STATEMENT OF EVIDENCE OF KIRDAN ROSS LEES ON BEHALF OF WELLINGTON CITY COUNCIL

18 January 2023

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INTRODUCTION

1. My name is **Kirdan Ross Lees**.

2. I am a Partner at Sense Partners, an economics and public policy consultancy based in Auckland and Wellington.

3. I am a PhD trained applied economist with 20 years' experience applying building models and producing forecasts related to policy issues in Wellington.

4. My evidence is given on behalf of Wellington City Council ("W**CC**") in relation to its population forecasts that support activities related to the District Plan.

5. Although this is a Council Hearing, I have read the Code of Conduct for Expert Witnesses contained in the Practice Note issued by the Environment Court 2023. I have complied with the Code of Conduct when preparing my written statement of evidence and I agree to comply with it when I give any oral evidence.

6. Other than when I state that I am relying on the evidence or 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 I express.

7. Any data, information, facts, and assumptions I have considered in forming my opinions are set out in the part of the evidence in which I express my opinions. Where I have set out opinions in my evidence, I have given reasons for those opinions.

SCOPE OF EVIDENCE

8. This statement discusses demographic forecasts – including primarily population forecasts – produced by Sense Partners for Greater Wellington Regional Council – and used for planning purposes by local councils with the region.

OBJECTIVE

9. Our objective is to assist local councils plan by modelling and communicating likely future demographics across the Wellington region.

10. Population forecasts are inherently uncertain. So we provide forecast ranges that reflect uncertainty. This is the range of 50,000 to 80,000 extra people Wellington City Council use for long-term land use planning purposes, allowing council to plan for a range of outcomes.

11. The forecasts produced should be interpreted as potentials. There are a number of things that the forecasts do not take into account, such as national or local policy changes which can affect actual population and economic growth.

12. We also update our forecasts on an annual basis. This allows us to take into account changes in the underlying data. This can mean population forecasts can shift higher or lower when unexpected changes occur.

13. Modelling migration and forecasting more frequently than Statistics New Zealand helps provide a better product and more accurate forecasts. In particular, our models provided a better, albeit imperfect read on the strong population growth New Zealand experienced between 2013 and 2019.[1]

14. We have produced two sets of forecasts to date (in March 2021 and in March 2022) and are contracted by Greater Wellington Regional Council to produce 3 additional sets of forecasts (see Figure 1).

Figure 1: Timing of Sense Partners population forecasts

Year	Deliverable	Date
Year 1	Full update	03/3//2022
Year 2	Partial update	26/03/2022
Year 3	Partial update	26/03/2023
Year 4	Full update	26/03/2024
Year 5	Partial update	26/03/2025

[1] In 2018, we were commissioned by New Zealand Treausry to provide population and migration forecasts that were used to move away from Statistics New Zealand forecasts..

OUR APPROACH TO PRODUCING DEMOGRAPHIC FORECASTS

15. The focus of our method is to use persistent and predictable structural and compositional characteristics of populations and economies to extrapolate future trends.

16. The methods place a premium on respecting adding-up constraints (e.g. domestic migration must sum to zero) and consistency between forecasts. For this reason the model is a national model, with district details.

17. To capture uncertainty around trends we conduct monte-carlo simulation, where inputs are varied randomly and repeatedly (500 times) to produce distributions over future values, rather than point estimates. This approach helps emphasise the considerable uncertainty that exists about the future and the extent to which this uncertainty grows the further out we look.

18. The forecasts are based on 4 component models:

    (i) People

    (ii) Work

    (iii) Households

    (iv) Housing

19. The modelling proceeds in a linear fashion through each of the models that I discuss in turn.

THE PEOPLE OR POPULATION MODEL

20. The modelling framework uses a *Leslie Matrix* to predict future population that are determined by combining fertility, mortality and migration models.

21. We combine national age-specific fertility data and regional age-group specific fertility rates (only available in census years) to forecast fertility across New Zealand using a standard “Lee-Carter” model. We allow for Variations in fertility rates across districts estimated.

22. We use national age- and sex-specific cohort life tables 1876-2018 and Stats NZ subnational (district) age-group and sex-specific life-tables to estimate mortality. Both the fertility and mortality models use methodologies close to Statistics New Zealand.

23. Rather than follow Statistics New Zealand and make an assumption on the future number of net migrants, we choose to model both inward migration and external migration as rates or propensities to migrate, using a large number of models we average across.

24. We produce 500 sets of population forecasts to simulate the uncertainty that surround each forecast.

THE WORK MODEL

25. To model employment and the labour force, we follow methods that are similar to those used by the Treasury for long-term fiscal modelling. We use a growth accounting method intended to capture long term structural trends as opposed to focussing on short term cycles.

26. Forecasts are based first on (external/exogenous) forecast national trends and cycles in unemployment, labour force growth and growth in multi-factor productivity (this is the growth accounting method).

27. District level employment is forecast using labour force growth (as above), national unemployment rate forecasts, and district level age-specific unemployment rates relative to national rates.

28. Forecasts of employment and earnings are district-specific, with no enforced adding-up constraints, with respect to national GDP.

29. Earnings growth and GDP growth fall out of calculations of labour force and employment growth – that is the growth accounting method.

30. Estimates of unemployment rates by age and by district are based on census data (as this is the only data available on unemployment by district and by age).

31. National aggregate unemployment rates are measured using the Household Labour Force Survey (HLFS) as this is the conventional measure of unemployment nationally.

THE HOUSEHOLD MODEL

32. We model seven 'household' types: sole person, sole parent, couple, two parents, multi-person, multi-family, other (nonprivate dwelling i.e. not a household).

33. Statistics New Zealand provides us with data on living arrangement type rates by district (see illustrative examples of age-specific living arrangement rates at right). That is, the probability that a person of a given age and gender lives in a particular family or household type.

34. Presently we use Stats NZ projections of trends in living arrangement to calibrate our forecasts. That data is currently based on the 2013 census.

THE HOUSING MODEL

35. Statistical model predicts demand for houses within a district by local area (SA2) by household type and dwelling type, accounting for: – estimated cost of travel to employment – population density – location of similar households

36. Predicted housing demand is compared against existing stock and high-level estimates of housing development capacity: – based on the 2019 Housing and Business Development Capacity Assessments – councils' high-level assessments of the implications of recent and future policy and plan changes including initial assessments of the implications of government requirements to intensify in certain areas1 – existing land zones and housing densities.

37. Excess demand, due to capacity constraints, is reallocated based on an "optimisation model" (linear programming) which accounts for: – land values (the lower the better) – excess development capacity (the more the better) – vacancies (the more the better)

38. We assume a long-run average minimum level of vacancies of: – 5% in typical residential areas – 20% in areas with high numbers of holiday homes.

A CLOSER LOOK AT SOME OF POPULATION FORECASTS

39. Sense Partners forecasts tends to produce higher net migration, leading to a higher population at a national level (See Figure 2).

Figure 2: Sense Partners forecasts are higher than Statistics New Zealand

Sense Partners forecasts vs Statistics New Zealand, March 2022, median population growth

Year	Sense Population (millions)	Sense Annual growth (average)	StatsNZ Population (millions)	StatsNZ Annual growth (average)
2003	4.03	1.3%	4.03	1.3%
2008	4.26	1.1%	4.26	1.1%
2013	4.44	0.8%	4.44	0.8%
2018	4.90	2.0%	4.90	2.0%
2023	5.19	1.2%	5.22	1.3%
2028	5.56	1.4%	5.46	0.9%
2033	5.87	1.1%	5.68	0.8%
2038	6.16	1.0%	5.88	0.7%
2043	6.46	1.0%	6.06	0.6%
2048	6.72	0.8%	6.22	0.5%

40. Over the next twenty years, our mean population growth rate is 1.1 percent, lower than the growth rate over the past twenty years (1.4 percent) but higher than the growth rate embedded in Statistics New Zealand's forecasts (0.8 percent).

41. In general, Sense Partners forecasts present a wider range of uncertainty than Statistics New Zealand (see Figure 3).

Figure 3: Ranges of possible growth rates by percentile

Sense Partners forecasts vs Statistics New Zealand, March 2022, mean population growth rates

Growth rates in the next 20 years		
Percentile	Sense	StatsNZ
5	0.0%	0.2%
10	0.2%	0.3%
25	0.5%	0.6%
50	1.1%	0.8%
75	1.7%	1.0%
90	2.1%	1.2%
95	2.2%	1.3%
Last 20 years		
Mean		1.4%
Std deviation		0.9%

42. Our central estimate for the Wellington region suggest a population of 714,978 by 2048 with a 50 confidence interval spanning 613,750 to 823,691 people (see Figure 4).

Figure 4: Ranges of possible growth rates by percentile

Sense Partners forecasts, March 2022

Population					
Year	5th percentile	25th percentile	50th percentile	75th percentile	95th percentile
2003	452,326	452,326	452,326	452,326	452,326
2008	471,744	471,744	471,744	471,744	471,744
2013	486,724	486,724	486,724	486,724	486,724
2018	526,012	526,012	526,012	526,012	526,012
2023	547,338	551,521	554,517	557,458	561,885
2028	556,416	576,232	590,926	606,132	623,105
2033	560,807	592,202	624,334	662,569	696,580
2038	558,409	604,435	654,053	718,606	776,659
2043	551,520	610,966	687,871	775,251	861,416
2048	544,544	613,750	714,978	823,691	954,309
5 yearly average growth rates					
Year	5th percentile	25th percentile	50th percentile	75th percentile	95th percentile
2003					
2008	0.8%	0.8%	0.8%	0.8%	0.8%
2013	0.6%	0.6%	0.6%	0.6%	0.6%
2018	1.6%	1.6%	1.6%	1.6%	1.6%
2023	0.8%	1.0%	1.1%	1.2%	1.3%
2028	0.3%	0.9%	1.3%	1.7%	2.1%
2033	0.2%	0.5%	1.1%	1.8%	2.3%
2038	-0.1%	0.4%	0.9%	1.6%	2.2%
2043	-0.2%	0.2%	1.0%	1.5%	2.1%
2048	-0.3%	0.1%	0.8%	1.2%	2.1%

43. Population growth for Wellington City Council tends to be a little lower than for other councils in the region (see Figure 5).

Figure 5: Ranges of possible growth rates by percentile

Sense Partners forecasts vs Statistics New Zealand, March 2022, annual average population growth

Annual average population growth

	Historical	Stats NZ medium projections			Sense median projections		
Area	1998-2018	2018-2028	2028-2038	2038-2048	2018-2028	2028-2038	2038-2048
Kapiti Coast	1.5%	0.8%	0.4%	0.2%	1.5%	1.3%	1.0%
Porirua	0.9%	1.0%	0.5%	0.4%	1.4%	1.1%	1.0%
Upper Hutt	0.9%	1.0%	0.4%	0.3%	1.5%	1.1%	0.8%
Lower Hutt	0.4%	0.7%	0.3%	0.1%	1.2%	1.0%	0.9%
Wellington	1.2%	0.7%	0.5%	0.4%	0.8%	0.8%	0.8%
Masterton	0.6%	0.8%	0.3%	0.1%	1.8%	1.3%	1.0%
Carterton	1.7%	0.9%	0.3%	0.1%	1.7%	1.4%	1.2%
South Wairarapa	1.0%	0.9%	0.3%	0.0%	1.7%	1.3%	1.0%