Stokes WDC GHG Evidence Review

Prepared for Waimakariri District Council
Prepared by Beca Limited

7 July 2024

Contents

Revision History

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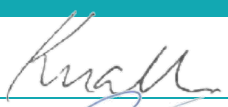
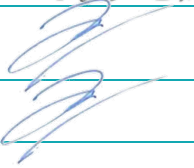
Prepared by	Kuan-Wen Sang, Clare Harvey		7/07/2024
Reviewed by	Andrew Murray, Genevieve Smiths		7/07/2024
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on behalf of	Beca Limited		

Executive Summary

This report reviews the evidence related to Greenhouse Gas (GHG) emissions provided by the proponent for the development proposed at Stokes in the District Plan Review hearing.

The proposed development site is currently zoned as rural and is proposed to be a mixture of Rural Lifestyle Zone and Large Lot Residential Zone under the notified Proposed District Plan. The proposal seeks to rezone the site to General Residential/ Medium Density Residential Zoning.

This analysis has focused on GHG impacts of the activity proposed by the submitter and has not considered planning consideration of the specific zoning requested, except as it relates to the submitter's GHG assessment that suggests the proposal would align with the Objective in the NPS-UD that the planning decisions support a reduction in GHG emissions.

In reaching this conclusion the submitter's assessment implies comparison of the proposal against two potential baseline scenarios, namely:

- Baseline 1: continuation of the current agriculture use; and
- Baseline 2: The same type and scale of development but without proposed design features that would support the reduction of GHG emissions (e.g. provision of cycling facilities, tree planting and banning of gas appliances).

We consider that a more relevant and intuitive scenario for the assessment of NPS-UD is:

- Baseline 3**:** The same type and scale of development at alternative sites (**AS**) elsewhere in Waimakariri or Selwyn Districts.

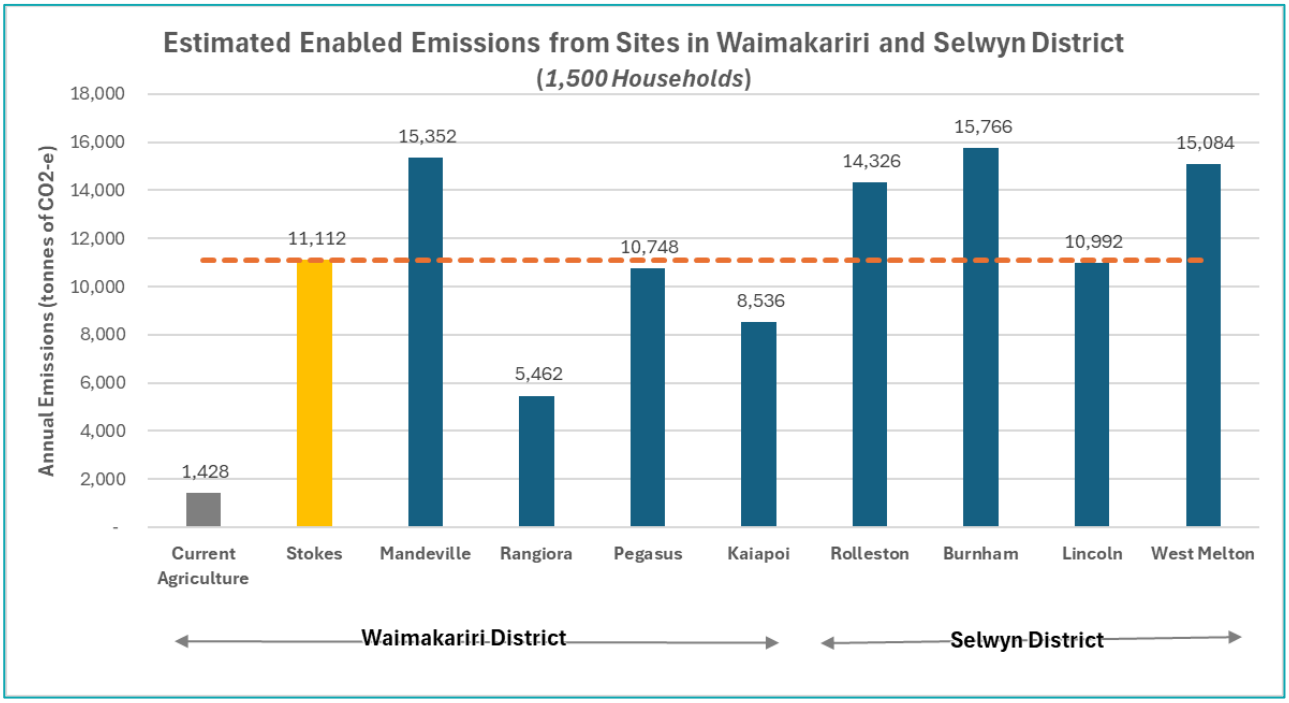
The assumptions required for Baseline 1 to be valid are considered highly unlikely and Baseline 2 is not considered suitable for the purposes of land use planning decisions of the development itself. Baseline 3 is considered a relevant baseline scenario.

It is worth noting that the potential rezoning under the proposed district plan was not considered as part of the assessment by Mr Farrelly but rather the emphasis has been placed on comparing against the existing agricultural use. Although we consider the proposed district plan land use may be a better baseline instead of the existing land use, we consider for the purpose of this assessment, Baseline 3 remains the most relevant.

In terms of Baseline 1, the emissions from the existing agricultural use is estimated to be some 1,428 tonnes CO2-e per year while enabled vehicle emissions associated with the development are estimated to be significantly higher at some 11,112 tonnes per annum.

We note the comparative assessment of embodied emissions for the development is highly sensitive to the urban form the site is compared to. Any such comparison is considered best done on a per unit rather than the per m^2 basis suggested in the submitters evidence. The available research indicates that on a per unit basis, low density, detached housing such as proposed for this site has higher embodied carbon than apartment or medium density units.

Baseline 3 comparisons of enabled vehicle emissions for the same scale of development in other locations were estimated as per the following figure.



This comparison suggests that the vehicle emissions for this site would be higher than locations closer to existing centres where there is planned growth such as Kaiapoi or Rangiora but could be lower than locations even further from the main Christchurch urban areas such as Mandeville, West Melton, Rolleston or Burnham.

We note the proposed development is close to other urban areas such as the proposed Ravesnwood Town Centre, close to recreational areas such as that of Waikuku Beach and has an existing bus service that has the potential to be modified to serve the development. All of this has the potential to contribute to lowering GHG, however as indicated by the analysis, it is still likely to have significantly higher GHG emissions than the existing land use and higher than equivalent developments in planned growth areas closer to existing centres such as Kaiapoi or Rangiora.

Given these high-level findings, it is considered that there is insufficient evidence to support the submitters claim that the proposed development at the Stokes rezoning site "*supports a reduction in GHG emissions*" (as per NPS-UD Policy 1(e)). In fact, this review indicates that the GHG emissions associated with this proposal would be higher than either the existing agricultural land use or similar scale development in planned growth areas in existing centres such as Kaiapoi, Rangiora, Woodend or Pegasus. Only if compared against similar development in areas more remote from the main Christchurch urban areas would this site be likely to have lower GHG emissions.

1 Introduction

Beca Limited (Beca) has been commissioned by Waimakariri District Council to provide a review of the Greenhouse Gas (GHG) emissions assessment related to the development proposed at Stokes as proposed by a submitter to the District Plan Review hearing.

The scope of this report is a review of the evidence related to GHG emissions provided by the proponent of the development. This has included a review of the following assessments in the evidence of Mr Paul Farrelly for the submitter:

- The assessment of agriculture emissions of the existing use of the site;
- The assessment of embodied emissions related to the physical materials and resources involved in the creation of the proposed land use;
- The assessment of emissions enabled by the land use change, specifically as relates to vehicle emissions associated with the land use;
- Various baseline (or 'counter-factual') scenarios against which the development was assessed; and
- Assessment against the policies and objectives of the National Policy Statement on Urban Development (NPS-UD), as relates to planning decisions supporting reductions in greenhouse gas emissions.

This assessment is focused on traffic and GHG impacts of the activity proposed by the submitter but has not considered any planning consideration of the specific zoning requested except for consideration of the NPS-UD. This review has also relied on details of the proposal (e.g. assumptions of development size) provided in the submitter evidence of the following experts:

- Evidence of Mr Paul Farrelly (for GHG); and
- Evidence of Chriss Rossiter (for transport)

The report presents its findings in the following sections:

- Summary of submitter evidence;
- Discussion of baseline for comparison (i.e. counter-factual scenarios);
- Review of carbon effects for agricultural, embodied and enabled emissions;
- Review of the proposal against NPS-UD requirements, to support reductions in greenhouse gas emissions; and
- Conclusion

2 Summary of Submitter Evidence

This section summarises the submitter evidence around the following points:

- The proposed development details;
- Emissions from the existing agricultural land use activity;
- Embodied and operational emissions associated with the development and operation of the urban environment ;
- Emissions enabled from the development, namely vehicle emissions from the residents and visitors to the site. This included comparison with similar development at other locations;
- NPS-UD – Consideration of the NPS-UD for land use planning decisions to support reductions in greenhouse gas emissions.

The relevant source of information is included in the footnote.

2.1 The Proposal

The proposal seeks to rezone the area at 81 Gressons and 1375 Main North Road, Woodend, Waikuku which is currently rural. The proposed development for the site, as depicted in Figure 1[1], seeks to rezone the site from a mixture of Rural Lifestyle Zone (**RLZ**) and Large Lot Residential Zone (**LLRZ**) as per notified under the Proposed District Plan into General Residential / Medium Density Residential Zoning.

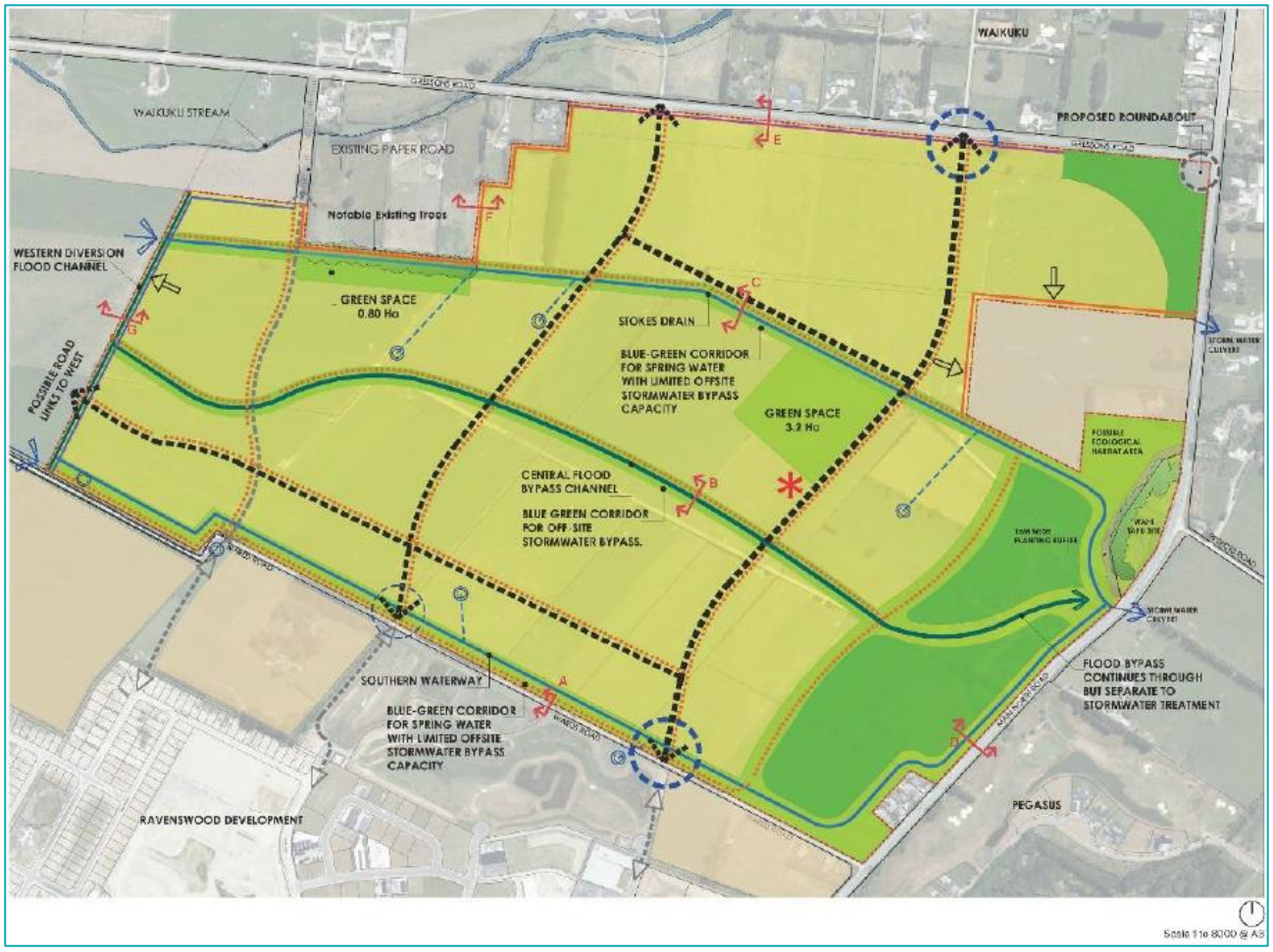


Figure 1 – Outline Development Plan for Stokes

The proposal intends to enable delivery of 1,200 to 1,500 dwellings in accordance with the outline development plan shown above.

2028 was adopted as the base year for the development Transport Impact Assessment.[2]

2.2 Agricultural Emissions

In Mr Farrelly's evidence emissions from the dairy farming operation on the existing site were calculated using guidance provided by the Ministry for the Environment (MfE). This is not a comprehensive and detailed analysis of the agricultural emissions, however the methodology used by the Mr Farrelly to calculate agricultural emissions (total of 1,428 tons CO2-e per year)[3] is in alignment with standard industry practice. Further in Mr Farrelly's evidence, as a comparator to the agricultural emissions estimated, the equivalent

[1] Figure 10-1 of evidence of Chris Rossiter
[2] Paragraph 12.8 of evidence of Chris Rossiter
[3] Paragraph 8.17 of evidence of Paul Farrelly

number of vehicle kilometres travelled were stated, and the equivalent emissions from average annual electricity usage of households in canterbury were also stated.

2.3 Embodied and Operational Emissions

Embodied emissions related to roading infrastructure (Mr Farrelly evidence sections 8.19-8.24)

Mr Farrelly's statement, *'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)*[4]. We agree that a flat site is likely to require less earthworks (and therefore have lower earthworks related emissions) than a hilly site. We consider geological and hydrological conditions (for example, soil/ground conditions or the presence of existing waterbodies or streams) are factors that may also impact overall roading infrastructure emissions.

Mr Farrelly's statement, *'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). '* [5] We concur with this statement.

Embodied and operational emissions related to housing provision (Mr Farrelly evidence sections 8.25-8.43)

Mr Farrelly's statement provides lifetime emissions for multi-storey apartment (AP), (medium density (MDH) and detached housing (DH) typologies from a 2020 industry study, noting that '*On a per m^2 basis, across a 90-year period, the lifetime emissions are highest for multi-story apartments (21 kg CO2-e/m^2/yr) when compared to lifetime emissions for detached housing and medium density housing (13 kg CO_2-e/m^2/yr)'.*

Studies relating to estimations of embodied and operational emissions for different housing typologies (for example low, medium, high density) are limited for the New Zealand context. As such, the industry study referenced in Mr Farrelly's statement[6] can be considered as a useful industry reference point.

Mr Farrelly's statement in Paragraph 8.32 provides lifetime emissions on a per m^2 basis. We consider a per-unit measure would be a more appropriate comparison and using this alternative metric, the industry study referenced indicates that on a per unit basis, a medium density housing unit has the lowest embodied and operational lifetime emissions, followed by one apartment unit (30% higher than the medium density unit) and a detached house unit is the highest (70% higher than the medium density unit).

We do not agree with Mr Farrelly's statement in Paragarph 8.34 'embodied carbon is a much higher relative contributor to lifetime emission for properties developed in the South Island'[7]. NZ grid emissions are measured using a single emissions factor (MfE 2024) and so the location of the consumption of grid electricity is not relevant.

2.4 Emissions from Transportation

2.4.1 Vehicle Generation

The traffic impact assessment was assessed based on the full development of the Site of 1,500 dwellings. As set out in Mr Rossiter's evidence, a traffic generation rate of 8 vehicles per day per household was applied noting that this is '*dependent upon location in relation to education, employment and retail centres and also*

[4] Paragraph 8.22 of evidence of Paul Farrelly
[5] Paragraph 8.23 of evidence of Paul Farrelly
[6] Paragraph 8.29 of evidence of Paul Farrelly
[7] Paragraph 8.34 of evidence of Paul Farrelly

public transport services.' As such Mr Rossiter considers this represents the upper limit of what could be generated by the site and has estimated a total traffic generation of 12,000 vpd. [8]

While we note the typical daily generation rate is 8.2 vehicles per day for Outer Suburban dwellings as per Waka Kotahi NZTA Research Report 453, we consider the trip rate of 8 vehicles per day used is reasonable noting the reasons provided above and note the proposed Woodend Bypass under the draft GPS 2024 will improve accessibility for longer trips for private vehicles and therefore induce these trips. In addition, the trip rate will have minimal impact on this GHG assessment, particularly in the context of the comparative analysis against other locations discussed later in this report.

2.4.2 Avoided Vehicle Emissions through use of Walking and Cycling

The evidence of Mr Farrelly outlines the Site will have separated cycleways and walkways that will connect to the main commercial area and the proposed cycleways will connect to off-road cycleways in the area. He notes the site is approximately 8km away from Rangiora which is a large destination of employment. The area is accessible via off-road cycleways and considers '*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'.* [9]

In addition, Mr Farrelly notes the development of Ravenswood town centre will only be 1 to 2km away from most of the Site and as such will provide easy access to employment opportunities and recreational activities. This coupled with the ODP providing direct active mode access to Ravenswood will promote active mode usage and reduce vehicle emissions.

We agree that the proposed active mode facilities and its connection to key commercial areas will enhance social and economic accessibility via active modes for the Site and will positively contribute to active mode uptake. The site is also within close proximity to recreational routes such as that to Waikuku Becah. However, the exact mode shift anticipated is unknown at this stage and will be partly attributed to the development of Ravenswood town centre. As such we consider, the vehicle trip rate is suitable for the use in estimating comparative GHG transport emission and no further reductions are considered to be needed to reflect the proposed active mode facilities at this stage.

2.4.3 Avoided Vehicle Emissions through use of Public Transport

The evidence of Mr Farelley and Mr Rossiter both note that it is likely that public transport enhancement and services will be provided with the development of Ravenswood town centre. Mr Farallely also discusses further enhancements anticipated to public transport facilities and services in the area[10] and notes the submitter will work alongside the Council to enable the site to connect to the future public transport network. He concludes that '*access to public transport from the Site, as the Proposal progresses, is likely to be reasonably good when compared with other greenfield development sites in the region*'[11] with Mr Rossiter noting '*The planned introduction of new public transport services in the area will contribute to reducing the modelled travel demands*'.[12]

In terms of enabled transport emissions, the attractiveness (and hence use), of such public transport services is relevant in regard to any impact on the likely use of private vehicles. The proposal suggests there will be improved public transport services as development occurs however the evidence has not presented what these improvements are or provided any forecasted patronage.

[8] Paragraph 11.2 of evidence of Chris Rossiter
[9] Paragraph 8.79 of evidence of Paul Farrelly
[10] Paragraph 8.86 to 8.88 of evidence of Paul Farrelly
[11] Paragraph 8.90 of evidence of Paul Farrelly
[12] Paragraph 12.20 of evidence of Chris Rossiter

We agree public transport services will likely be improved as development occurs especially noting that there is an existing bus services that close to the site which could be modified to cater for this site and in turn be useful in increasing accessibility. We also consider any services provided for the Site will unlikely be a frequent service and will likely require transfer to onwards services especially for those wishing to head into Christchurch. It is unlikely this will be an attractive alternative for those with ready access to cars, and therefore only likely to be used by a small proportion of residents. On this basis, it is unlikely to make a material difference to vehicle use from the site.

We consider that the agreed vehicle trip rate is suitable for the use in estimating comparative GHG transport emissions, with no further reductions needed given the uncertainty surrounding the improvements to public transport for the site and the area.

2.4.4 Consideration of Greenhouse Gases

Mr Farrelly considers '*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*'[13]. However, he made the following points in relation to the potential reduction of enabled emission in the future:

- The total emissions resulting from current activity on the farm per annum (1,428 tons of CO2-e) is equivalent to 5.67 million vehicle kilometres travelled in a typical New Zealand vehicle (using the MFE's default private car emission factor (2022) per km of 0.252kg)[14].
- Emissions from transportation related to the rezoning request are a function of the mode of transport, distance travelled and frequency of travel.[15] It is important to consider how this may change into the future accounting for the travel pattern and the current way of travel.[16]
- With cycling and public transport improvements in the area, vehicular journey to work trips are likely to drop due to mode shift to public transport, carpooling, cycling including e-bikes and working from home. With expected raise in electric vehicle (EV) uptake, the average emission rate of vehicular trips is also likely to drop[17].
- The proximity of the Site to the Ravenswood commercial area will minimise GHG emissions from travel when compared with other greenfield development sites around the region.[18]

2.5 NPS-UD Considerations

The NPS-UD requires planning decisions to contribute to well-functioning urban environments, which are environments that "*support reductions in greenhouse gas emissions*" *(Policy 1(e))*[19]. In his evidence, Mr Farrelly considered that Policy 1(e) is not intended to mean that an absolute reduction in greenhouse gas emission is required[20], and provides assessment of the proposal against the existing land use activity and provides discussion of the likely transport emissions of a similar development located elsewhere in the region.

Mr Farrelly in Paragraph 6.6 states that *'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'*. Mr Farrelly has provided no evidence to support this conclusion. Although we agree that there is a potential for a reduction in emissions,

[13] Paragraph 6.7 of evidence of Paul Farrelly
[14] Paragraph 8.17 of evidence of Paul Farrelly
[15] Paragraph 8.44 of evidence of Paul Farrelly
[16] Paragraph 8.45 of evidence of Paul Farrelly
[17] Paragraph 8.79, 8.80, 8.90 & 8.99 of evidence of Paul Farrelly
[18] Paragraph 8.57 of evidence of Paul Farrelly
[19] Paragraph 6.1 of evidence of Paul Farrelly
[20] Paragraph 6.4 of evidence of Paul Farrelly

it is also possible that the change of use scenarios given in Mr Farrelly's statement would result in an increase in emissions.

Mr Farrelly's evidence in Paragraph 6.7 also states that '*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'.* This statement conflicts with Mr Farrelly's statement in paragraphs 6.4 and 6.8, and is misleading. Whilst emissions estimations will require assumptions to be made and there is an associated higher level of uncertainty at this proposal stage of a project, it would be possible to estimate GHG emissions either based on the available data from similar developments or high level estimations of materials quantities for comparison purposes, if required.

Mr Farrelly concludes that:

"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."

This conclusion regarding a reduction in GHG is therefore based on, and sensitive to, the baseline against which the proposal is assessed. This is discussed in the following section.

3 Discussion of Baseline

The NPS-UD policy relates to planning decisions so requires an assessment of the proposal against a relevant baseline, in order to assess if there is likely to be a reduction in greenhouse gas emissions.

The baseline requires particular attention when considering housing development for a future, growing population. Given the cumulative, global impact of GHG emissions and the context of these planning decisions impacting the future environment, the most valid baseline is considered to be a future scenario with similar global population. That is, the proposal with future, new residents should not be compared against the current-day population. Mr Farrelly appears to agree with this where he notes that any greenfield development would not meet NPS-UD requirements, if Policy 1(e) were to mean that an absolute reduction in GHG emissions is required and this was a net increase in development rather than replacement for similar development elsewhere.

Mr Farrelly appears to have assessed the proposal against two different baseline scenarios[21]:

- **Baseline 1:** Business as usual (**BAU**) – continuation of the current agriculture use and the development does not happen anywhere;
- **Baseline 2:** The same type and scale of development but without proposed design features that would support the reduction of GHG emissions (e.g. provision of cycling facilities, improved public transport services).

Baseline 1 is only considered valid if the development and the associated demand for housing of this type would not appear elsewhere, and the displaced agricultural use would not be possible elsewhere. This baseline implies a net reduction in dairy activity and a net increase in urban development and population (i.e. swapping population for dairy cows). This relies on an assumption that there is no other capacity available for either equivalent dairy use or urban development elsewhere, which is not considered plausible. As such

[21] These scenarios have not been explicitly set out in evidence especially Baseline 3 but have been inferred i.e. such as the comparison between this site with other greenfield sites in Paragraph 1.7 of the evidence of Paul Farrelly.

this is not considered a relevant baseline for this planning decision, except in the unlikely event that this assumption can be proven. Notwithstanding this concern, this review has considered the relative GHG emissions of the existing and proposed activities.

Baseline 2 assumes that the same proposed activity would take place, but without suitable mitigating design features. This is not considered a valid baseline for the purposes of planning decisions on whether to allow for the development in the first place.

We consider that a more relevant and intuitive scenario for the assessment of NPS-UD is:

- **Baseline 3:** The same type and scale of development at alternative sites (**AS**) elsewhere in Waimakariri or Selwyn Districts.

Although Mr Farrelly does not explicitly consider Baseline 3, in Paragraph 1.7, he does state '*A key advantage of this site (in GHG emissions terms) relative to other greenfield sites is its close proximity to Ravenswood (1km away)…*'

It is worth noting that the potential rezoning under the proposed district plan was not considered as part of the assessment by Mr Farrelly but rather the emphasis has been placed on comparing against the existing agricultural use. Although we consider the proposed district plan land use may be a better baseline instead of the existing land use, we consider for the purpose of this assessment, Baseline 3 remains the most relevant.

4 Review of Carbon Effects

Taking account of the submitted evidence and the considerations for suitable baseline to assess NPS-UD Policy 1(e) against, this section summarises the review of carbon effects for the agriculture, embodied and enabled emissions. It covers the following emissions categories:

- **Agricultural emissions** – Farm-related GHG emissions emitted (for example from animals, manure management, and nitrogen fertiliser) or absorbed (sequestered in forests or vegetation).
- **Embodied and operational emissions –** Embodied (or embedded) emissions are the GHG emissions resulting from manufactured products and materials used in construction of the built environment. Operational emissions are the GHG emissions resulting from the energy use of a building during its operation. Combined, the sum of embodied emissions plus the sum of the operational emissions constitutes 'total emissions in the built environment'.
- **Enabled emissions** – Emissions resulting from the public use of infrastructure (for example tailpipe emissions as a result of vehicle kilometres travelled (VKT)).

4.1 Agricultural Emissions

As noted above, baseline 1 is not considered a likely or valid comparison. Even if this were valid, given the existing use of any alternative sites is not known, if there was agricultural use at these sites then emissions could be higher, lower or similar.

4.2 Embodied and Operational Emissions

When considering the proposed development site against counterfactual sites in other locations, the main factor that would have an impact on the embodied and operational emissions would be:

- housing typologies and density within the development.

Other considerations that may affect the overall embodied emissions for a development include:

- land typology and topography including geological considerations,
- any infrastructure provision required around the site to support the development.

In the absence of detail relating to these factors for alternative sites, it is not possible to determine whether the embodied and operational emissions would be higher or lower than the proposed development, as this would be highly dependent on the above-mentioned factors.

4.3 Enabled Emissions from Transportation

Mr Farrelly did not estimate total emissions from transport, but seems to imply these would be similar to the current agriculture emissions. However, simple calculations using the submitter's data can be used to back-calculate the implied vehicle trip length for this to be true as shown in Table 1.

Table 1 - Transport Emissions Calculation - Daily and Annual Rate

Transport Emissions[22]	Calculation	Value
Daily per km	12,000 trips per day × 0.252kg CO_2-e per km	3,024kg CO_2-e per day
Annual per km	Daily × 300 days[23]	907 tonnes per year

This indicates that, if the total emissions were to be no worse than the BAU baseline scenario (1,428 tonnes per annum), the average trip length of all traffic associated with the development would need to be less than 1.6km. This is approximately the distance of Rangiora Woodend Road from Bob Robertson Drive to Boys Road or to Ravenswood. This is considered extremely short and extremely unlikely.

Even if the emission rate for the residents' vehicles dropped by as much as 20%[24] from current averages to take account of the increase in EV uptake and change in fleet composition in the future, this still implies that the average trip length must be less than 2.0km. Even accounting for Ravenswood town centre being just 1 – 2km from most of the development, this is still considered implausible short given the distance of the development to other social, educational and economic services and opportunities are much further.

If we consider this another way and assume the trip rate is too high given there may be mode shift in the future and the 8 vehicles per day trip rate is on the 'upper limit' as noted by Mr Rossiter. To reach the BAU or existing baseline of 1,428 tonnes per annum will require a trip rate of approximately 1 vehicle per day. This will mean, of the 12,000 trips per day estimated, 10,500 trips by car is reduced which is considered implausible.

To estimate the likely trip length and enabled emissions, the strategic transport model (Christchurch Transportation Model V21a) is used. That model estimates future travel patterns in response to land use and transport inputs. This is understood to be the same model used in the evidence of Mr Rossiter to estimate the distribution of development traffic to the surrounding road network.

The following map shows the daily average trip length from light vehicles, estimated by the model for 2028, from sites located in the vicinity of Stokes or locations with similar a rural-settlement context.

[22] From proposed land use, based on assumptions used in the existing evidence
[23] As the daily number usually represent a normal week day, which generally had more trips than the weekend or public holidays, a annualisation factor less than 365 (days in a year) and higher than 250 (working days in a year) is applied to convert from daily to annual.
[24] Based on VEPM 6.3, the emission factors for light vehicles are expected to drop between 11% to 18% from 2018 to 2031.

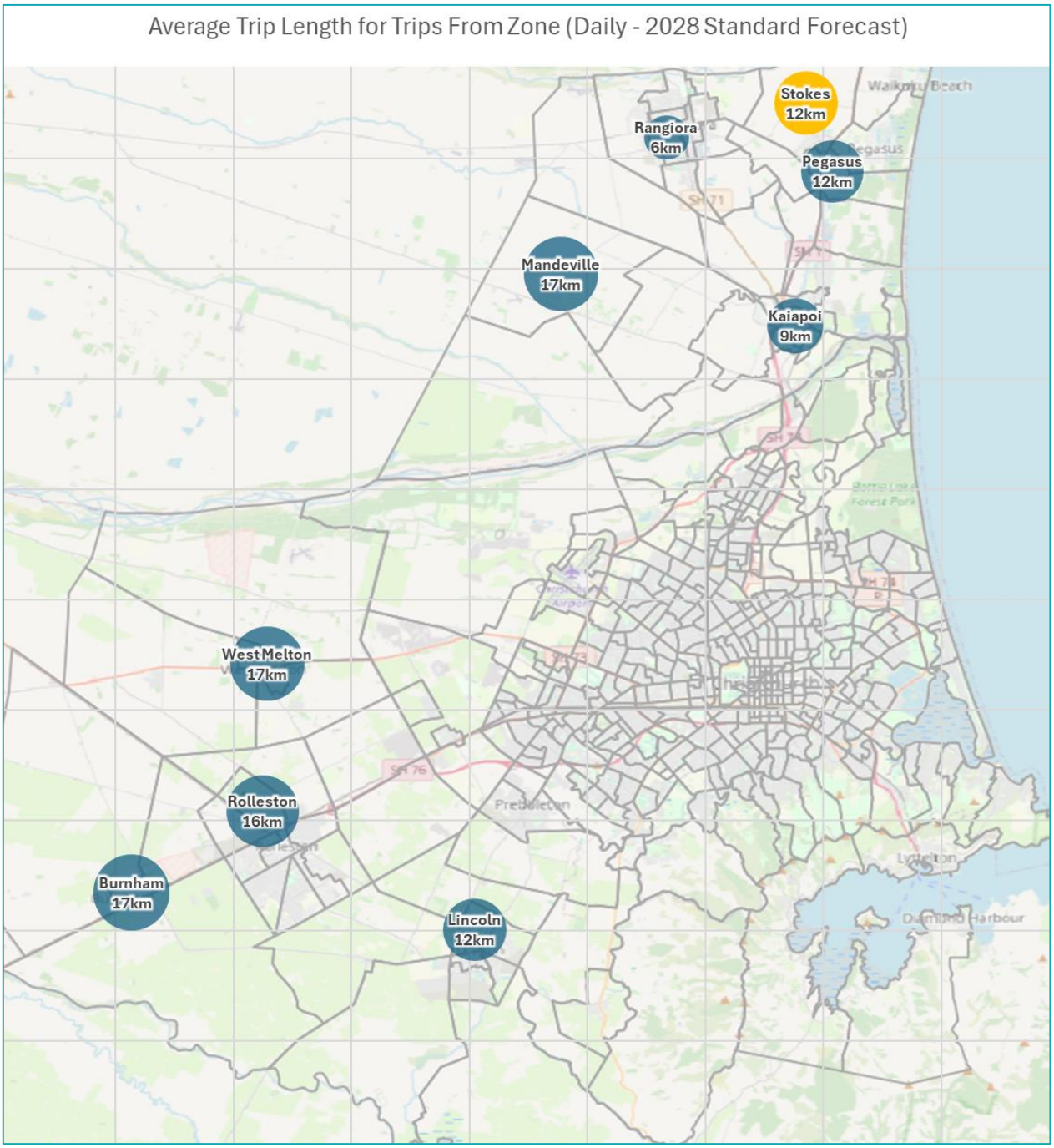


Figure 2 – Daily Average Trip Length from Zone around Greater Christchurch Region (based on 2028 modelled results)

As indicated by the map, even for well-established townships like Rangiora and Kaiapoi where planned growth is to occur, the average trip length from these locations is between 6km to 9km respectively. The nearby settlement of Mandeville is estimated to have a daily average trip length of 17km. All of which were higher than the derived trip length of under 2km from the data referenced in the submitter's evidence.

Using the trip length data and the transport emission rate for the proposed development (i.e. 907 tonnes per year per km in **Table 1** the following graphs depict the expected annual enabled emissions for a number of sites in Waimakariri and Selwyn District.

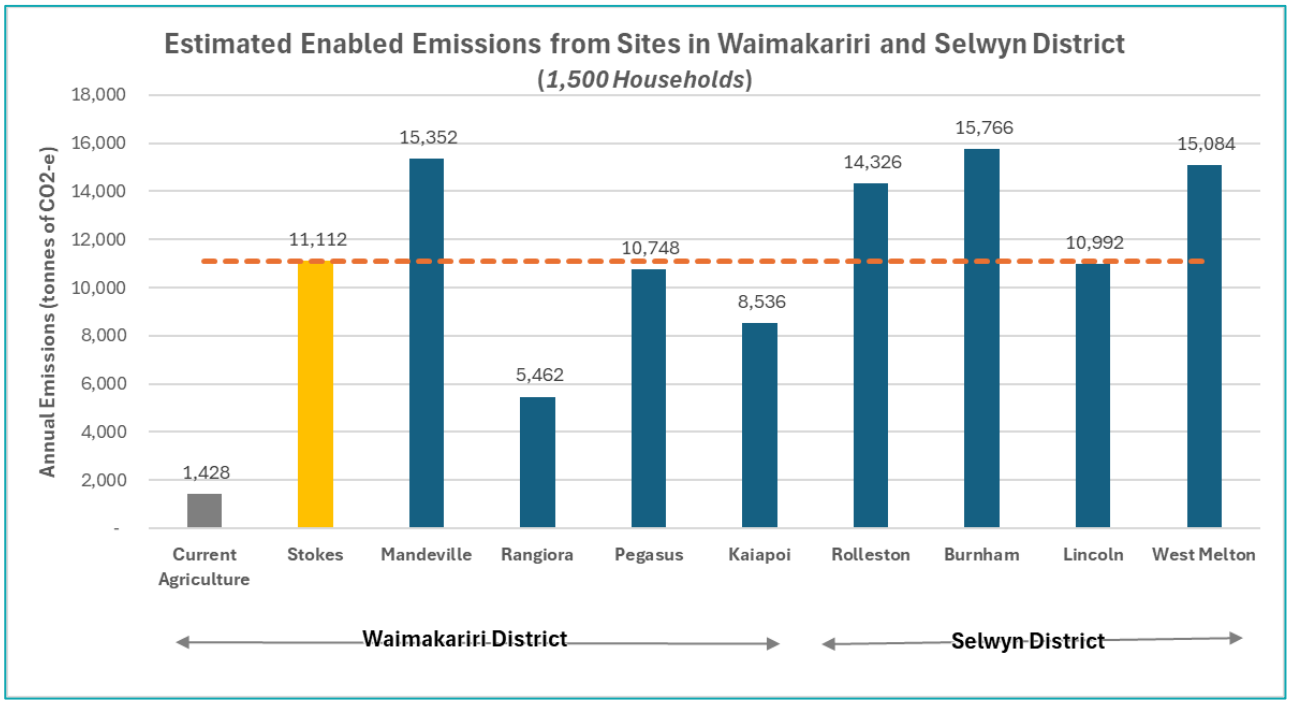


Figure 3 – Estimated emissions from transport based on 2028 modelled daily average trip length – ordered by distance to the Christchurch CBD

As shown in the figures, emissions from current agriculture activity (as per the submitter's evidence, and highlighted in grey in the graph) is significantly lower than emissions estimated for Stokes and all other alternative sites. The estimated emissions for the proposed development at Stokes is higher than Rangiora or Kaiapoi where there is planned growth. It is also slightly higher compared to Pegasus or Lincoln, while lower than sites in Mandeville, Rolleston, West Melton and Burnham.

5 Conclusion

The specific conclusions of this analysis are as follows:

- The submitters GHG assessment implies comparison of the proposal against two potential baseline scenarios, namely:
    - Baseline 1: continuation of the current agriculture use
    - Baseline 2: The same type and scale of development but without proposed design features that would support the reduction of GHG emissions (e.g. provision of cycling facilities, improved public transport services);
- We consider a more relevant Baseline is to consider the same type and scale of development at alternative sites elsewhere in Waimakariri or Selwyn Districts (Baseline 3). Although not explicitly considered in the submitter's evidence, reference was made to other developments.
- The assumptions required for Baseline 1 to be valid are considered highly unlikely and Baseline 2 is not considered suitable for the purposes of land use planning decisions of the development itself. Baseline 3 is considered a relevant baseline scenario;
- The emissions from the existing agricultural use of some 1,428 tonnes CO2-e per year is considered appropriate;
- The comparative assessment of embodied and operational emissions for the development is highly sensitive to the urban form the site is compared to. Any such comparison is considered best done on a per unit rather than the per m^2 basis suggested in the submitter's evidence. The available research

indicates that on a per unit basis, detached housing such as proposed for this site has higher combined embodied and operational carbon than apartment or higher density units;

- The submitters proposal for cycle facilities and public transport services are considered useful in terms of recreational use, amenity use and general accessibility for the site but are unlikely to attract sufficient regular usage to make a material difference to vehicle use of its residents;
- The submitters adopted net vehicle trip rate is considered suitable for use in estimating comparative GHG transport emissions, with no further reductions needed to reflect the proposed cycle facilities or bus services;
- The enabled vehicle emissions associated with the development are estimated to be in the order of 11,112 tonnes per annum;
- Comparisons with the same scale of development in other locations suggest the vehicle emissions for this location would be higher than locations closer to existing centres with planned growth such as Kaiapoi or Rangiora, but could be lower than locations further from the main Christchurch urban areas such as Mandeville, West Melton or Burnham;
- The development is close to other urban areas such as the proposed Ravesnwood Town Centre, close to recreational areas such as that of Waikuku Beach and has an existing bus service that has the potential to be modified to serve the development. All of this has the potential to contribute to lowering GHG. However, as indicated by the analysis, it is still likely to have significantly higher GHG emissions than the existing land use and higher than equivalent developments in planned growth areas closer to existing centres such as Kaiapoi or Rangiora.

Given these high-level findings, it is considered that there is insufficient evidence to support the submitters claim that the proposed development at the Stokes rezoning site "*supports a reduction in GHG emissions*" (as per NPS-UD Policy 1(e)). This review indicates that the GHG emissions associated with this proposal would be higher than either the existing agricultural land use or similar scale development in planned growth areas in existing centres such as Kaiapoi or Rangiora. Only if compared against similar development in areas even more remote from the main Christchurch urban areas would this site be likely to have lower GHG emissions.