Before an Independent Commissioner
Appointed by the Selwyn District Council

Under	the Resource Management Act 1991
In the matter of	a hearing on Plan Change 79 to the Operative Selwyn District Plan
	Birchs Village Limited
	Proponent

Statement of Evidence of Paul Michael Farrelly

17 April 2023

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Qualifications and Experience

1 My full name is Paul Michael Farrelly.

2 I have a BE Civil Engineering (Hons) from 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.

3 For the past 4 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 greenhouse gas (**GHG**) inventories for a significant number of organisations, in a broad range of sectors. This includes infrastructure companies, an airport, several electricity distribution businesses (**EDBs**), manufacturers, consulting firms and retail businesses. Through this work, I am well versed in calculating GHG emissions.

4 I am familiar with the plan change application by Birchs Village Limited (**BVL**) to rezone approximately 37 hectares of rural land in Prebbleton to residential land, enabling medium density housing and a commercial centre. (**PC79**).

Code of Conduct for Expert Witnesses

5 While this is not a hearing before the Environment Court, I confirm I have read the Code of Conduct for expert witnesses contained in the Environment Court of New Zealand Practice Note 2023 and I have complied with it when preparing my evidence. Other than when I state I am relying on the advice of another person, this 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 that I express.

Scope of Evidence

6 My evidence addresses:

(a) What greenhouses gas emissions are;

(b) Greenhouse gas emissions from current land use;

(c) Anticipated greenhouse gas emissions from PC79 land use;

(d) Responses to submissions; and

(e) Section 42A report.

Summary of Evidence

7 When considering the 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.

8 GHG emissions are currently occurring on the proposed development land, because of the livestock (sheep) that is grazed on the land.

9 These emissions occur primarily from methane, which is known to have a much greater impact on global warming than carbon dioxide.

10 The removal of livestock from the land would support a reduction in GHG emissions compared to potential development sites that have a different current land use (such as a golf course).

11 PC79 will result in new emissions from the construction and operation of dwellings, and from travel undertaken by residents. However, these emissions would occur elsewhere in New Zealand if this development does not proceed, as these people would simply live elsewhere.

12 Based on my understanding, the typical buyer targeted in this development, and indeed much of the market for the Selwyn district is a buyer who wishes to purchase a relatively affordable, modern property, relatively close to a major metropolitan centre.

13 Assuming that property affordability is a key criteria for these prospective buyers, I think it is not unreasonable to assume that if a prospective buyer in Prebbleton is unable to find a suitable affordable property, they are likely to buy a similar property in a more affordable area, which (given the relative value of land) logically means buying further out from Christchurch. So, I believe there is a significant risk in Greenhouse Gas emissions increases if there is not adequate availability of affordable property in greenfield locations close to Christchurch, such as Prebbleton.

14 PC79 proposes a minimum density of 15 households per hectare. This is relatively high for a Greenfield site and is advantageous from a GHG perspective in comparison to lower density developments because the infrastructural emissions are lower on a per resident basis.

15 The location in Prebbleton provides some climate resilience as the site is not in a flood plain area or near to coastlines.

16 Over a 90-year life cycle, energy usage is currently the most significant source of emissions that occurs in residential developments in New Zealand, followed by the embodied carbon of building materials.

17 Stand alone or detached housing emissions are lower on a per m^2 basis[1] 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 PC79), that are primarily constructed of timber.

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

19 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 area to floor area.

20 The PC79 site is located adjacent to the major bus route between Christchurch and Lincoln, and there are 2 bus routes (80 and 81) that currently travel along this route.

21 The Greater Christchurch transport plan[2], has identified that the preferred future public transport option for Christchurch is a bus network, with a "Turn Up and Go" service to be developed along a route between Hornby and Belfast, that is well integrated to existing core bus routes, including those that run along Birchs Road. As such, PC79 is extremely well located in respect of public transport provision compared to other Greenfield sites in the region.

22 The PC79 site is also ideally located for cycling, with excellent off-road cycling access to both Prebbleton (approx. 2km) and Lincoln (approx. 7km) provided by way of the Little River Rail Trail cycleway that runs from Christchurch to Little River. The section is flat, smooth, and well maintained.

23 The GHG impact of commuting trips is also expected to reduce as uptake of electric vehicles (*EVs*) increases and as working from home continues to be well-utilised by workers that have longer commutes.

24 Accounting for the points above, I consider that, on balance, the PC79 development supports a reduction in GHG emissions, relative to other greenfield development opportunities available in the greater Canterbury region.

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

[2] https://www.greaterchristchurch.org.nz/huihui-mai/transport/

Introduction to Greenhouse Gases

25 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.

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

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

28 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.

29 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.

30 The GWP of CO_2 is 1.

31 Methane is a short-lived GHG and has a GWP that is 28-36 times that of carbon dioxide over a 100-year time frame. Over a shorter year time frame its impact is much more significant, estimated at 84 times that of carbon dioxide over a 20-year period.

National Policy on Urban Development

32 The National Policy Statement on Urban Development 2020 (**NPSUD**) requires decision makers to consider whether proposals "support reductions in greenhouse gas emissions".

33 When considering the GHG emissions of a proposed development or land change it is appropriate to consider the life-cycle emissions of the proposed development, and the net change in emissions compared to the emissions arising from the current land use.

34 It is notable that the NPSUD does not specify a geographical boundary in which the effect of greenhouse gas emissions should be considered.

35 Therefore, I consider that supporting reductions in GHG emissions could be considered at several different levels – local, regional, national, or global.

36 The ultimate purpose of reducing GHG emissions is to limit global warming. In the context of this purpose, it should not matter where or how emissions reductions are supported.

37 New Zealand has a growing population and a critical need to build more affordable housing.

38 There are many potential ways that this growing population can be accommodated. For instance, dwellings can be built in different locations, different types of housing can be constructed, and different construction materials can be used.

39 Due to the materials required to build new housing, and the energy used in the operation of houses, some emissions arising from new developments are unavoidable.

40 Therefore, it is important that decisions on where to build houses in New Zealand are made in respect of their overall impact on GHG emissions, compared to other potential locations.

41 In the context of GHG emissions arising from housing related developments, I believe that GHG assessments should be based primarily on how the development's net life cycle emissions (that is an evaluation of emissions before and after the development) compares to alternative comparable development options within New Zealand, as opposed to whether the development, in and of itself reduces GHG emissions.

42 To that end, I note the comments of the Commissioner for Plan Change 68[3] : "*I agree with Ms Harte when she stated in evidence that comparing PC68 with intensification of existing residential areas needed to be considered against the fact that NPS-UD contemplates expansion as well as intensification. She said that it was not appropriate to compare the two forms of increasing capacity in the context of supporting a reduction in greenhouse gas emissions."*

43 In other words, when considering greenhouse gas emissions, it makes more sense to compare Greenfield development options against other potential Greenfield sites.

Overview of Birchs Village Development

44 The Site is located on the outskirts of Prebbleton at the corner of Hamptons Road and Birchs Road opposite the new District Park known as Kakaha Park.

45 The Plan Change 79 request is to rezone 36.58 hectares of Rural Inner Plains to Living Medium Density Prebbleton and Business 1.

[3] PC68 Commissioner Final Recommendation-23 June 2022, 4.130.

46 PC79 envisages the development of over 500 dwellings, with a minimum density of 15 households/hectare and 600m^2 of Business 1 Zoning to be located on Birchs Road, opposite Kakaha Park.

Emissions from Existing Land Use

47 When considering a proposed development's impact on GHG emissions, it is first important to establish the level of emissions arising from the existing use of the land.

48 I visited the area of PC79 on 2 April 2023 and I have also read through the Geotechnical assessment, Preliminary Site Investigation and the Landscape and Visual Assessment reports.

49 The land is largely flat, and mostly open with some areas of partial tree coverage. I observed that sheep are grazed on some parts of the plan change area, however I was not able to ascertain the exact numbers from my observations.

50 However, I note from the submission of Tom and Helen Fraser (PC79-0014) that a stocking rate of approximately 50 sheep per hectare is possible on the land *"In total we were farming over 200 stud sheep on the land that we were leasing, all holdings of around 4ha. In more recent times we have supplied prime lambs to the local market. At least 24 ha. Of PC 79 site is currently being farmed relatively intensively producing prime lambs for the local market as well as being taken for hay and silage and sold on to other primary producers."*

51 The most significant emissions from the current land would therefore arise from the methane associated with the livestock (sheep) that is raised on the land.

52 GHG emissions from farming operations include methane emissions from the livestock that is grazed on the land, manure and urine produced be these animals and the use of fertiliser on the farm.

53 Methane is a short-lived GHG and has a Global Warming Potential that is 28-36 times that of Carbon Dioxide 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 consequently a global pledge has been signed by 105 countries, including New Zealand, to reduce methane emissions 30% by 2030 compared to 2020 levels.

54 Notably, agriculture is by far the largest contributor to Greenhouse Gas emissions in the Canterbury region[4], accounting for approximately 62.6% of the region's emissions in 2019, based on Statistics NZ data (7,296,000t/ 11,641,000).

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

(a) Enteric fermentation – the process by which ruminant animals produce methane by digesting feed.

(b) Manure management – the storage and treatment of manure produces emissions.

(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.

56 Emissions for a farming operation can be calculated using guidance provided by the Ministry for the Environment (**MFE**)[5]. In this guide, MFE provide annual emissions on a per animal basis.

57 The relevant emissions factors, per sheep, per annum are as follows, updated to reflect the latest emissions factors published by MFE in August 2022.

(a) Enteric fermentation – 318 kg CO2-e;

(b) Manure management – 3.53 kg CO2-e; and

(c) Agricultural soils – 36.3 kg CO2-e.

58 The MFE factors above are based on a GWP value of 25 for methane, however it is recommended by the International Panel on Climate Change (**IPCC**) that a higher GWP, of at least 28, should be used when calculating methane emissions.

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

[5] Measuring Emissions: A Guide for Organisations – 2022 detailed guide.

59 Were the rezoning request not to go ahead, I have assumed the land would continue with its existing uses for the foreseeable future, with the associated emissions continuing.

60 Using MFE factors for agriculture, the emissions of the existing land use are primarily a function of the number of sheep grazed. This can be calculated as (318 + 3.53 + 36.3) = 358kg CO_2-e per sheep.

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

62 I consider that the conversion of the proposed land from quasi rural residential to residential development, expected to occur because of PC79, will lead to a reduction in emissions, because sheep will no longer be grazed on the land.

63 This should be taken into account when comparing this proposal against other Greenfield developments, particularly where a Greenfield development would convert land with currently low or negative emissions (e.g. a golf course, or tree covered area), to housing.

64 The low tree coverage across the site means that there is limited level of carbon sequestration currently occurring on the land. I'd expect that a much greater level of sequestration will be achieved through the retention of as many existing trees as possible as the PC79 land is developed, and through the (significant) additional plantings as identified in the ODP.

Emissions from Proposed Land Use

65 Like any new residential development, GHG emissions will be emitted during three different stages of the project:

(a) Construction of the infrastructure required to support the development;

(b) Construction of the dwellings and commercial buildings; and

(c) Emissions arising from the occupation of the dwellings and businesses operating out of the commercial buildings – primarily these emissions relate to energy use.

66 Emissions will also arise from travel related activities of residents who live within the blocks.

67 In terms of GHG emissions from infrastructure work (i.e. prior to the construction of the houses):

(a) The site is relatively flat which should limit the extent of earthworks required and therefore the amount of fossil fuels that will be used in preparing the site for development.

68 A Geotechnical Report has been prepared by Coffey dated 9 March 2021, and updated 7 July 2022. This concluded the following:

(a) The site is suitable for residential development and can be generally categorised as Technical Category (**TC**) 1 with localised pockets of TC2 performance.

(b) Groundwater has been established and it is not anticipated any future earthworks activities will intercept groundwater.

(c) It is expected future earthworks associated with subdivision of the site will be limited to minor reshaping/regrading of existing levels to form new road alignments and the possible formation of stormwater attenuation/detention facilitates.

(d) It is also expected there may be some minor reshaping and regrading of existing ground levels to achieve compliant surface falls on residential allotments.

69 The bulk of materials required in the development (that have GHG emissions associated) are anticipated to be roading related (concrete/asphalt) and piping.

70 The amount of infrastructure related materials required are largely a function of the hectares to be developed as opposed to the number of dwellings.

71 Therefore, from an emissions intensity perspective (that is the emissions per resident), there is a benefit of increasing the density of housing in a development, which the proposed rezoning request supports.

72 In terms of materials for infrastructure, there is currently limited scope to avoid the use of GHG producing construction materials, however lower emissions materials are being developed all the time, and it is likely that by the time the development commences that lower emissions materials can be specified by the developer.

73 The second major component of GHG emissions is the emissions associated with construction of the dwellings. The major contributing factor is emissions “embodied” in materials that are used in the build.

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

(b) There are two main ways of reducing embodied carbon in a dwelling:

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

(ii) reduce the size of a dwelling.

74 A recent (2020) study undertaken by Massey University and BRANZ[6] assessed the expected life cycle emissions for 3 different types of residential dwellings: detached housing, medium-density housing, and an apartment.

75 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.

76 The study considers that a New Zealand home is expected to last for 90 years and, therefore, the analysis should consider emissions across this timeframe.

77 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%.

78 Embodied carbon was relatively more significant for apartments, due to the greater use of high emissions materials such as concrete and steel in construction.

79 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).

80 As multi-storey apartments are unlikely to be built in the proposed rezoning area, given the applicable Living MD Prebbleton rules, I consider that the embodied emissions resulting from the type of dwellings envisaged on the sites to be relatively efficient from a GHG perspective.

81 Furthermore, I think it is important to recognise that the emissions factor for electricity used in this study relates to a NZ average, whereas in reality the emissions for electricity usage in the South Island are 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

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

sources including geothermal, natural gas and coal. As such, the electricity used in the North Island has higher emissions.

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

83 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.

84 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 BVL rezoning request is approved.

(a) 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 development. It is also reasonable to assume that larger houses would not necessarily accommodate more people.

85 As such, the emissions/per person arising from the construction of housing can be expected to be relatively low for houses developed in PC79.

86 When it comes to emissions from operational energy use, the main factors that influence this are 1) how energy efficient a dwelling is, 2) the type of energy that is used in the dwelling, 3) the size of the dwelling, and 4) the use of on-site renewables.

87 Emissions in the PC79 site can be minimised by encouraging[7] energy efficient homes to be built, ensuring that natural gas/LPG infrastructure is not provided as part of the development and encouraging the uptake of solar PV panels.

88 New homes offer the potential to be much more energy efficient than traditional NZ houses, due to better building materials, higher levels of insulation and the ability to design homes to maximise thermal (or solar) gain.

89 There is growing awareness of the value of passive houses, and I expect to see an increased uptake of these type of homes in the coming years. A passive home is one that is primarily heated passively (via the sun), oriented to optimise solar gains in winter and to prevent overheating in summer. Passive houses target energy use

[7] Rules mandating such requirements are not proposed, however they can be readily encouraged or promoted by the land developer and or home builders.

of around 25 kWh/m^2. For an average sized (180 m^2) passive house, energy use would be expected to be just 4,500kWh per annum, which equates to approximately 450 kg CO_2-e per annum at current grid emissions factors. As NZ's electricity grid becomes increasingly renewable these emissions can be expected to reduce to around 250 kg CO_2-e per annum[8] in 2030. Note that emissions from energy use are largely carbon dioxide, with little methane emitted in electricity generation.

90 An ideal site for passive design is a flat site, that is free of obstructions to the north and unlikely to be built out in future.

91 As such I consider the PC79 site to be ideal for passive house construction.

92 I also consider that the site is well suited for solar PV due to the flat nature of the land and the relative lack of existing trees within the area.

93 Furthermore, as apartments are unlikely to be built within the PC79 Site, most houses are expected to be detached or semi-detached, and I would expect there to be a relatively high uptake of solar.

94 Taking these factors into account, I expect that dwellings built in the PC79 site would be relatively energy efficient compared to other developments and consequently would have relatively low emissions per resident.

Climate Resilience

95 There have been several adverse weather events affecting New Zealand in recent times and it is increasingly important that we place greater emphasis on where we build houses, considering future anticipated climate change impacts, and that we ensure there is sufficient development capacity available across the country to house potentially displaced residents. The effects of climate change, including sea level rise, due to increased GHG emissions has meant that some locations, particularly next to coastlines, are no longer appropriate for housing development.

96 According to Ministry for the Environment figures[9], around 750,000 New Zealanders and 500,000 buildings are near rivers and in coastal areas already exposed to extreme flooding.

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[8] Modelling recently released by The Climate Change Commission and used in *Inaia tonue nei: a low emissions future for Aoterora*, estimates a grid emissions factor of 55.1g CO2-e/kWh in 2030. The 2018 grid emissions factor is 101 g CO2-e/kWh.

[9] https://environment.govt.nz/what-government-is-doing/areas-of-work/climate-change/adapting-to-climate-change/managed-retreat/

97 According to the Draft National Adaptation Plan published by the Ministry for the Environment in April 2022:

> *A warmer and wetter climate may affect the durability of building materials and the life span of our homes and buildings. This could include an increased risk of damage due to coastal erosion or the risk of subsidence during intense rainfall and storm surges along the coastline.*

98 The proposed rezoning site is at less risk of adverse effects from future sea level rise due to its distance from coastal areas and waterways.

99 The officer's report for PC79[10] confirms that the site is not located in the floodplain of any major rivers or streams.

100 Given this, and the fact that PC79 is not near the coast, I consider that the site has strong climate resilience.

101 If the anticipated impacts of climate change (sea level rise, flooding) occur sooner or more frequently than currently expected, there is a chance that a significant portion of the existing housing stock across New Zealand may become damaged and need to be replaced more quickly than may currently be anticipated.

102 In this context, it will be highly valuable for the region, and indeed New Zealand as a whole, to ensure that there is sufficient land available in locations that have climate resilience (such as Prebbleton) to meet an unexpected increase in future housing demand due to climate displacement.

Emissions from Transportation

103 Emissions from transportation are a function of the mode of transport (vehicle, bus, bicycle), distance travelled, and frequency of travel.

104 It is extremely difficult to accurately model or predict the future level of travel related emissions that may occur from residents of any proposed development, and indeed how these may compare to the travel related emissions of an equivalent number of residents in any other location.

105 Emissions from transportation primarily arise from trips undertaken in vehicles that use fossil fuels. In New Zealand this is primarily passenger vehicles.

[10] PC79-Jonathan-Clease-s42a-Report.pdf

106 GHG emissions arising from vehicle travel between Prebbleton and Christchurch are cited by several submitters as a key GHG issue.

107 In this context, it is important to consider the site's location relative to other Greenfield sites in the greater Christchurch area.

108 The PC79 site is located approximately 16km from the Christchurch Central City (defined as the Riverside market location). This is far closer than other locations outside of Christchurch City with greenfield development potential including Kaiapoi (20km), Lincoln (22km), Rolleston (26km), West Melton (27km), Ravenswood (27km) and Leeston (42km).

109 Because Prebbleton is closer to Christchurch compared with these other locations, it is reasonable to consider that growth in Prebbleton reduces the potential of greenhouse gas emissions relative to the other growth options in the Selwyn District that might otherwise be developed.

110 Furthermore, many employment opportunities in Christchurch are in the South-Western corridor of the city, as evidenced by the following geospatial map (Figure 1) from Statistics New Zealand (taken from the 2018 census).[11]

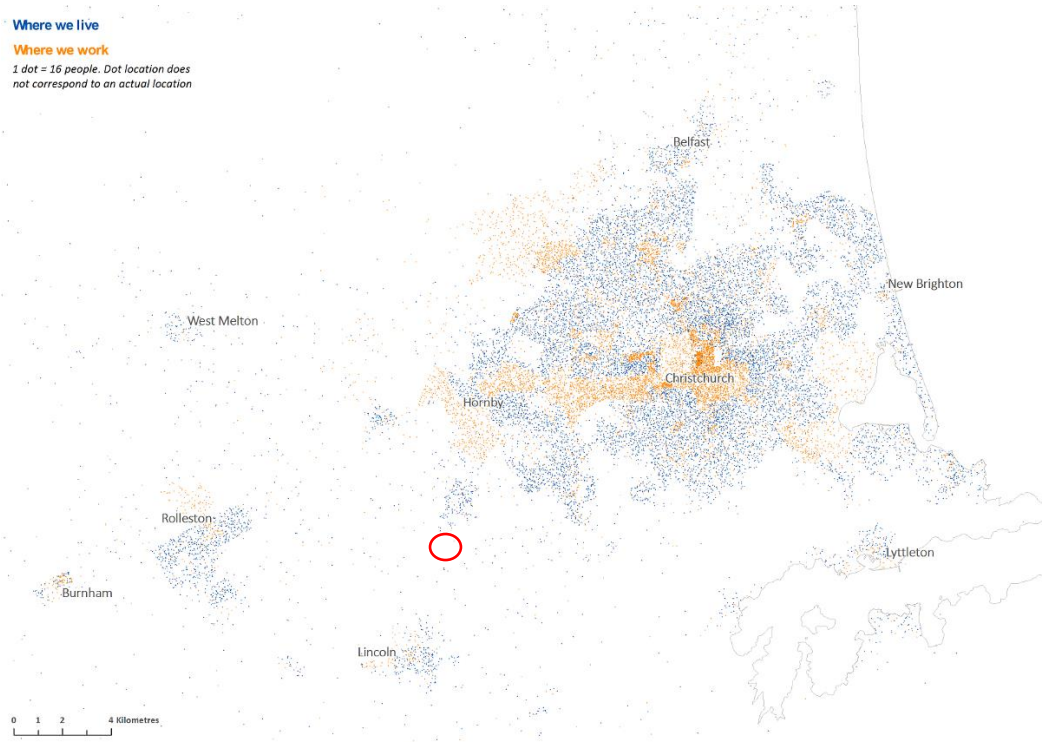

Figure 1: Where we Live vs Where we Work (Greater Christchurch)
(Approximate located of PC79 shown in red)

[11] https://storymaps.arcgis.com/stories/6f8b5f981ad34f11bedaf1725e9cb698

111 The distance from PC79 to key centres of employment like Hornby (7km), Wigram (7km) and the Blenheim Road corridor (8km) is in many cases less than the travel distance from Greenfield locations within the Christchurch City boundary, in particular new subdivisions in areas such as Prestons and Northwood.

112 Over time the frequency of travel between Prebbleton and Christchurch will likely reduce, due to working from home becoming more prevalent.

(a) I believe it is likely that instances of working from home (**WFH**) will increase in the future, which will substantially reduce the frequency of commuting.

(b) The experience of Covid-19 has shown that a significant proportion of workers are able to perform their duties from a home office. Many large employers now offer employees significant autonomy and flexibility when it comes to where and when they choose to complete their work duties.

(c) The incentive to WFH is greater for employees who live further from their place of employment, due to the time and cost savings.

(d) WFH will likely be even more attractive to those who live in a new, well-built, warm homes.

(e) It is therefore likely that residents of PC79 (who work in a Christchurch office, or in other Selwyn towns) will be strong adopters of WFH.

(f) There is emerging evidence[12] from around the world that WFH has become an established practice in much of the Western World, with recent statistics from the US suggesting that the number of days employees are spending WFH is increasing (for 1.58 days/week in Jan 2021 to 2.37 in June 2022).

(g) Additionally, people in the state of Victoria[13], Australia were found to be more likely to live in 'peri-urban' (commuter belt, semi-rural) areas if they had the option to WFH.

113 Reducing vehicle travel from PC79 (to Christchurch City and Lincoln) is also supported by its excellent proximity to public transport and a major cycleway.

114 The Site is located on the main Lincoln-Christchurch bus route and is currently served by 2 bus routes.

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[12] https://www.weforum.org/agenda/2022/07/work-from-home-employers-workers-work-life

[13] Infrastructure Victoria. (2021). The post-pandemic commute: the effects of more working from home in Victoria.

115 Bus Route 80 runs every 15 minutes at peak times and (according to timetable information on metroinfo.co.nz) takes approximately 40 minutes to the Central Bus Interchange (which is approximately the same time as it would take to drive, according to google maps information on a typical weekday at 8am).

116 Bus route 81 runs twice in the morning peak and takes 29 minutes to get the Bus Interchange.

117 Bus route 80 is noted as a Frequent route and is identified within The Greater Christchurch Public Transport Futures Combined Business Cases (Nov 2020)[14] as a route that should have greater frequency and directness – with a recommendation that 15-minute frequency is provided all day, and that the route is directed along Riccarton Road.

118 The fact that the service is expected to be directed along Riccarton Road is important in the context of work[15] currently being undertaken through The Greater Christchurch Partnership.

119 The Greater Christchurch Partnership is a voluntary coalition of local government, mana whenua and government agencies working collaboratively foster and facilitate a collaborative approach between the Partners to address strategic challenges and opportunities for Greater Christchurch.

120 The partners include Environment Canterbury, Mana whenua, Christchurch City Council, Selwyn District Council, Waimakariri District Council and Waka Kotahi NZ Transport Agency.

121 The partnership has produced a draft future public transport plan, which states:

> *"We are starting by improving our existing public transport system, making it a more competitive option. Some of the changes we are planning are – better bus frequency and reliability, readily accessible real-time information, a fully electric bus fleet, and more bus shelters and bus priority lanes."*

122 The plan then goes onto identify the concept of a "high-tech, high-frequency, high-capacity, no-emission, public transport "Turn up and go" public transport network.

123 This would be well integrated with existing bus routes and would provide high frequency along the "Turn up and go route".

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[14]https://www.greaterchristchurch.org.nz/assets/Documents/greaterchristchurch/Spatial-Plan/GreaterChristchurchPublicTransportFuturesCombinedBusinessCaseNonTechSummary20201119.PDF

[15] https://www.greaterchristchurch.org.nz/huihui-mai/transport

124 The proposed future bus network routes for Greater Christchurch are shown in Figure 2.

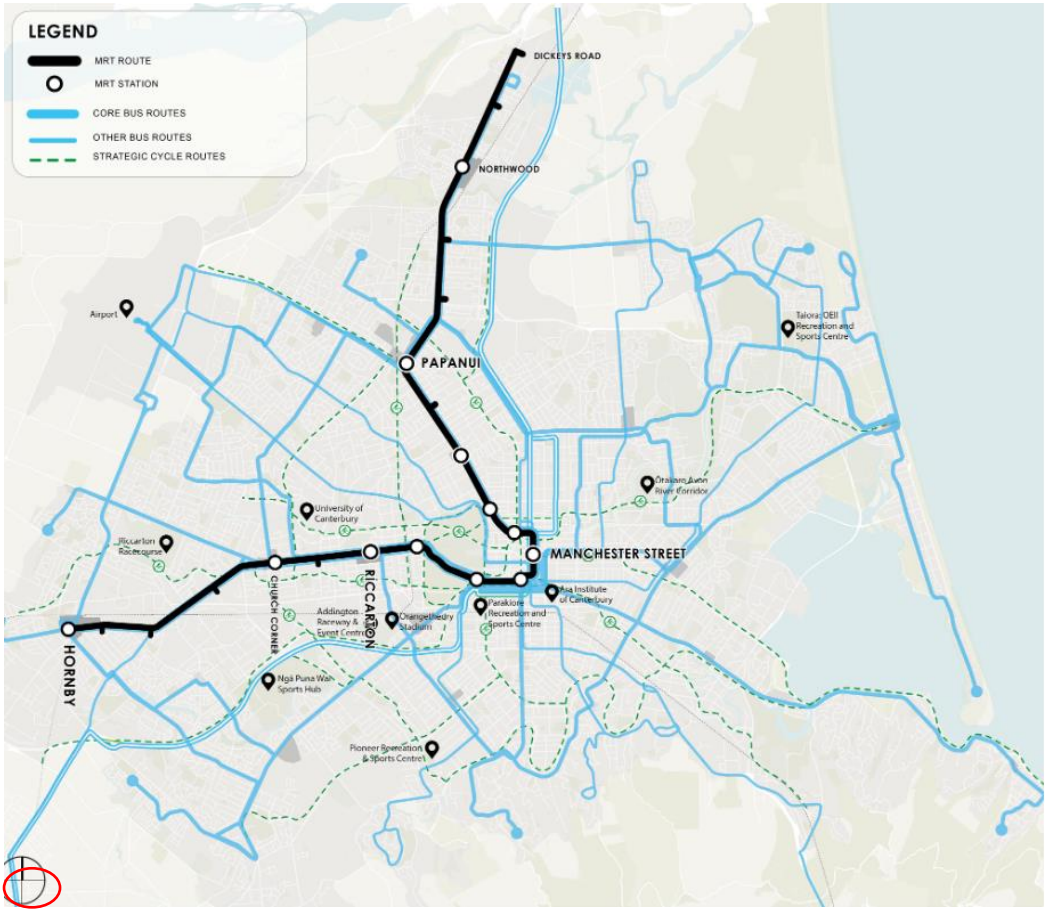


Figure 2: Proposed Future Public Transport Network Map (Greater Christchurch Partnership) (Approximate location of PC79 shown in Red)

125 The PC79 site is shown at bottom left of the map, and the existing bus route 80 that runs along Birchs Road has been identified as a Core Bus route.

126 I consider that the site has good public transport access already (especially compared to other Greenfield sites) and this is highly likely to be enhanced in the future as the Greater Christchurch public transport plan is rolled out, and as the townships of Lincoln and Prebbleton further develop.

127 I therefore believe that, given its location along a key bus route, that PC79 has (and will continue to have) substantially better access to public transport compared to other Greenfields sites in the region.

128 The Birchs Road site is also ideally located for cycling and micromobility (e-bikes and e-scooters), with excellent off-road cycling access to both Prebbleton (17pprox. 2km) and Lincoln (17pprox. 7km) provided by way of the Little River Rail Trail cycleway that runs from Christchurch to Little River. The section between PC79 and Prebbleton appears to be flat, smooth, and well maintained.

129 The trail is well connected to other (off-road, or separated) cycle routes in Christchurch City, which provide a cycling commute distance to Christchurch City of approximately 15km. The map of cycleways in the Southwestern part of Christchurch, extending into Selwyn is shown in Figure 3. It is notable that the only cycleway located in Selwyn that currently connects with the Christchurch network runs along Birchs Road.

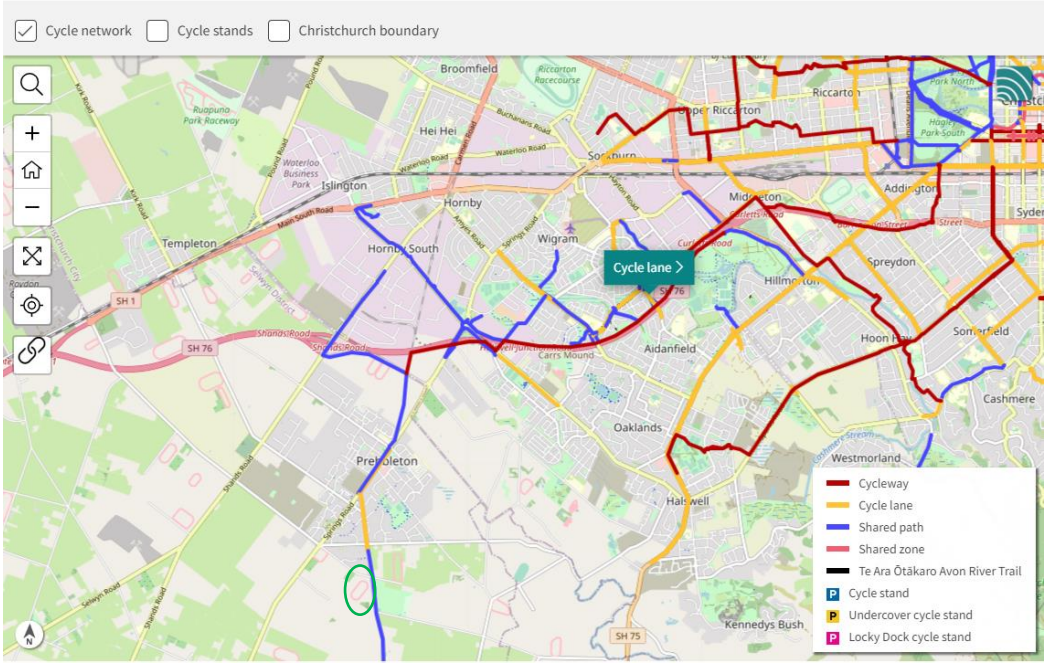


Figure 3: Map of Cycleway Network, Christchurch City
(Approximate location of PC79 shown in Green)

130 PC79 provides excellent connectivity to Christchurch, and Lincoln, via active travel modes compared to other Greenfields sites in the region.

131 I consider that 15km is a distance that is achievable for a commuter, particularly an e-bike rider.

132 There has been a substantial increase in the number of e-bikes[16] in New Zealand, with an estimate of between 100,000 and 200,000 across the country and a reported 50,000 imports in 2021. I expect the rise of e-biking to continue, and I believe that 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.

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

133 Research published by Waka Kotahi[17] 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”.

134 And further:

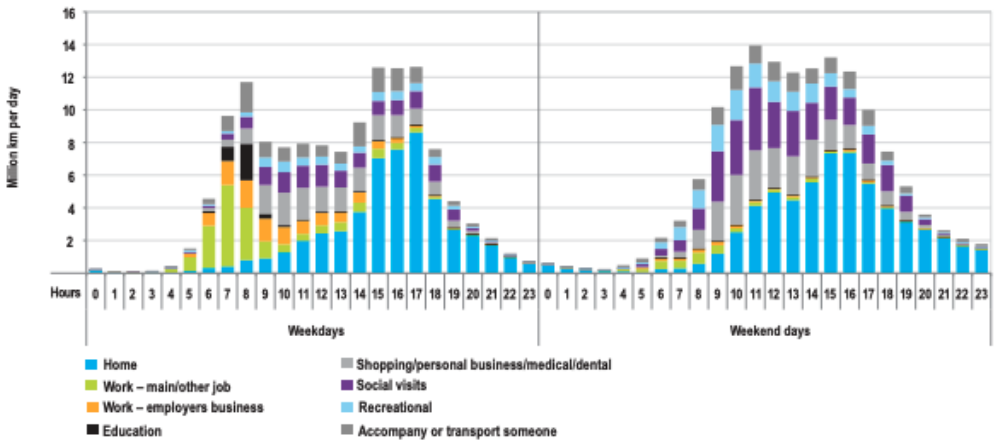
> *“The growth in availability and ownership of micromobility will lead to an increase in public transport patronage by up to 7% in urban contexts and 9% in suburban contexts as a result of first/last mile micromobility use”.*

135 It is also notable that one of the recommendations in this report is that infrastructure providers should “Provide or upgrade shared path and cycleway infrastructure to offer high quality pavement, comfortable and safe path widths, and physical separation or separators from other transport modes.” The Little River Rail trail pathway already provides this and is therefore well positioned to see an increase in patronage as the uptake of micro mobility (primarily e-bikes and e-scooters) continues to grow.

136 The most comprehensive data for the types of trips that people undertake in New Zealand is provided by the Ministry of Transport.[18]

137 The following chart from that study shows the average distances travelled per day for different purposes:

Figure 12: Average distance per day by purpose and time of day (2010–2014)



[17] Mode shift to micromobility. February 2021. NZ Transport Agency research report 674.

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

138 This shows that, on average, people travel further on weekend days than they do on weekday days, so the relative influence of commuting on overall travel emissions may be less than is commonly assumed.

139 It is notable that a high proportion of trips are for education, shopping, and recreation purposes.

140 Prebbleton is already relatively well-serviced with amenities and recreation facilities, and it is reasonable to assume that a greater proportion of trips originating in the town will stay within the town as these facilities are further developed.

141 Prebbleton already has a medium sized Fresh Choice supermarket, several hospitality outlets, a chemist, hairdresser and excellent sporting facilities including Prebbleton Domain, and the developing Kakaha Park just across the road from the PC79 site.

142 Furthermore, I anticipate that tenancies in the commercial area proposed in PC79 will likely be self-selected, accounting for their likely desirability and convenience to nearby residents, and that these tenancies will be well utilised by PC79 residents.

143 For example, tenancies such as a day care centre, a café, a convenience store and potentially takeaways would be well utilised by the residents of the PC79 and mitigate the need for travel further to other destinations. It is also likely, given the ODP design, that active modes of travel will be well used to access these facilities.

144 It is reasonable to assume that many “high frequency” trips are made to the most conveniently located destination for the purpose of the trip (e.g. nearest dairy/takeaway outlet/café) whereas trips to “destination” locations – such as heading to a larger supermarket for weekly shop occur relatively less frequently.

145 In terms of “education” trips, I agree that, if PC79 is approved, that it in combination with PC68 and PC72 would mean that a second primary school will be required in Prebbleton.

146 Whilst no location is currently identified for such a school, I note that Plan Change 79, and additionally both PC68 and 72 have the following in their ODP narrative:

> *"At the time of subdivision, consultation with Ministry of Education will consider whether it is appropriate and necessary for any land to be provided for education purposes within the Site, and the appropriateness of any amendments to the ODP to accommodate this."*

147 I note that the distance from PC79 to both PC68 and PC72 is relatively short and I expect that a potential new school location would seek to maximise the use of

"active" travel, therefore I would expect that a significant proportion of "education" trips from residents in PC79 will be undertaken using active modes, as opposed to in private passenger vehicles.

148 I do expect that (even with its good public transport access and proximity to the cycleway), that a significant proportion of "general" trips (e.g. supermarket shopping) originating from PC79 will be undertaken in passenger vehicles for the foreseeable future.

149 However, over time the proportion of these trips that is undertaken in low, or zero-emissions vehicles is expected to increase, which will reduce the impact of transport related GHG emissions.

150 The NZ government committed (in its May 2022 Emissions Reduction Plan) to a target of 30% of electric vehicles in the light vehicle fleet by 2035.

151 Since this time, the rate of uptake of EVs in New Zealand has been rapid[19] with the introduction of the Clean Car discount and the availability of more EV models. Additionally, a substantial increase in the price of fossil fuels has resulted in more and more New Zealanders looking to switch to electric.

152 By the time that PC79 is developed it is reasonable to expect a significant proportion of vehicles in the NZ fleet will be electric.

153 Furthermore, my expectation is that the uptake of EVs is likely to be higher in locations on the fringe of urban areas, particularly where new housing is developed.

154 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[20].

Section 42A Report

155 I have read the officer's report and make the following observations.

156 In paragraph 173, Mr Clease concludes that PC79 will provide limited accessibility to employment, by way of active transport, because the Site does not contain a large commercial area nor is Prebbleton a large employment centre. I largely agree

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

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

with this, although the site will provide some new employment opportunities as the commercial area develops.

157 I agree with Mr Clease's comment that PC79 is located within cycling (and micromobility) access of Key Activity Centres including Lincoln, Prebbleton and Hornby. I would further add the Wigram area to this, and I also believe that (especially via e-biking) that Central Christchurch is also accessible via active travel from PC79. I would also note a fundamental difference between PC79 and other recent plan Prebbleton changes is that PC79 has excellent access to the Little River Cycle way which is the key off-road cycle route within Prebbleton and connects Prebbleton to key activity centres in both Lincoln and Christchurch.

158 In paragraph 175, Mr Clease discusses the proposed commercial area and how it was originally proposed to be on land that is currently 142 Birchs Road. I note that the revised ODP addresses this, and that the commercial area is now closer to the centre of PC79. I do appreciate that the proposed commercial centre is relatively small, however I would expect that the tenancies would be facilities that are likely to have a high frequency of utilisation by local residents (e.g. a café). I further expect that these tenancies would be utilised by visitors to Kakaha Park, which would likely reduce the need for park visitors (who may have driven to the park from outside Prebbleton) to visit Prebbleton to access these services.

159 In paragraph 176, Mr Clease notes that Prebbleton is closer to Christchurch than other Inner Plains townships and arguably reduces the potential for greenhouse gas emissions relative to other growth options in Selwyn. I agree with this statement.

Conclusion

160 I consider that PC79 supports a reduction in GHG emissions, relative to other greenfield development opportunities available in the greater Canterbury region.

Paul Michael Farrelly

Dated this 17th day of April 2023