Before an Independent Hearings Panel
appointed by the Waimakariri District Council

under: the Resource Management Act 1991

in the matter of: Submissions and further submissions in relation to the proposed Waimakariri District Plan, Variation 1 and Variation 2

and: Hearing Stream 10A: Future Development Areas, Airport Noise Contour, Bird Strike and Growth policies

and: **Christchurch International Airport Limited**
Submitter 254

Summary of Evidence of Laurel Smith (Acoustics)

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SUMMARY OF EVIDENCE OF LAUREL SMITH

INTRODUCTION

1 My name is Laurel Jean Smith and I am a consultant at Marshall Day Acoustics Limited. I have undertaken noise prediction and provided consulting advice for a number of airports across New Zealand.

2 I prepared a brief of evidence addressing the relief sought by Christchurch International Airport Limited (*CIAL*) on the proposed Waimakariri District Plan and the Variation. This statement provides a summary of key points and responds to the evidence of submitters where relevant to my expertise.

SUMMARY OF EVIDENCE

3 At the time the Proposed Plan was notified, the air noise contour remodelling process for Christchurch International Airport (*Christchurch Airport / CIA*) was ongoing.

4 The remodelling has now been completed (finalised in June 2023). As explained in Mr Kyle's evidence, CIAL is seeking that the Outer Envelope Updated Noise Contours apply for the purpose of the Proposed Plan.

5 The Outer Envelope Updated Noise Contours provides a technically robust and up-to-date identification of the location of future aircraft noise exposure.

6 The current planning framework for CIA was developed generally in accordance with New Zealand Standard 6805 and with consideration of the existing land uses and existing aircraft noise protection at the time. Applying the current planning framework to land within the Updated Noise Contours maintains this level of protection for the benefit of both the community and CIA.

7 Recent research shows that the prevalence of annoyance relative to aircraft noise exposure (L_{dn}) has been increasing. Internationally other noise metrics such as L_{night} and Number Above are also being considered when assessing and planning around aircraft noise.

8 The 2018 WHO guidelines present the most comprehensive, evidence-based recommendations on assessing aircraft noise effects. The guideline values are generally considered low and achieving these retrospectively in already urbanised areas, for the most part, is likely unrealistic. Nonetheless the guideline values can be used to inform decisionmakers to balance community health, amenity, airport efficiency and a range of other planning, economic and environmental matters. In my view, the guideline limits are particularly relevant and useful when considering land use planning

decisions relating to greenfield and urban intensification situations where there is the opportunity to proactively limit the scale of future noise impacts on a population.

9 Managing the effects of aircraft noise relies on a multidimensional approach and land use planning is a key component. The scale of aircraft noise effects on a population is directly related to the size of the population exposed. The current planning framework in Waimakariri District enables an appreciable increase in residents exposed to aircraft noise effects. Relaxing the current land use provisions could increase this even further.

10 A history of low prevalence of complaints at Christchurch Airport does not indicate that people are not annoyed or will not become annoyed at future aircraft noise levels which are forecast to be appreciably greater than today.

11 Operational restrictions such as movement caps and curfews have been imposed on airports in response to extreme public pressure. Operational restrictions can also be imposed through regular planning processes where objective measures are relied on. Increasing the number of residents exposed to aircraft noise not only increases the scale of adverse effects but also adds weight to a case for imposing operational restrictions.

12 Acoustic insulation does not resolve all aircraft noise effects. In my opinion, sound insulation is a less desirable option to avoiding the effects of airport noise through appropriate land use controls.

13 The Canterbury region is currently in the fortunate position to have controlled residential growth in areas affected by aircraft noise at or above 50 dB L_{dn} and most of the land within the 50 dB L_{dn} contour is low density or non-noise sensitive use. From a noise management perspective, I recommend that this approach continues, and is applied to areas within the Updated Noise Contours, to limit the scale of future noise effects.

RESPONSE TO SUBMITTER EVIDENCE

14 I have reviewed and comment on the evidence of:

14.1 **Prof John-Paul Clarke**, **Mr William Reeve**, **Mr Fraser Colegrave** and **Mr Brian Putt** on behalf of Momentum Land Limited and Mike Greer Homes NZ Limited; and

14.2 **Mr Jon Styles** and **Mr Lance Jimmieson** on behalf of Kāinga Ora – Homes and Communities.

Mr Colegrave Paragraphs 130 – 138 and 158 - 170

15 Mr Colegrave discounts many of the international examples of reverse sensitivity effects on airports provided by Airbiz as they are not directly comparable to Christchurch Airport's situation. He then suggests that the Kaiapoi 'natural experiment' is the most relevant case study to assess the likely impacts of residential development inside the OCB. The current aircraft noise levels in Kaiapoi are approximately 43 – 48 dB L_{dn}, some 7 dB below the future level. Therefore, the natural experiment has barely begun. The lack of complaints from these residents is not predictive of future potential reverse sensitivity.

16 In paragraphs 158 – 170, Mr Colegrave discuses three options for managing aircraft noise effects on residents and reverse sensitivity effects on the airport.

16.1 For Option 3 (no complaints covenants), Mr Colegrave acknowledges that it does not mitigate the noise effects at all. I agree.

16.2 Option 1, he describes as prohibiting noise sensitive activities inside the contours and defines this as CIAL's position. This is inaccurate as the operative and proposed framework does not prohibit such activities, nor is this CIAL's position. CIAL's position is to avoid the development of such activities beyond the operative densities. Option 1 is the most effective of the three options at minimising the scale of noise and reverse sensitivity effects, however it is still a compromise solution as it does not prohibit any development at all inside the contours or protect land outside the contours on which noise effects will still be felt.

16.3 Option 2 is mechanical ventilation and double glazing. This option does not limit the number of people exposed to noise effects. Instead, it partially mitigates some of the effects (i.e. indoor noise levels). This option does not address outdoor living environments. Like Option 1, this is not a perfect solution, however it is far more compromised as it does not minimise the number of people exposed to the residual noise effects.

17 In summary, I remain of the position that the most effective and appropriate way to limit the overall scale of the noise effects is to minimise the number of people affected.

Mr Reeve

Stacked Conservatisms

18 Mr Reeve concludes that the Outer Envelope Updated Contours have been modelled in a way that represents stacked conservatisms that

go further than the baseline values recommended in NZS 6805 to protect community health and amenity values.

19 The stacked conservatisms he refers to are:

19.1 **Using the busiest 3 months** – This aligns with the NZS 6805 recommendation;[1]

19.2 **Using ultimate runway capacity for future operations projection** – This aligns with NZS 6805 which recommends a minimum 10 years (i.e. not less than) but also recommends future operations are projected in terms of current and future runway capacity[2];

19.3 **Using the 50 dB L_{dn} contour** – This is more conservative than 55 dB L_{dn} recommended in NZS 6805 but aligns with the operative framework.

20 The only factor above that does not strictly align with NZS 6805 is the use of 50 dB L_{dn}. Therefore, I do not agree with Mr Reeve's point about stacked conservatisms. In addition, the use of 50 dB L_{dn} is an available option in the context of NZS 6805 (with 55 dB L_{dn}, being the *minimum* recommendation), aligns with the operative framework and recognises the unique land use planning history in Canterbury, which my evidence addresses in detail.

21 When Mr Reeve considers conservatisms, he has only addressed how the OCB has been located rather than how the standard, as a whole, has been implemented. There are two aspects to consider, firstly locating the OCB and secondly the controls that apply. I agree using 50 dB L_{dn} to locate the OCB is more conservative than the Standard's minimum recommendation of 55 dB L_{dn}. However, with respect to land use controls inside the OCB, the Standard states:

21.1 '*The outer control boundary defines an area outside the air noise boundary within which there shall be no new incompatible land uses'*.[3]

22 The approach in Canterbury is far less rigorous than this. Even at the 55 dB L_{dn} contour, where the Standard recommends to prohibit as the first option or permit with acoustic insulation as a second option, the Canterbury approach takes the more permissive second option.

[1] Clause 1.4.1.2 and 1.4.2.2

[2] Clause 1.4.3.2(d) of NZS 6805:1992

[3] Clause 1.4.2.1 of NZS 6805:1992

23 In summary, it is somewhat true that locating the OCB using the 50 dB L_{dn} contour is more conservative than the Standard, however the application of the controls within, is not.

Low Predicted Complaint Burden

24 Mr Reeve concludes that there is not a strong link between aircraft noise levels and number of complaints. In my evidence in chief (paragraphs 64 – 71), I discuss how complaints do not relate to annoyance effects. The annoyance curves demonstrate the effects are experienced despite a lack of complaints. While individual persistent complainants are a burden on an airport authority's resources, they do not usually result in serious operational restrictions on the airport. Therefore, in my opinion, Mr Reeve's prediction of the likelihood of future complaints is not the key issue relating to reverse sensitivity effects.

25 As covered in my evidence in chief (paragraphs 75 – 92), reverse sensitivity effects resulting in operational restrictions have generally occurred when triggered by a planning process, or a change in operations where residents can collectively voice their annoyance and use the opportunity to instigate restrictions.

26 In these situations, the reasonableness of affecting large numbers of residents will likely be assessed in the present, with no account of the historical planning timeline. In a cost benefit analysis, the presence of more residents would increase the health cost. The greater the residential density, the greater the health cost adding weight to the case for operational restrictions. I note that Professor Clarke considers that cost benefit analyses should be carried out to compare the cost of annoyance against other societal costs so that trade-offs are made in a systematic way (paragraph 37 of his evidence). This supports my view that the potential for reverse sensitivity effects would be influenced by the size of population inside the noise contours.

Outer Envelope versus Annual Average Updated Contours

27 In my view, Mr Reeve over-simplifies the question of whether the Annual Average or Outer Envelope contour is appropriate from a noise effects point of view. He considers that because factors other than noise should be included in this decision, that this means the noise effects between the Outer Envelope and Annual Average contours are irrelevant and land use controls are unnecessary (paragraphs 21 and 55).

28 The question of whether land use controls inside the Outer Envelope 50 dB contour are necessary from a noise effects point of view, depends on what the goal is (i.e. are the controls necessary to achieve what outcome?).

29 Mr Reeve correctly identifies that the same overall noise exposure would occur for either option. The difference between the options is the size of the area where the policy to avoid new noise sensitive land use would apply. Ultimately the difference in outcome will be the number of people affected by aircraft noise (i.e. the scale of noise effects). If the goal is to manage or minimise the overall scale of aircraft noise effects, then land use controls inside the Outer Envelope Contour would better achieve this goal.

30 In summary, the difference between the two options from a noise effects point of view is the ultimate scale of noise effects resulting from the size of the population affected. The decision between the two options would certainly have a bearing on the scale of noise effects. Therefore, I do not agree with Mr Reeve's simplification of the matter that concludes controls in the Outer Envelope are unnecessary.

Professor Clarke

31 Professor Clarke's main conclusions and my summary responses are:

31.1 *The Updated Contours are bigger than they should be*;

The inputs to the updated noise contours have been prepared by a team of experts and peer reviewed by an independent team of experts and found to be appropriate for the Christchurch Airport context which includes a regular review period. The so-called 'absolute worst case' or 'stacked conservatism' in the Outer Envelope Contour is not unreasonable or significant as suggested by Professor Clarke and Mr Reeve.

31.2 *The 2018 WHO guidelines health related target (45 dB L_{den}) is lower than typical regulatory limits for aircraft noise*;

I agree, and it is not proposed to apply the WHO limit for CIA. It is proposed to continue using 50 dB L_{dn} which was previously determined to be appropriate for Canterbury.

31.3 *Aircraft noise annoyance has not increased and there is no data that warrants a change in aircraft noise policies*.

There is uncertainty over whether aircraft noise annoyance has increased, and which survey methods and annoyance curves are most accurate. There is no compelling evidence that aircraft noise annoyance has decreased. Determining whether or not annoyance has increased is not the key issue relating to mitigating the

scale of the effect. There will be uncertainty in any method selected to quantify annoyance effects. The key measure is the relative scale of effects of the various options.

32 I will expand on these matters further.

Noise Modelling Assumptions

33 One of Professor Clarke's main criticisms of the updated noise contours is that the aircraft fleet used for the modelling is not representative of the next generation of aircraft that will be operating when the airport is forecast to reach ultimate capacity (i.e. 2084).

34 Data for these aircraft is not available in the modelling software. It is Professor Clarke's view that next generation aircraft will likely be 5 dB quieter than current aircraft (paragraph 87) and that these will likely be a substantial part of the operating fleet in 2050 (paragraph 80).

35 My response to Professor Clarke's criticism of using available noise data (i.e. current fleet) to model ultimate capacity (circa 2084) is as follows:

35.1 It is not common practice to apply an overall quiet aircraft factor (e.g. a 5 dB discount) to future modelled contours;

35.2 Christchurch Airport's contours will be reviewed before 2050 at which time available data on next generation aircraft and altered air space management will be taken into account.

36 The inputs to the updated noise contours have been prepared by a team of experts and peer reviewed by an independent team of experts and found to be appropriate for the Christchurch Airport context which includes a regular review period.

37 Professor Clarke also describes the Outer Envelope as the 'absolute worst case' due to using the busy 3 month runway use as well as the busy 3 month peaking factor for aircraft movements plus a 10% climate change factor on the crosswind runway.

38 In practice the 10% climate change factor means the runway 29 usage was adjusted from 13% to 14.3% and commensurate reductions in runway use were applied to the main runway to balance the change. The movements on the crosswind runway were not all factored up by 10% as Professor Clarke implies. There were no extra movements added to the model, it is a very slight adjustment to the runway utilisation statistics.

39 With respect to using the highest recorded runway usage for each runway, it was identified in the modelling report (Volume 5) that the applied runway utilisation statistics are representative of typical 3 month utilisation in each runway direction and do not represent outliers.

40 The applied peaking factor for the busiest three months of aircraft movements, depends on the category of aircraft. For the main contributing categories (scheduled and freight movements) the peaking factors were 7% and 8% respectively. An 8% increase in movements represents 0.3 dB increase in noise.

41 In summary, I consider the assumptions applied to the Outer Envelope contours to model a busiest three month scenario for all areas are not extreme or unreasonable as characterised by Professor Clarke.

Applicability of the 2018 WHO guideline target

42 In paragraph 36 Professor Clarke states that the 2018 WHO guidelines target for aircraft noise (45 dB L_{den}) would protect the majority of the normal population from experiencing **any noise annoyance at all**. This is an overstatement as the relationship relates to high annoyance and does not include other response measures such as moderate annoyance. Also his discussion about the target level (equivalent to 45 dB L_{dn}) does not relate directly to the operative and proposed frameworks in Canterbury which use 50 dB L_{dn}.

Quantifying Aircraft Noise Annoyance

43 The main points Professor Clarke makes about quantifying annoyance are:

43.1 The annoyance curves cannot be used for the Outer Envelope;

43.2 The annoyance curve referenced by the 2018 WHO guidelines overstates annoyance;

43.3 Aircraft noise annoyance has not increased over time.

44 I have used the 2018 WHO guidelines annoyance relationship to quantify annoyance effects for the Outer Envelope Updated Contours. Professor Clarke states that dose response relationships based on 12 month exposure cannot be used for the Outer Envelope scenario. I accept that applying the curve to a three month exposure rather than 12 month exposure would likely increase the uncertainty of those predictions but I do not agree that it cannot be used.

45 In response to Professor Clarke's opinion that the 2018 WHO curve overstates annoyance, I consider that regardless which curve is used, the graph in Figure 5 of my evidence in chief would largely look the same but with different numbers on the vertical axis. It would still show that the increase in future annoyance due to the permitted increase in population is appreciable. Using a different annoyance curve would not change my conclusion that relaxing the current land use controls would increase this further.

46 Professor Clarke goes to some lengths to demonstrate why it cannot be said that aircraft noise annoyance has increased. He considers the difference in the various curves are due to the survey methods, response scales and sample selection. The two survey methods and the two response scales that have both been shown to influence the survey outcome are summarised in Table 1 below. Research shows that using face to face or phone call methods results in a lower annoyance prediction whereas using mail out method results in a higher annoyance prediction. The use of the 11 point scale or the 5 point scale also influences the results in this way.

Table 1: How Survey Methodology Influences Results

Survey Method	Face to face / phone call	Low Annoyance Bias
	Mail out	High Annoyance Bias
Response Scale	11 point numerical scale	Low Annoyance Bias
	5 point descriptive scale	High Annoyance Bias

47 In his evidence, Professor Clarke prefers the 2001 dose response curve[4] which was surveyed using both the low annoyance bias method and scale. When comparing any other curves, he adjusts the high annoyance bias down to align with the low annoyance bias methods and concludes there has been no change in annoyance. He concludes that no data has been presented that should warrant a change in today's policies regarding acceptable exposure limits for aircraft noise.

48 I accept that different survey methods and response scales appear to influence the results. However, Professor Clarke does not consider which method and response scale give more representative results. His assertion appears to be that the low annoyance bias methods are correct. Whereas, it is reasonable, in my view, to consider that respondents may be more honest when given time and anonymity to complete the survey and that a descriptive scale is more meaningful to respondents than a numerical one. I have

[4] Miedema & Oudshoorn (2001) Annoyance form transportation noise. Environmental health perspectives, 409-416

not researched this matter so do not know if there is a common view on which methods are best.

49 Regardless of whether true annoyance has increased or not, the fact that different survey methods yield different results does not necessarily make the high annoyance bias methods and results incorrect. If I adjust the 2001 curve up to align with the high annoyance bias methods then it shows 10% of people highly annoyed at 44 dB L_{dn}.

50 In summary, it is possible that annoyance hasn't increased, but it is also possible the 2001 study did not apply the best survey methods to achieve the most accurate results. There is no compelling evidence that aircraft noise annoyance has decreased.

Mr Styles

51 I have reviewed the evidence of Jon Styles for Kainga Ora. There are several technical matters in the evidence that I consider would be best addressed through expert noise conferencing, which I understand has been scheduled for later this week.

Dated: 21 February 2024

Laurel Smith