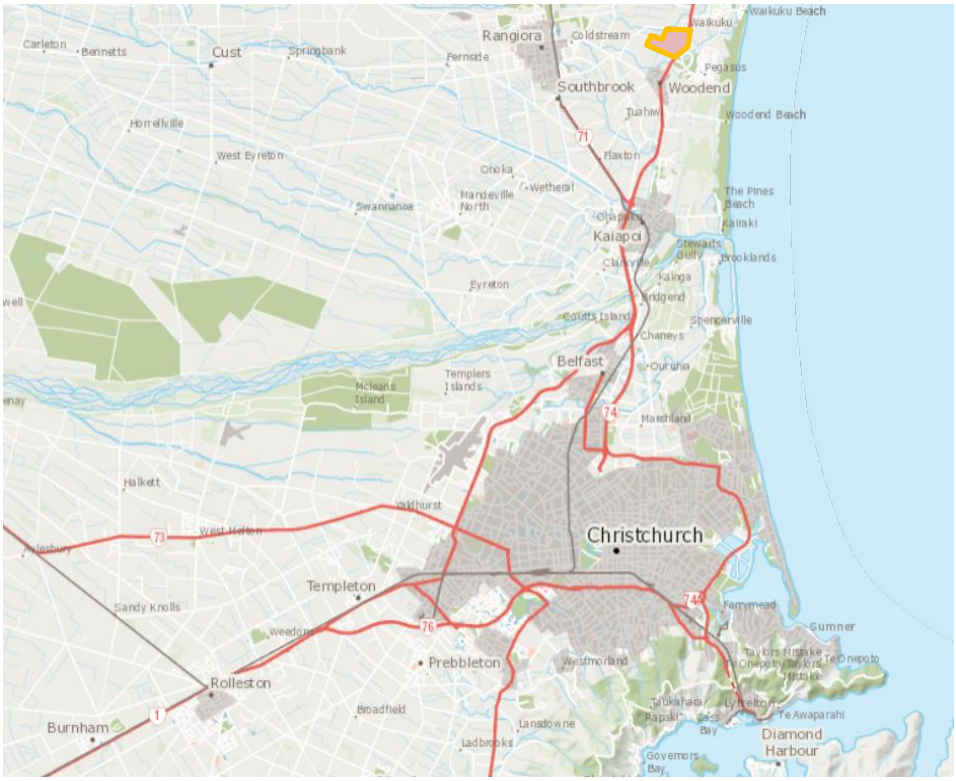

Figure 2: Location of Site in the context of Greater Christchurch

6 PLANNING CONTEXT

6.1 The National Policy Statement on Urban Development 2020 (**NPS-UD**) requires decision makers to consider whether proposals for land-use changes in urban areas "support reductions in greenhouse gas emissions."[3]

6.2 I consider this to be the most relevant policy in respect of GHGs when considering rezoning applications in urban areas.

6.3 New Zealand has a rapidly growing population and a need to develop facilities and employment opportunities for this population. This is especially true in the Waimakariri district, one of the fastest growing areas in the country.

6.4 In this context, my opinion is that Policy 1(e) is not intended to mean that an absolute reduction in GHG emissions is required. If this were the requirement then it would likely not be feasible to develop any greenfield site, short of prohibiting any private vehicle use.

6.5 This is because emissions will be incurred during the development phase (building the infrastructure and the housing/commercial buildings), and then during the operational phase of the buildings for their lifetime (primarily due to energy use and travel of residents).

6.6 An exception might be where a current land-use is particularly carbon-intensive (e.g. industrial production or intensive dairy farming). In this case, a change to residential or commercial use could potentially result in an actual reduction in emissions.

6.7 Regardless, it is extremely difficult to accurately calculate future GHG emissions arising from a proposed land-use change with any precision given changes (technology, population, behavioural) that could occur in future.

6.8 Moreover, I do not believe such a calculation is required under the NPS-UD, as the key test is whether a proposed development "supports a reduction in greenhouse gas emissions."

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[3] https://environment.govt.nz/publications/national-policy-statement-on-urban-development-2020-updated-may-2022/ at Objective 8(a) and Policy 1(e).

6.9 Given this, this evidence does not attempt to make specific calculations about the future emissions of the land-use, and instead we focus on taking a 'big picture' look at how the development impacts on GHGs at a higher level.

7 GREENHOUSE GASES

7.1 There are several gases that contribute to the problem of global warming, the most prevalent of these being carbon dioxide (**CO_2**), methane and nitrous oxide.

7.2 Each of these gases has differing abilities to trap extra heat in the atmosphere, and it is the trapping of this heat that leads to global warming.

7.3 When evaluating GHG emissions, it is useful to have a common measure to allow comparisons between gases.

7.4 As CO_2 is by far the most prevalent of the GHGs, it is standard practice when measuring emissions to determine the level of each gas emitted, and then convert these emissions into their carbon dioxide equivalent, or CO_2-e.

7.5 The global warming potential (**GWP**) of a gas is a measure of its ability to trap extra heat in the atmosphere over time relative to CO_2. This is most often calculated over a 100-year period and is known as the 100-year GWP.

7.6 The GWP of CO_2 is 1.

7.7 New Zealand is committed to reducing GHG emissions substantially in the coming years. The Climate Change Response (Zero Carbon) Amendment Act 2019 (**Zero Carbon Act**) sets in legislation the following targets for the country:

(a) reduce net emissions of all GHGs (except biogenic methane) to zero by 2050; and

(b) reduce emissions of biogenic methane to 24–47 per cent below 2017 levels by 2050, including to 10 per cent below 2017 levels by 2030.

7.8 In response to the Zero Carbon Act, the Government has developed a comprehensive Emissions Reduction Plan (**ERP**)[4], which was released on 16th May 2022. This sets out how New Zealand will achieve emissions reduction targets and identifies a comprehensive set of actions and additional targets that will support achievement of the overall goals.

7.9 The ERP has been heavily guided by advice provided by the climate change commission, in their *Ināia tonu nei: a low emissions future for Aotearoa* report (June 2021).[5]

7.10 Key strategies for achieving the reduction targets include:

(a) increasing the mix of renewables in our electricity generation network;

(b) conversion of fossil fuelled industrial, manufacturing, and process heat to low emissions energy (electricity or biomass);

(c) electrification of our vehicle fleet;

(d) increasing the proportion of (personal) travel undertaken using active travel modes and public transport;

(e) reducing freight emissions; and

(f) reducing agricultural emissions, primarily through a mix of lower herd numbers (less dairy cows and sheep/cattle) and some technological innovations. The Climate Change Commission's demonstration pathway specifically shows that a 23% reduction in dairy cows across New Zealand would be required by 2050 (compared to 2021 numbers) for the 2050 target to be achieved.

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4 Defined as a commercial centre identified as a focal point for employment, community activities, and the transport network

5 https://www.climatecommission.govt.nz/our-work/advice-to-government-topic/inaia-tonu-nei-a-low-emissions-future-for-aotearoa/

8 EMISSIONS ASSESSMENT

Emissions from existing land use

8.1 When considering a proposed development's impact on GHG emissions, it is useful to consider the level of emissions arising from the existing use of the land.

8.2 I visited the Site and the surrounding area on 19 November 2023 and I have also read through the Geotechnical assessment, Preliminary Site Investigation and the Landscape and Visual Assessment reports that were attached to the submissions on behalf of the submitter.

8.3 The Site is largely flat and mostly open with some areas of partial tree coverage, mostly hedging. I observed a reasonably large number of dairy cows across a few locations on the Site. Information provided by the Site owners identifies that a dairy farm is currently operating with a herd of 420 cows.

8.4 GHG emissions from farming operations include methane emissions from the livestock that is grazing on the land, manure and urine produced by these animals and the use of fertiliser on the farm. Methane is a short-lived GHG and has a GWP that is 28-36 times that of CO2 over a 100-year time frame and 84 times over a 20-year period. Its potency and impact on global warming were reflected at the recent COP26 climate change summit, where a global pledge was signed by 105 countries, including New Zealand, to reduce methane emissions 30% by 2030 compared to 2020 levels.

8.5 Notably, agriculture is by far the largest contributor to GHG emissions in the Canterbury region[6], accounting for approximately 62.6% of the region's emissions in 2019 based on Statistics NZ data (7,296,000t/ 11,641,000).

8.6 GHG emissions from the current farming operations include the following:

(a) enteric fermentation – the process by which ruminant animals produce methane by digesting feed;

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6 https://www.stats.govt.nz/information-releases/greenhouse-gas-emissions-by-region-industry-and-household-year-ended-2019.

(b) manure management – the storage and treatment of manure produces emissions (including the emissions from manure which is applied to land);

(c) agricultural soils – soils emit nitrous oxide due to the addition of nitrogen to soils through manure, dung and urine;

(d) fertiliser use – applying nitrogen (urea-sourced or synthetic) fertiliser onto land produces nitrous oxide and carbon dioxide emissions. Applying lime and dolomite fertilisers results in carbon dioxide emissions; and

(e) the use of energy in operating the farm – fossil fuels used in vehicles and electricity to power cow sheds/irrigators/pumps.

8.7 Emissions for a farming operation can be calculated using guidance provided by the Ministry for the Environment (**MFE**).[7] In this guide, MFE provides annual emissions on a per animal basis.

8.8 The relevant emissions factors, per dairy cow, per annum are as follows (updated to reflect the latest emissions factors published by MFE in July 2023):

(a) Enteric fermentation – 2,423 kg CO2-e.

(b) Manure management – 254.5 kg CO2-e.

(c) Agricultural soils – 377.2 kg CO2-e.

8.9 The relevant emissions factors published by MFE in July 2023 for non-dairy cattle, per annum per animal, are as follows:

(a) Enteric fermentation – 1,679 kg CO2-e.

(b) Manure management – 23.3 kg CO2-e.

(c) Agricultural soils – 226.6 kg CO2-e.

8.10 Using the MFE factors, the emissions of the existing land use can be determined based on the number of animals grazed. This can be

[7] Measuring Emissions: A Guide for Organisations – 2023 detailed guide.

calculated as (2423 + 254 + 377) = 3,055 kg CO2-e per dairy cow and (1679 + 23 + 227) = 1,929 kg CO2-e per non-dairy cattle.

8.11 As outlined above, another significant emitter of GHG emissions from farm operations is the use of nitrogen fertiliser.

8.12 GHG emissions occur when the nitrogen in fertiliser is converted to nitrous oxide through natural biological soil processes.

8.13 According to a Ravensdown fertiliser report provided by the Submitter, for the 12 month period to May 2023, 31.45 tons of limestone-based fertiliser and 28.21 tons of nitrogen-based fertiliser were applied to the Site. This translates to approximately 145 tons CO2-e per year.

8.14 Using MFE factors, we calculate that the total emissions resulting from activity on the farm per annum are 1,428 tons of CO2e, based on:

(a) total emissions from 420 milking cows of approximately 1,283 tons CO2-e per year; and

(b) approximately 145 tons CO2-e per year from fertiliser application.

8.15 This total excludes any emissions from fossil fuels used on the land and electricity use, as these figures are not available.

8.16 This total also excludes fossil fuels, electricity use and vehicle fuel associated with processing the milk collected from the farm, which I understand to be processed by Fonterra at their Darfield site – which is largely still powered by coal.

8.17 To put this into perspective, 1,428 tons CO2-e is equivalent to the following:

(a) 5.67 million vehicle kilometres travelled in a typical NZ vehicle (using the MFE's default private car emission factor (2022) per km of 0.252); or

(b) the average annual electricity usage emissions of approximately 2,265 Canterbury households.[8]

[8] The average residential home in Canterbury uses 8,550kWh per annum – per Electricity In New Zealand, 2018, The Electricity Authority. Emissions per kWh are 0.0742kg CO2-e/kWh (latest MFE factors – July 2023).

Emissions from proposed land use

8.18 For any new residential development, GHG emissions will occur across three different stages:

(a) Emissions associated with earthworks and the building of infrastructure required to support the development.

(b) Emissions associated with construction and occupation of the dwellings and commercial buildings (primarily emissions arising from energy use).

(c) Emissions from travel related activities of residents who live within the blocks.

Infrastructure emissions

8.19 The level of infrastructure related materials required for a subdivision is largely a function of the hectares to be developed, as opposed to the number of dwellings.

8.20 Emissions associated with new roading are one of the key factors to consider.

8.21 These emissions are directly related to the amount (km) of roading required, the width of the road, the materials used and the nature of the Site (for instance a flat site with limited earthworks requirements has lower emissions than a hilly site).

8.22 I am satisfied that the amount of roading has been minimised as much as practical in the ODP, and the flat nature of the Site will limit the extent of earthworks required and the amount of fossil fuels that will be used in preparing the Site for development.

8.23 At least in terms of infrastructure, increased density is advantageous from a GHG perspective in comparison to lower density developments because the infrastructural emissions required to develop the area are lower on a per resident basis (for example less km of roading is required to be developed per resident compared to larger lots).

8.24 Therefore, I am supportive of the proposed zoning change from Large Lot Residential to General Residential / Medium Density Residential from an emissions perspective.

Building lifecycle emissions

8.25 The second major component of GHG emissions is the emissions associated with construction and operation/occupation of the buildings.

8.26 A major contributing factor is emissions "embodied" in materials that are used in the buildings.

8.27 Embodied carbon relates primarily to the energy used to create building materials. Examples of materials with high embodied carbon are concrete and steel, compared to timber which has comparatively low embodied emissions.

8.28 There are two main ways of reducing embodied carbon in a dwelling:

(a) build dwellings using lower-carbon materials; and

(b) reduce the size of a dwelling.

8.29 A recent (2020) study undertaken by Massey University and BRANZ[9] assessed the expected life cycle emissions for three different types of residential dwellings: detached housing, medium-density housing, and an apartment.

8.30 A lifecycle analysis considers the emissions expected to be emitted across the various life stages of the development – this includes construction, operation, and end of life treatment. The study considers that a New Zealand home is expected to last for 90 years and, therefore, a lifecycle analysis should consider emissions across this timeframe.

8.31 Key conclusions from the study were that the product stage (embodied carbon) is responsible for 16% of the life cycle emissions, with operational energy use responsible for 59%. Embodied carbon was more significant for apartments, due to the greater use of high emissions materials such as concrete and steel in construction.

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[9] Application of Absolute Sustainability Assessment to New Zealand Residential Dwellings - S J McLaren et al 2020 IOP Conf. Ser.: Earth Environ. Sci. 588 022064

8.32 On a per m^2 basis, across a 90-year period, the lifetime emissions are highest for multi-storey apartments (21 kg CO_2-e/m^2/yr) compared to lifetime emissions for detached housing and medium density housing (13 kg CO_2-e/m^2/yr).

8.33 As multi-storey apartments are not anticipated for the Site, I consider that the embodied emissions resulting from the type of dwellings envisaged on the Site is to be relatively efficient from a GHG perspective.

8.34 Furthermore, it is important to recognise that the emissions factor for electricity used in this study relates to a New Zealand average, whereas the emissions for electricity usage in the South Island are almost always lower than electricity in the North Island, due to the different mix of generation in the two islands. Most of the electricity used in the South Island comes from low emissions sources (hydro and wind), whereas electricity used in the North Island is generated from a mix of sources including geothermal, natural gas and coal. As such, the electricity used in the North Island can be considered to have higher emissions.

8.35 Taking this into consideration, embodied carbon is therefore a much higher relative contributor to lifetime emissions for properties developed in the South Island compared to the North Island.

8.36 Therefore, to minimise the lifetime emissions associated with housing developed in the South Island we should be looking, as much as possible, to build houses using materials that have low embodied carbon such as standalone houses, medium density housing (townhouses) or apartments that are built primarily using timber.

8.37 Noting that emissions are also a function of dwelling size, it is important to consider the size of dwellings that would likely be built if the Proposal is approved.

8.38 It is reasonable to expect that, on average, smaller houses would be developed under the proposed density than would be developed under a lower density zoning, such as Large Lot Residential zoning. It is also reasonable to assume that larger houses (such as those in Large Lot Residential) would not necessarily accommodate more people.

8.39 As such, the emissions per person arising from the construction of housing can be expected to be relatively low for houses developed on the Site relative to multi-story units and large lot residential housing.

8.40 When it comes to emissions from operational energy use, the main factors that influence this are:

(a) how energy efficient a dwelling is;

(b) the type of energy that is used in the dwelling;

(c) the size of the dwelling; and

(d) the use of on-site renewables.

8.41 With recent building code changes[10], new homes are more energy efficient than traditional New Zealand houses, due to better building materials and higher levels of insulation.

8.42 The Site is well suited for solar PV due to its flat nature and limited obstructions (i.e. no hills) north of the Site.

8.43 As apartments are unlikely to be built within the Site, most houses are expected to be detached or semi-detached, and I would expect there to be a relatively high uptake of solar.

Emissions from travel

8.44 Rezoning the Site for residential use will result in new emissions from travel undertaken by residents. Emissions from transportation are a function of the mode of transport (vehicle, bus, bicycle), distance travelled and frequency of travel. Emissions from transportation primarily arise from trips undertaken in vehicles that use fossil fuels (primarily passenger vehicles).

8.45 When considering transportation emissions related to a new residential development (with an anticipated lifetime of 90 years) it is important to consider both the current way in which we travel, and also to consider how travel patterns and modes of transport may change as we look forward to the future.

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[10] https://www.mbie.govt.nz/about/news/new-building-code-requirements-bring-biggest-energy-efficiency-change-in-over-a-decade/

8.46 The most comprehensive data for the types of trips that people currently undertake in New Zealand is provided by a 2015 Ministry of Transport study.[11]

8.47 The following chart (**Figure 3**) from the study shows the main purposes of daily travel.

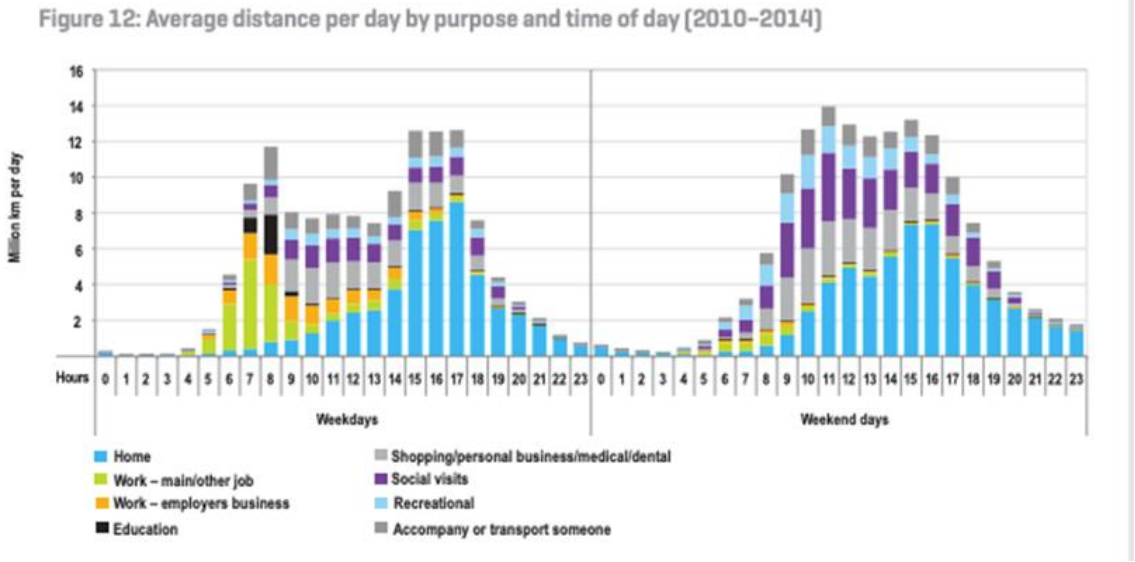

Figure 3: Why we travel.

8.48 From this, we can group reasons for travel into 3 key categories – commercial/recreation (including social visits), work and education.

8.49 I look into at each of these in the following sections of this evidence.

Access to commercial and recreation activities

8.50 The Site is already well serviced with nearby amenities and recreation facilities (for instance being relatively close to beaches and golf courses).

8.51 With the future development of the Ravenswood town centre just 1-2 kms from most of the residential lots proposed on the Site, it is set to be located closer to "high frequency" destinations such as a supermarket, cafes, gyms and childcare centres than a typical suburb in a large city. This will limit the need for residents to make high frequency trips outside the Ravenswood area.

[11] Ministry of Transport. (2015). 25 Years of New Zealand Travel: New Zealand Household Travel 1989-2014.

8.52 The nearest supermarket to the Site is New World Ravenswood, which borders the Site, requiring residents to travel only a short distance to access essential day-to-day supplies.

8.53 The distance to the supermarket is less than 1km for much of the proposed residential lots on the Site, which is closer than most houses are located to their nearest supermarket in a typical urban area, and a much shorter distance to a supermarket compared to most greenfield sites.

8.54 With 20 hectares of commercially zoned land, Ravenswood Central will grow to become the third largest commercial centre in the Waimakariri district. Many businesses are already established in the development, with many more to come, as illustrated on the latest Ravenswood master plan (**Figure** 4).

Figure 4: Ravenswood Commercial Area Masterplan

8.55 The introduction of many businesses to the area will provide easily accessible employment opportunities for residents of the Site.

8.56 The ODP provides direct access via active modes of transport to the Ravenswood commercial area. This direct access, coupled with the proximity of the existing commercial areas in Ravenswood will

encourage residents to use active/low emissions modes of transport to access services.

8.57 Consequently, the proximity of the Proposal to the Ravenswood commercial area will significantly contribute to the minimisation of GHG emissions generated from travel, especially relative to alternative greenfield development sites around the region.

8.58 Emissions can be further mitigated by ensuring that the areas of greatest proposed housing density in the Site are located closer to the Ravenswood end of the area.

8.59 Overall, due largely to its proximity to Ravenswood, and the ability for residents to easily access Ravenswood via active travel modes, the emissions associated with travel for commercial/recreation activities as a result of the Proposal are expected to be relatively low compared to other greenfield locations.

Access to employment

8.60 While some residents can be expected to work in the new Ravenswood commercial area (and will be able to travel to work via active travel modes), other residents will commute for work, with the most likely destinations for employment being Christchurch and Rangiora.

8.61 The distance to central Christchurch is 27km, which is at the upper limit for a cycling commute, meaning that the most common modes of travel are likely to be public transport (via the number 95 bus that connects Pegasus to Central Christchurch) and private vehicle travel (potentially car-pooled).

8.62 However, my expectation is that a significant amount of workers (particularly those that Christchurch-based) will opt to work from home reasonably frequently, and I'd also expect there will be a rapid uptake of electric vehicles (**EV**) by those that are required to commute, as the economic incentive to purchase an EV is greater for those that have a longer commute (as the cost of charging an electric car at home is likely to be less than the cost of running a fossil-fuelled vehicle).

8.63 These factors will serve to limit commuting emissions.

8.64 The developer of the Site could also support the adoption of car-pooling to Christchurch by promoting car-pooling benefits and supporting or facilitating communication channels, such as creating a Ravenswood Facebook commuters group, or similar.

8.65 The other major employment centre is likely to be Rangiora which is 8km away.

8.66 There is off road cycleway access available between Rangiora and the Site (refer later section regarding cycleways). This is a distance that is generally regarded to be achievable for daily commuting, particularly on a separated flat section.

8.67 There is also a bus service that runs between Pegasus and Rangiora, so residents that work in Rangiora have an option to use public transport.

8.68 While the existing bus network is currently relatively limited, it is likely that improvements will occur over time as the population of Woodend/Ravenswood/Pegasus grows.

Access to education

8.69 The Site is currently within zone for Pegasus Bay school (3km), which caters for children from year zero to year eight, while the Eastern side is zoned for Kaiapoi high school (approximately 10km) and the Western side zoned for Rangiora high school (8km).

8.70 I consider that Pegasus bay school is too far away to be accessible for primary school aged children via walking or cycling, and so it is likely that, if the area is zoned for Pegasus school, that most travel to school will be by private vehicle or potentially by school bus if such a service was to be offered.

8.71 The submitter has engaged with the MOE, and it is my understanding that provision for a school is not precluded by the ODP. If developed, that would reduce emissions associated with travelling to school for primary aged children compared to travelling to schooling at Pegasus.

8.72 Alternatively, were a school to be developed within the Ravenswood area, I would expect that it would be relatively easily accessed via active

walking and cycling due to the planned walkways and cycleways within the ODP that connect into Ravenswood.

8.73 In terms of high schools, my understanding is that there is a school bus service that connects the area to Kaiapoi high school currently. It is unclear if such a service is available to Rangiora high school.

8.74 In terms of cycling, accessibility from the Site to Kaiapoi is currently limited however there is separated cycleway access to Rangiora (8km – a distance that I think is achievable for high school students).

8.75 Given this, it is my view that it would be beneficial from an emissions perspective if the Site, if developed in accordance with the Proposal, could be zoned for Rangiora high school.

Cycling

8.76 The Site is well located for cycling, with the proposed cycleways in the ODP planned to connect to off-road cycleways already in the area. (Refer **Figure 5**)

8.77 Rangiora (approx. 8km away) is accessible from the Site via off-road cycleways on Bob Robertson Drive (Ravenswood) and the dedicated Rangiora-Woodend cycleway.

8.78 These sections are flat, smooth, well maintained and can be ridden by families and riders with low confidence.

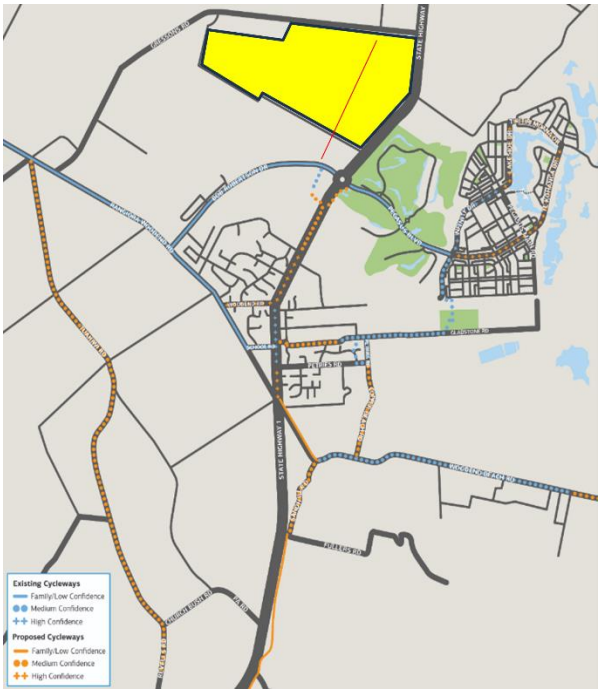

Figure 5: Cycleways in the Woodend/Pegasus/Ravenswood area

8.79 I consider that 8km is a distance that is relatively easily achievable on a flat-section of road for a commuter, particularly an e-bike rider, so there should be a reasonable uptake of cycling for residents of the Site that work in Rangiora.

8.80 This is likely to increase over time as uptake of e-bikes increase.

8.81 There has already been a substantial increase in the number of e-bikes in New Zealand, with an estimate of between 100,000 and 200,000 across the country and a reported 50,000 imports in 2021 alone.[12]

8.82 I expect the rise of e-biking to continue, and I believe that Greater Christchurch is perfectly suited for this mode of transport and that we will see a significant proportion of trips in the region via e-bike over the next 10-20 years.

8.83 Research published by Waka Kotahi in 2021 concludes "the usage of shared paths and separated cycle facilities will be three to eight times higher than for forecasts of pushbikes alone" and that "the growth in availability and ownership of micromobility will lead to an increase in

12 https://www.nzherald.co.nz/nz/on-your-bike-everything-you-need-to-know-about-e-bikes/QOHXNWYVPA2Q6AIE7J46AVBWTU/

public transport patronage by up to 7% in urban contexts and 9% in suburban contexts as a result of first/last mile micromobility use."[13]

Public transport

8.84 Presently, there are two bus routes that serve the Ravenswood area:

(a) Route 95 runs from Waikuku/Pegasus to Ara Institute via the Christchurch Central bus exchange, with services approximately every 30 mins during the morning peak.

(b) Route 97 runs hourly between Rangiora and Pegasus, via Woodend and Ravenswood.

8.85 As the Ravenswood town centre develops it is likely that additional services will be offered, potentially as an extension of other services (for instance Kaiapoi-Christchurch). Further increasing the population that is within easy reach of Ravenwood (such as that on the Site) will help to underpin demand for such services.

8.86 In the meantime, Park + Ride facilities are already available in Rangiora and Kaiapoi, providing a connection to the Christchurch public transport system for residents of the Site.

8.87 It is also expected that the frequency of services between Rangiora and Kaiapoi to Christchurch will be increased to every 15 minutes at peak times and to every 30 minutes at off peak times.[14]

8.88 Plans are in place to enhance Rangiora's Park + Ride facilities. This includes upgrading the facility as a multimodal interchange to reflect and encourage the incorporation of active modes of transport to the public transport system.[15]

8.89 The submitter has indicated a willingness to work alongside the Waimakariri District Council to account for the inclusion of bus stops and bus friendly roads in the ODP to enable the Site to be connected to future public transport routes, as required.

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13 Mode shift to micromobility. February 2021. NZ Transport Agency research report 674.

14 Greater Christchurch Public Transport Joint Committee (2020) *Greater Christchurch Public Transport Futures Combined Business Case – Non-Technical Summary,* 2020.

15 https://greaterchristchurch.org.nz/assets/Documents/greaterchristchurch-/Draft-GCSP/GCSP-Draft-Officers-Report-Final-for-Circulation-2023-10-04.pdf

8.90 Overall, I consider that access to public transport from the Site, as the Proposal progresses, is likely to be reasonably good when compared to other greenfield development sites in the region.

Electric vehicles

8.91 By the time that development on the Site is completed, it is, in my opinion, reasonable to expect that a significant proportion of vehicles in the New Zealand fleet will be electric, and that the adoption rate of EVs will likely be faster in a location such as the Site.

8.92 The New Zealand Government committed (in its May 2022 Emissions Reduction Plan) to a target of 30% of EVs in the light vehicle fleet by 2035.

8.93 Since this time, the rate of uptake of EVs in New Zealand has been rapid with the introduction of the Clean Car discount and the availability of more EV models.[16] Whilst the new Government has committed to removing the clean car discount (effective 31 Dec 2023), the clean car standard remains in place, which serves to encourage vehicle importers to ensure that new vehicles are lower emissions (thus we can expect to see a high percentage of new vehicles as EV/hybrid into the future).

8.94 The new Government has announced plans to support the rollout of EV charging infrastructure nationally, which will help to overcome the barrier to EV uptake of "range anxiety."

8.95 Additionally, a substantial increase in the price of fossil fuels has resulted in more and more New Zealanders looking to switch to electric.

8.96 Over the four quarters April 2022 – March 2023, registrations of EVs averaged 12% of all light vehicles.[17] Additionally, plug in hybrid and hybrid vehicle numbers also increased.

8.97 The following chart (**Figure 6**) illustrates how the number of low-emissions vehicles in New Zealand has increased in recent years.

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16 https://www.stuff.co.nz/motoring/129246542/evs-past-the-tipping-point-for-mass-adoption

17 https://www.transport.govt.nz/statistics-and-insights/fleet-statistics/quarterly-fleet-statistics/

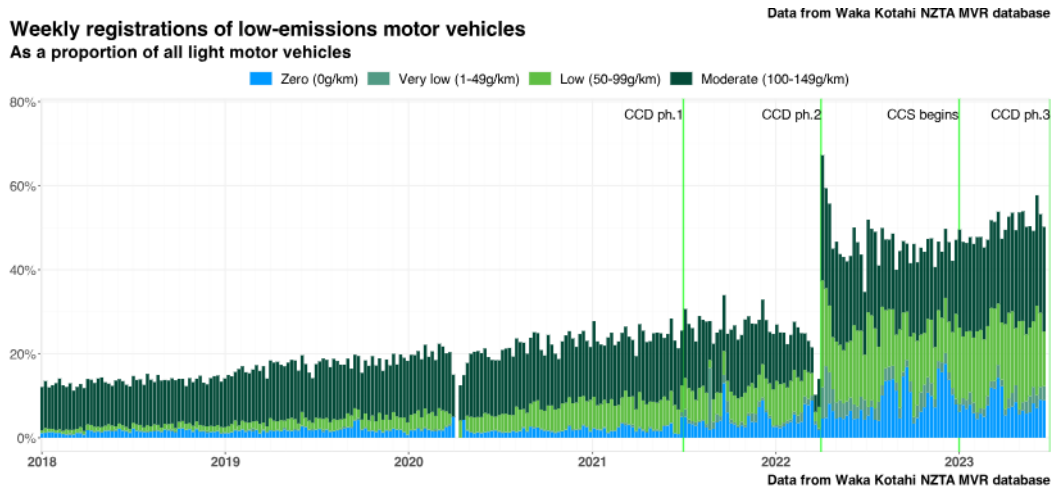

Figure 6: Registrations of low emissions vehicles

8.98 Looking at other countries (akin to New Zealand) that are focusing on EVs as part of their emissions reduction plans, Norway is a world-leader with EVs now making up approximately 80% of new vehicle registrations.[18] This shows the rate of EV uptake that could be possible in New Zealand, with the right incentives.

8.99 It is therefore reasonable to expect that a significant proportion of vehicles in New Zealand will be electric by the time the Site is developed. I also expect that the rate of uptake of EVs at the Site is likely to be higher than the national average for the following reasons:

(a) New housing allows for the additional electrical demand that EV charging requires to be more easily accommodated. For instance, it can be challenging in an older home to charge a vehicle, given electrical capacity limitations.[19]

(b) There is a strong economic incentive, via fuel cost savings, to choose an EV instead of a traditional internal combustion engine vehicle in "commuter-belt" areas such as Ravenwood/Waikuku, where the daily commute distance to Christchurch is around 20-

[18] www.nytimes.com/2023/05/08/business/energy-environment/norway-electric-vehicles.html

[19] For instance - 7 kW chargers (required to charge a vehicle in a reasonable timeframe) require a 40 A circuit, which is less commonly available in older houses. Charging may need to be managed carefully to avoid overloading the standard 62 A single-phase connection. Alternatively, a second line (additional electrical connection) may need to be added to an older home (which obviously adds cost).

30km and where the round-trip distance is not so long that range anxiety becomes an issue.

(c) Cost parity between internal combustion engine vehicles and battery electric vehicles is expected to be reached between 2026-2028, further contributing to the economic incentive and economic accessibility of EVs for residents living on the Site.[20]

9 CONCLUSION

9.1 The removal of dairy cows from the land (resulting from the Proposal) directly supports a reduction in GHG emissions. In my opinion, for the reasons set out in this evidence, the proposed rezoning of the Site to General Residential / Medium Density Residential supports a reduction in GHG emissions, particularly relative to other greenfield development opportunities available in the greater Canterbury region.

Paul Farrelly
4 March 2024

[20] https://www.mdpi.com/2032-6653/12/1/21