BEFORE INDEPENDENT HEARING COMMISSIONERS
APPOINTED BY THE WAIKATO DISTRICT COUNCIL

IN THE MATTER	of the Resource Management Act 1991 (**Act**)
AND	
IN THE MATTER	of hearing submissions and further submissions on the Proposed Waikato District Plan.
SUBMITTER	NZTE Operations Limited Submitter [No. 823]

EVIDENCE-IN-CHIEF OF LAUREL SMITH ON BEHALF OF NZTE OPERATIONS LIMITED

(ACOUSTIC)

Dated: 15 February 2021

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INTRODUCTION, QUALIFICATIONS AND EXPERIENCE

1 My name is Laurel Jean Smith. I am a consultant in the acoustical consulting practice of Marshall Day Acoustics Limited. I hold the degree of Bachelor of Engineering from Auckland University. For the past 18 years I have worked in the field of acoustics, noise measurement and control in New Zealand. My work has included noise control engineering work for various industries in New Zealand.

2 I have undertaken noise prediction and provided consulting advice on over eight airports in New Zealand. My work has involved noise calculations, computer modelling, noise boundary development, assessment of noise effects, recommending airport noise rules, development of sound insulation packages and noise monitoring.

CODE OF CONDUCT FOR EXPERT WITNESSES

3 I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2011. I have complied with it in preparing this evidence and I agree to comply with it in presenting evidence at this hearing. The evidence that I give is within my area of expertise except where I state that my evidence is given in reliance on another person's evidence. I have considered all material facts that are known to me that might alter or detract from the opinions that I express in this evidence.

BACKGROUND

4 I was engaged by NZTE Operations Limited (**NZTE**) in August 2018 to provide independent acoustic advice throughout the proposed Waikato District Plan (**pWDP**) process in relation to Te Kowhai Aerodrome (**Aerodrome**).

5 I confirm I have read the submission and further submission by NZTE, and the submissions that I refer to in this Evidence-in-Chief as they relate to my discipline.. I am also familiar with the national, regional and district planning documents relevant to the pWDP.

6 The Airfield is subject to the Te Kowhai Airpark Zone (**TKAZ**). The TKAZ, along with the operation of the Aerodrome, allows for the establishment of a

complimentary Airpark consisting of commercial and residential precincts (**Airpark**).

7 I was initially requested to peer review the Te Kowhai Airpark acoustic provisions in the pWDP including the acoustic technical report prepared by Hegley Acoustics Consultants Ltd (**HACL**). I found that the rolled over airport noise control boundary and associated rules did not align well with New Zealand Standard NZS 6805:1992 Airport Noise Management and Land Use Planning (**NZS 6805**)[1] and did not provide for current or future anticipated activity at the Airpark.

8 I have prepared alternative noise control boundaries based on the forecast future aircraft activity and recommended revised noise provisions for the Airpark that are more aligned with NZS 6805.

SCOPE OF EVIDENCE

9 The keys points addressed in my evidence are:

(a) NZS 6805 is the primary approach to managing airport noise and surrounding land use in New Zealand and is appropriate for the Aerodrome and Airpark.

(b) The notified pWDP airport Outer Control Boundary (**OCB**), Airpark Noise Buffer (**ANB**) and associated rules are missing key aspects of the NZS 6805 approach and in my view are inappropriate.

(c) The alternative noise control boundaries and amendments to the rules in the NZTE submission are, in my view, appropriate to replace the notified provisions and better achieve the objectives of NZS 6805. I have also recommended some additional night-time controls in this evidence.

(d) My assessment of noise effects from the NZTE alternative provisions shows the future aircraft noise levels would result in moderate but reasonable annoyance effects for occupants of existing dwellings with the potential for sleep disturbance effects on a small number of dwellings. To address this, I have recommended additional night-

[1] NZS 6805:1992 Airport noise management and land use planning.

time controls to manage sleep disturbance effects to a reasonable level should these activities be someday undertaken at the Aerodrome.

(e) Comments on submissions as they relate to my expertise.

(f) Comments on Section 42A report as it relates to my expertise.

NZS 6805:1992 AIRPORT NOISE MANGEMENT AND LAND USE PLANNING

10 NZS 6805 provides a recommended approach for territorial authorities dealing with airports and land affected by airport noise. The standard aims to manage the adverse effects of airport noise by:

(a) establishing compatible land use planning around an airport; and

(b) setting noise limits for the management of aircraft noise at airports.

11 NZS 6805 is used for all the major international and regional airports throughout New Zealand as well as many smaller airports and aerodromes to manage airport noise effects, through the implementation of its provisions in district plans.[2]

12 NZS 6805 recommends that airport noise boundaries be developed to control aircraft noise and land use. The noise boundaries are based on future noise contours[3] using the L_{dn} noise metric. L_{dn} is the day / night level which sums the 'noise energy' from each aircraft event with a 10 dB penalty for events that occur at night (10pm to 7am). The future noise contours are calculated to represent the average L_{dn} noise level from aircraft operations over the busiest three months for the forecast year. NZS 6805 recommends a minimum 10 year forecast of future aircraft operations. In practice, it is common to forecast for a 20 to 30 year planning horizon.

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2 Auckland, Christchurch, Wellington, Rotorua, Palmerston North, Nelson, Hawke's Bay, Kapiti Coast, Ardmore, Timaru, Taupo, Queenstown, Wanaka, Whenuapai, Whangarei, Dunedin, Invercargill, Tauranga, Marlborough, Hamilton, Gisborne, Omaka, Rangiora, Omarama, Waipukarau.

3 Airport noise contours are the calculated output from a noise model. These differ to airport noise boundaries which are included on district plan maps and are based on the predicted airport noise contours but may have been adjusted for other reasons, such as following parcel boundary lines, land features or airport property boundaries.

13 NZS 6805 recommends two boundaries, the ANB set at 65 dB L_{dn} and the OCB set at 55 dB L_{dn}. These boundaries are used to define noise limits and land use controls in the district plan rules.

14 The standard recommends that noise from aircraft operations shall not exceed 65 dB L_{dn} outside the ANB.

15 The land use controls recommended in NZS 6805 are:

Inside the ANB

(a) New noise sensitive uses (including residential) should be prohibited.

(b) Existing residential buildings and subsequent alterations should have appropriate sound insulation.

Between ANB and OCB

(c) New noise sensitive uses (including residential) should be prohibited unless a district plan permits such use subject to appropriate sound insulation.

(d) Alterations or additions to existing noise sensitive uses (including residential) should include appropriate sound insulation.

16 Overall, I agree with the approach set out in NZS 6805 and consider it an appropriate standard to manage the noise effects from airports including Te Kowhai Aerodrome. Regarding land use controls within the Airpark, I consider that the NZS 6805 recommendations are appropriate for regular residential accommodation but that relaxed controls would be appropriate for hanger home type accommodation for Aerodrome users within the Airpark.

REVIEW OF THE NOTIFIED pWDP AIRPARK PROVISIONS

17 I reviewed the notified pWDP provisions for the Aerodrome and the Airpark on behalf of NZTE. The following summarises my findings:

(a) The pWDP includes provisions for activities within the Aerodrome and the Airpark in Chapter 27 TKAZ.

(b) The TKAZ is divided into precincts to identify areas for operational, commercial and residential activity within the zone. The Te Kowhai Airpark Precinct Plan is in Appendix 9 of the pWDP.

(c) An OCB for the Aerodrome and an Airpark Noise Buffer are shown on planning map 26.2 in the pWDP. The OCB has been rolled over from the Operative District Plan (**ODP**). The Airpark Noise Buffer is a new feature proposed to control noise effects from aircraft taxiing in the Airpark.

(d) Acoustic insulation requirements for noise sensitive activities outside the TKAZ are set out in Chapters 22 (Rural Zone rules 22.3.7.3 and 22.3.7.4) and 24 (Village Zone rule 24.3.7) and Appendix 1 (section 3) of the pWDP.

18 The pWDP provisions are partially based on the NZS 6805 approach for managing airport noise effects. The provisions align with NZS 6805 in the following ways:

(a) the planning maps include an OCB for aircraft operations noise; and

(b) noise sensitive activities inside the OCB are required to be acoustically insulated.

19 However, in my view the provisions are inappropriate for the following reasons:

(a) noise from aircraft operations is not controlled by a limit;

(b) the OCB does not adequately provide for current or future aircraft activity at the Aerodrome; and

(c) noise from aircraft taxiing has been treated as a separate noise source rather than being included with aircraft operations noise.

20 Following my initial review, NZTE engaged me to calculate L_{dn} noise contours for future aircraft operations including taxiing around the Airpark. From these noise contours I have prepared alternative airport noise boundaries that reflect industry practice for aerodromes in New Zealand to replace the rolled over OCB and the Airpark Noise Buffer in the pWDP. I

have also recommended amendments to the pWDP noise rules to align more closely with NZS 6805 and industry practice. These changes were included in the NZTE submission on the pWDP[4] and are summarised in this evidence.

NZTE'S SUBMISSIONS

21 Among other matters, the NZTE submission seeks to:

(a) Increase the size of OCB and add an ANB for the Aerodrome and Airpark which includes taxiing noise and reflects future aircraft operations.

(b) Remove the Airpark Noise Buffer shown on Map 26.1 and the associated rules.

(c) Add a noise limit for aircraft operations based on the revised OCB and ANB.

(d) Define the activity status for new noise sensitive activities inside the ANB as non-complying except activities associated with the Airpark.

(e) Retain the pWDP acoustic insulation standards for new noise sensitive activities inside the OCB and add a figure showing the Te Kowhai Aerodrome future noise contours in 2 dB increments for the purpose of designing acoustic insulation.

22 I discuss these matters in more detail in the following sections of my evidence.

ALTERNATIVE NOISE CONTROL BOUNDARIES

23 The OCB in the pWDP has been rolled over from the ODP without any review or assessment. The acoustic technical report by HACL (Appendix 3 of the Section 32 report) specifically excludes assessment of the Aerodrome noise control boundaries. The HAC assessment is limited to noise from aircraft taxiing around the Airpark and commercial activities.

[4] Submission number 823.

24 In his assessment, Mr Hegley treated taxiing as a separate noise source rather than including it with aircraft operations noise. This is understandable given the limited scope of his assessment and the small size of the OCB that was rolled over. However, in my review of the pWDP provisions, I found that the rolled over OCB does not represent future aircraft activity at the Aerodrome and is even too small to represent current aircraft activity at the Aerodrome. Therefore, to implement the NZS 6805 principles and provide for future use of the Aerodrome, the noise boundaries should be updated. Doing this provides an opportunity to include taxiing noise in the noise control boundaries rather than the proposed separate Airpark Noise Buffer and associated rules.

25 Annual aircraft movements at the Aerodrome for the last three years have been 6,323 in 2017, 8,061 in 2018 and 9,925 in 2019. 2020 saw a drop in movements to 5,012 due to COVID 19. Historically, the Aerodrome was busiest in 2008 when the annual number of movements was 14,537. NZTE undertook a forecasting exercise to look at historic movement data and project the potential level of future aircraft activity once the Airpark is established. This future forecast and rational is set out in the evidence of Mr Dan Readman of NZTE.[5] This involved low, medium and high growth forecasts. NZTE selected the medium growth forecast for the noise modelling which projects 19,645 annual movements. I understand from Mr Readman that this is a 10 to 20 year planning horizon which is in accordance with NZS 6805. To allow for the busiest three-month period, as recommended in NZS 6805, I have added 30% peak period factor to the annual forecast. This is based on actual movement data from 2017 and 2018[6] which shows the busiest three-month average is 30% greater than the annual average.

26 The inputs to the noise model are detailed in my consultant advice note, dated 18 October 2018 (**Advice Note**) included with the NZTE submission of Stage 1 of the pWDP and appended to this evidence as **annexure A**. The calculated future noise contours are shown in Figure 1 of the Advice Note. Figure 2 shows OCB and ANB that I recommend replace the OCB in the pWDP. These boundaries represent the contours in Figure 1 except the

5 Evidence in Chief of Dan Readman paragraph 46.
6 Aircraft movement data is collected by AIMM Automated Intelligent Movement Management.

hook on the south side of the OCB has been straightened to follow the Airpark property boundary. This is a minor adjustment which serves only to simplify the shape. It would not alter the potential noise exposure or land use controls for any receiving properties.

27 In my opinion, the recommended OCB and ANB shown in Figure 1 should replace the pWDP OCB as they would better provide for the current and forecast future activity at the Aerodrome and Airpark and properly aligns with industry practice in accordance with NZS 6805. Although NZS 6805 does not explicitly include taxiing noise, in my view noise from aircraft landing, taking off and taxiing should be included in the calculation of the OCB and ANB. Including taxiing in the OCB and ANB removes the need for the separate Airpark Noise Buffer shown in the pWDP, therefore this should be removed if my recommended OCB and ANB are adopted.

RULE AMENDMENTS

28 If the pWDP OCB and Airpark Noise Buffer are replaced with my recommended OCB and ANB, then I recommend the following amendments to the pWDP rules:

(a) The noise limits and land use controls associated with the Airpark Noise Buffer should be removed.

(b) A noise limit for aircraft operations should be added. There is no applicable noise limit on aircraft using the Aerodrome in the pWDP meaning there is nothing stopping uncontrolled growth of aircraft activity and resulting noise. The two management measures recommended by NZS 6805 are land use controls and aircraft noise controls. These measures are co-dependent, and both need to be implemented to manage the effects of aircraft noise. In my view, aircraft noise should be limited, and it is important that the limit adequately provides for a reasonable future growth of activity at the Aerodrome. Therefore, if my recommended OCB and ANB are adopted, then a new rule requiring noise from aircraft operations to comply with the limits at these boundaries should be added. My recommended text to replace Rule 27.2.7 in the pWDP is set out in the Advice Note to annexure A of my evidence.

29 The pWDP sets out acoustic insulation standards for new noise sensitive activities inside the OCB but not inside the ANB as there is no ANB in the pWDP. NZS 6805 recommends new noise sensitive activities inside the ANB are prohibited and between the OCB and ANB they are either prohibited or permitted subject to acoustic insulation.

30 The NZTE submission seeks to:

(a) make new noise sensitive activities inside the ANB non-complying except activities associated with the Airpark; and

(b) any new noise sensitive activities between the OCB and ANB permitted subject to acoustic insulation standards.

31 In my view, while not as restrictive, the non-complying activity status inside the ANB still aligns with the NZS 6805 recommendation as any new noise sensitive activity will be required to meet the relevant tests in order to obtain consent for a non-complying activity. Between the OCB and ANB, NZS 6805 recommends that noise sensitive activities may be permitted subject to acoustic insulation, according with NZTE's submission. This approach aligns with the Hamilton Airport provisions. This approach provides a balance between managing the effects and not restricting property rights.

32 I consider that the NZS 6805 recommendations are appropriate for regular residential accommodation in all zones. For specialised accommodation such as hanger homes for Aerodrome users within the Airpark, it would be reasonable for these to be located at higher noise levels in my view. I discuss this further in paragraphs 102 – 105 of my evidence.

ASSESSMENT OF NOISE EFFECTS

33 The larger OCB and ANB I have recommended represent a change in aircraft noise for the surrounding community compared with current activity at the Aerodrome. I have assessed the noise effects of this change by calculating current noise contours using the 2019 aircraft movement numbers.

34 In 2019, the aircraft activity at the Aerodrome reached 9,925 annual movements. I note that historically 2008 was the busiest year since recording began, with 14,537 movements, showing that the Aerodrome usage fluctuates year to year. The future forecast includes 19,645 annual movements which is approximately a doubling of the 2019 number of movements and a 35% increase on 2008 movements. Figure 5 appended to this evidence **as annexure B** shows the calculated 2019 noise contours compared with the future noise contours. The two models have different numbers of aircraft movements but also different proportions of aircraft types.

35 Using aerial imagery and LINZ building footprint data, I have identified 54 buildings that appear to be dwellings within the future 55 dB L_{dn} contour. Using the current and future noise contours in one decibel increments, I have determined the current and future noise level at each of these dwellings and from this calculated the increase in noise exposure predicted to occur over 10 or more years. The results are summarised in the tables below.

Predicted Current and Future Noise Levels

Noise Level dB L_{dn}	Number of Identified Dwellings	
	2019	Future Contours
55 – 59	0	49
60 – 64	1*	4
65 - 69	0	1*

* Belongs to Readman Family (partial owners of NZTE)

Table 1: Predicted current and future noise levels.

Predicted Change in Noise Level

Increase in Noise Level (dB L_{dn})	Number of Identified Dwellings	Subjective Response to an Immediate Change
5 - 6	2	Noticeable change
7 – 8	35	Appreciable change
9	17	Significant change (twice as loud)

Table 2: Predicted change in noise level.

36 Tables one and two show that currently only one dwelling is affected by aircraft levels greater than 55 dB $L_{dn.}$ This property belongs to BM and SJ Readman who were previous part owners of Te Kowhai runway and support the NZTE submission. Under the proposed future scenario this would increase to 54 dwellings, 49 of which would receive levels of 55 – 59 dB L_{dn}, another four dwellings would receive 60 dB L_{dn} and the Readman dwelling would receive 69 dB L_{dn}.

37 Table 2 shows the change in L_{dn} noise level by comparing the current and future noise at each dwelling inside the future 55 dB L_{dn} contour (or revised OCB). The predicted increase ranges from 5 to 9 decibels with most dwellings expected to experience a 7 to 8 decibel increase. The typical subjective impression of an 8-decibel change, when receivers experience it immediately, is that the increase is appreciable. A 9 to 10 decibel increase subjectively sounds twice as loud and is considered to be a significant increase. In practice, the increase in aircraft noise would occur gradually over more than 10 years so the subjective impression would not be so stark. Nonetheless, the future noise contours represent a noticeable to significant increase in aircraft noise exposure for the community compared with current aircraft noise levels.

38 The noise associated with airports has historically caused annoyance in surrounding communities. International research has endeavoured to analyse and develop noise metrics to help understand the complex relationship between community response and aircraft noise. Aircraft noise is different to a number of other environmental noise sources as it consists of a series of short duration intermittent noise events at moderately high noise levels (depending on proximity) with periods without noise in between.

Annoyance due to aircraft noise is influenced by many factors including, but not limited, to:

(a) How loud the noise is.

(b) How long the noise lasts for.

(c) How many times the noise occurs in a day/month/year.

(d) The time of the noise event (i.e. daytime vs. night-time).

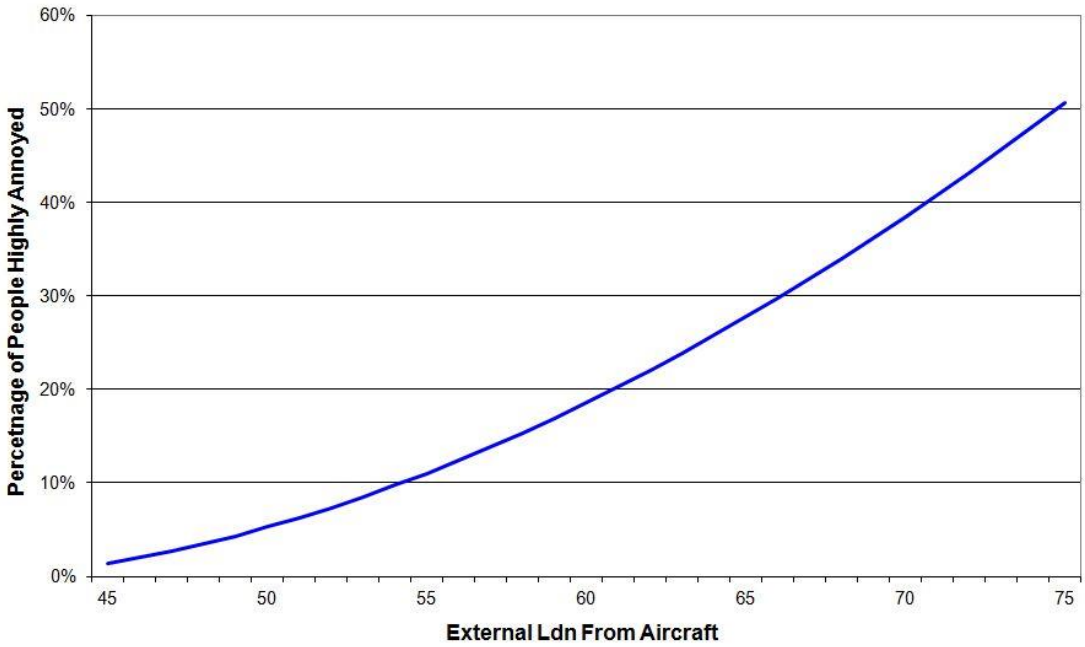
(e) The frequency (or pitch) of the noise.

(f) Whether there is a change to the noise source.

(g) The receiver's attitude to the noise source.

39 No single noise metric can account for all of the factors that influence annoyance. Many studies have been carried out to determine the general relationship between aircraft noise levels and community annoyance. The most widely used and recent amalgamation of the various airport noise studies was carried out by Miedema and Oudshoorn in 2001[7]. The Miedema and Oudshoorn relationship is shown in the **Figure 1** below.

[7] Miedema and Oudshoorn (2001); "Annoyance from Transportation Noise: Relationships with Exposure Metrics DNL and DENL and Their Confidence Intervals".



40 ***Figure 1: Miedema and Oudshoorn Aircraft Noise Annoyance Curve.***The relationship can be used to estimate community response for a given noise level (L_{dn}). For example, at 55 dB L_{dn}, 11% of the population are likely to be highly annoyed and at 65 dB L_{dn}, 28% of the population are likely to be highly annoyed. This aligns reasonably well with the NZS 6805 recommendations that below 55 dB L_{dn} is suitable for residential activity and above 65 dB L_{dn} is not. Between these levels, there are moderate effects, and an appreciable proportion of the community will be highly annoyed, however the majority will not. Between 55 and 65 dB L_{dn}, NZS 6805 recommends avoiding residential intensification or at least mitigating some of the effects through acoustic insulation.

41 I have used the above Miedema and Oudshoorn relationship to estimate the number of people inside the recommended OCB and ANB likely to be highly annoyed based on the future noise contours. The table below summarises the number of existing dwellings inside the recommended OCB and ANB and the predicted number of people highly annoyed.

Noise Level (dB L_{dn})	# Existing Houses	# People Highly Annoyed
55 - 59	49	17
60 - 64	4	2
65 - 69	1	1

Table 3: Predicted annoyance effects.

42 The one property inside the ANB belongs to BM and SJ Readman who, as discussed above, were previous part owners of Te Kowhai runway and support the NZTE submission.

43 NZS 6805 recommends that existing dwellings exposed to 65 – 70 dB L_{dn} should be provided with acoustic insulation however the standard does not recommend acoustic insulation for existing dwellings between 55 and 65 dB L_{dn}. The approach to airport funded acoustic insulation varies throughout New Zealand. No airports provide acoustic insulation between 55 and 60 dB L_{dn}. Between 60 and 65 dB L_{dn} some larger commercial airports provide partially funded ventilation systems whereas others do not. Hamilton Airport has an acoustic mitigation programme for existing dwellings affected by night-time jet movements, but insulation is not otherwise provided between 55 and 65 dB L_{dn} at Hamilton Airport. If a consistent approach is taken for the Aerodrome in accordance with NZS 6805, and BM and SJ Readman support the NZTE submission, then an acoustic insulation programme for existing dwellings is not required.

44 I have also considered the effects of night-time aircraft activity on the surrounding community. The Aerodrome does not currently have runway lights to enable movements between evening and morning civil twilight (except search and rescue and emergency landings) however the installation of runway lights may occur in the future. In noise terms, night-time is usually defined as 10pm – 7am. I note that in summer, morning civil twilight is earlier than 7am (as early as 5:20am) therefore aircraft movements can and do take place prior to 7am.

45 I have been informed by Mr Readman that of the small number of aircraft that may operate at night in the future (if any), the types of aircraft activity

between 10pm and 7am would mainly be privately owned aircraft. Some private owners may need to depart prior to 7am to reach destination airports at the required time, and some private aircraft require a night landing having flown most of their journey during daylight hours. However, data shows that these arrivals are more likely to occur between 8pm and 9pm rather than after 10pm. To provide certainty, NZTE now proposes a rule that disallows circuit training between 10pm and 7am (i.e. not included in NZTE's submissions).

46 The L_{dn} noise metric includes a weighting on night-time aircraft movements between 10pm and 7am treating these as having 10 times the impact as movements between 7am and 10pm. At night-time, high single event levels from individual aircraft events can cause sleep disturbance and NZS 6805 recommends that single event levels between 10pm and 7am be considered when establishing the ANB. The standard recognises that individual aircraft noise events at night may result in sleep disturbance effects that are not adequately managed using the night weighted sound exposure metric $L_{dn.}$ However, the standard falls short of specifying a suitable metric or limit.

47 The future L_{dn} contours for Te Kowhai do not include aircraft movements at night-time (10pm – 7am) however this does not mean night movements are prevented from taking place. It simply means that in the calculation of L_{dn} levels, for compliance, each night movement would be equivalent to 10 day-time movements. For example, the future noise model includes an average of 70-day time movements per day (35 arrivals and 35 departures). This is equivalent to 3 night-time and 5 daytime arrivals and 3 night-time and 5 daytime departures. So, in theory, the recommended future noise boundaries would allow an average of 3 arrivals and 3 departures every night but in practice this is unlikely to occur as it would severely restrict the allowable day time movements, which NZTE is unlikely to be able to operationally accommodate.

48 When calculating compliance with the L_{dn} noise boundaries, aircraft movements are averaged over 3 months. This means that on any one night there could be more than 3 arrivals and 3 departures without overly restricting day time movements. To comply with the L_{dn} limit over 3 months,

a busy night would need to be balanced by nights with no aircraft movements.

49 To understand the likely prevalence of night-time movements at the Aerodrome, I have considered recent statistics from similar airports, including Te Kowhai. The data shows that on average the percentage of night-time movements ranges from 0.3% to 2.2% of total movements.[8] At Te Kowhai the figure was 0.3%.

50 Noise from individual aircraft events can be quantified using the sound exposure level (L_{AE} or SEL) or the maximum level (L_{Amax}). L_{Amax} is the maximum noise level occurring during the aircraft noise event. L_{AE} is the noise level of one second duration that has the same total sound energy as the aircraft noise event. L_{AE} takes into account the level and duration of an event.

51 The findings of international studies generally relate sleep disturbance effects from aircraft flyovers to either the L_{AE} (also referred to as SEL) or L_{Amax} noise level in the bedroom. Marshall Day Acoustics has previously recommended that the outdoor 95 dB L_{AE} contour be used to delineate the area where night-time single event noise levels could result in significant sleep disturbance effects. This approach has been adopted at many New Zealand airports where night-time single event levels are controlled.[9]

52 I have calculated 95 dB L_{AE} noise contours for individual aircraft movements at the Aerodrome. The most prevalent and noisy aircraft in the future noise model is a generic single engine variable pitch propeller aircraft (GASEPV). This aircraft has been used to represent the range of different piston engine propeller aircraft anticipated to use the Aerodrome. The Cessna 206 is included in the model to represent commercial users such as parachute and crop-dusting services. These two aircraft are the loudest included in the future model and I have overlaid their 95 dB L_{AE} contours for take-offs in each direction. This is shown in Figure 6, appended to this evidence as **annexure C**. The landing contours are much smaller than the take-offs and do not affect any dwellings other than the Readman family house. 12

[8] 2018 – 2019 statistics for Hokitika, Wanaka, Matamata, Motueka, Parakai and Te Kowhai movements between 9pm and 7am provided by AIMM Automated Intelligent Movement Management.

[9] Rotorua, Christchurch, Nelson, Hamilton.

dwellings plus the Readman dwelling are inside the worst case 95 dB L_{AE} contour. For any one departure (i.e. one aircraft type in one direction), up to 6 dwellings are inside the 95 dB L_{AE} contour.

53 The methods for managing sleep disturbance effects at airports around New Zealand vary depending on the frequency and timing of the events. Some airports operate with partial night-time curfews to provide for late night and early morning passenger services while giving residents certainty during the middle of the night. Other airports such as Hamilton are required to insulate existing houses inside the 95 dB L_{AE} contour if frequent night operations occur. At the majority of New Zealand airports, some degree of night operations are permitted and may be controlled by single event noise limit or time restriction.

54 For the Aerodrome, regular night-time movements are not proposed but infrequent arrivals and departures may occur between 10pm and 7am. I predict the single event noise levels from arrivals would be reasonable. I do not, therefore, consider that controls on night-time arrivals are necessary. For departures, the single event noise levels for some aircraft would exceed the 95 dB L_{AE} threshold and I recommend restricting the number of night-time departures to manage potential sleep disturbance effects.

55 In my view an average of 3 night-time departures per week would be reasonable. Busier weeks would be acceptable if balanced by less busy weeks which would allow for the variability typical of general aviation airfields like Te Kowhai. Therefore, I recommend controlling sleep disturbance effects with a rule limiting night-time departures between 10pm and 7am to not more than 40 over any 3-month period. The 3-month assessment period aligns with the L_{dn} averaging period and is a pragmatic approach that is manageable and provides residents with certainty around night-time flying.

COMMENTS ON SUBMISSIONS

56 I note there are many submissions in support of the Airpark as well as those in opposition and others seeking changes to the Airpark provisions. In the following paragraphs I address those submissions that specifically mention noise matters.

57 Submitters 941 and 987 (Te Kowhai Community Group and Mr Graham McBride) opposed the Te Kowhai Airport Obstacle Limitation Surface for reasons including "*No proposed limitation about noise abatement, hours of flying, night flying, duration and frequency of flights and scope and scale of future activities*". I agree the pWDP is deficient as it lacks a limit on noise from aircraft using the Aerodrome. The NZTE submission seeks to add a noise limit in accordance with NZS 6805. Further to this, NZTE proposes additional restrictions on night-time circuit training and night-time departures. In my view this suite of controls will appropriately address the deficiency in the pWDP.

58 Submitter 664 (Waikato Regional Airport Limited (**WRAL**)) in its further submission, supports the NZTE submission relating to Rules 24.3.7 and 16.3.12. However, WRAL seeks a minor re-wording of the rules. I find the WRAL requested re-wording is still unclear as the Aerodrome does not have an SEL 95 Boundary. Also, I consider that "or" should replace "and" because insulation is required for Noise Sensitive Activities inside any one of the listed boundaries. I suggest the following wording would offer more clarity:

> *Construction, addition to or alteration of a building containing a Noise Sensitive Activity located within either the SEL 95 Boundary or the Outer Control Boundary of Hamilton Airport or Te Kowhai Airfield must achieve the internal design sound levels set out in Appendix 1 - Acoustic Insulation.*

59 Submitter 304 (Taylor) has requested the addition of a night-time curfew between 10pm and 7am on general aviation and recreational flying at the Aerodrome. NZTE proposes a restriction on circuit training between 10pm and 7am and I support this. I have assessed the night-time effects of take-offs and landings in this evidence (at paras 44 to 55). Regular night-time operations are not anticipated. However, it is proposed to provide for occasional late-night arrivals and early morning departures between 10pm and 7am. In my assessment, I found that night-time arrivals would not exceed the sleep disturbance threshold of 95 dB L_{AE} at existing dwellings therefore no control on arrivals is warranted. To manage the effects of night-time departures I recommend setting a limit of 40 departures between 10pm and 7am over three months (an average of 3 per week). In my view

this would provide both flexibility for Aerodrome users and certainty for residents that night-time operations would be managed to a reasonable level.

60 Submitter 923 (Waikato District Health Board (**WDHB**)) seeks an amendment to rules 27.2.6 and 27.2.7, the noise rules in the TKAZ (Chapter 27). I do not agree with any of the amendments sought to these rules. The WDHB amendments do not provide for aircraft operations and construction as permitted activities with appropriate noise standards. Also as previously mentioned, I recommend that noise from aircraft taxiing is included as aircraft operations noise therefore any specific reference to noise from aircraft movements on taxiways should be removed.

61 Submitter 831 (Parson) has requested that general residential zone noise limits in rule 16.2.1.1 be applied to "*activities affecting Residential Zones, such as airfields*". General noise limits are not appropriate for controlling aircraft noise. NZS 6802 specifically states that flight operations associated with airports is outside the scope of the general noise standard. NZS 6805 is the correct standard to apply to this type of activity. In my opinion, noise from aircraft using airfields should be managed using the approach in NZS 6805. I, therefore, do not agree with this submitter's request to apply general noise provisions to airfields. With respect to the Aerodrome, the NZTE submission seeks to amend the pWDP provisions to better align with NZS 6805.

62 Submitter 602 (Metcalfe). This submission is responded to as follows:

(a) <u>Section 9.2.1. The submitter seeks to add specific performance standards including Management Plan based on Fly Neighbourly principles, Hours of Operation, Maximum Aircraft Movements.</u> I support Fly Neighbourly principles and believe they should be adopted by airfields and the users. However, I rely on planners with respect to whether it is appropriate to include this as a policy for the Aerodrome. NZS 6805 provides an appropriate approach to managing noise from aircraft operations that does not require hours of operation and maximum number of movements to be defined. The standard does provide scope for territorial authorities to impose additional controls where appropriate. In this evidence, I have

addressed the noise effects and I have recommended some additional controls to manage night-time effects. However, I do not consider that reduced hours of operation or a limit on total movements needs to be defined in the pWDP to manage the noise effects at the Aerodrome.

(b) Section 24.3.6.7 Building Airport Noise Outer Control Boundary. The submitter seeks to amend the rule to clearly state it applies within the Airport Noise Outer Control Boundary only. I agree with this amendment.

(c) Section 27.1.1 Activity Status Table. The submitter seeks to define flight training school and circuit training as non-complying activities. Noise from circuit training has been included in the future noise contours I calculated for the Aerodrome. This activity is predicted to make up approximately 23% of movements. I understand circuit training is a fundamental activity at a general aviation aerodrome and that circuit training has taken place at the Aerodrome for many years. Circuit training is not just a commercial flight school activity. Private users, aeroclub members and small scale recreational training programmes also undertake circuit training. I do not agree with defining circuit training at the Aerodrome as non-complying.

(d) Section 27.2 Land Use – Effects. The submitter seeks to include a requirement for an Airpark Management Plan, stipulate hours of operation to limit night flying, stipulate a maximum number of aircraft movements being 21,000 per annum. I support the concept of an Airpark Management Plan. In this evidence, I have addressed the noise effects and I have recommended some additional controls to manage night-time effects. However, I do not consider that reduced hours of operation or a limit on total movements needs to be defined in the pWDP to manage the noise effects at the Aerodrome.

(e) Sections 27.2.6 and 27.2.7. The submitter seeks to include the Village Zone as a receiving location where the noise limits apply. I agree in principle that the noise limits should also apply at the Village Zone but note I have recommended some changes to these rules also.

(f) Further Submission. The submitter opposes the NZTE submitted airport noise control boundaries due to uncertainty on the nature, scale and operation of the Airpark and how adverse effects can be appropriately managed. In this evidence, I have addressed the noise effects and recommended additional controls to manage night-time effects specifically. With respect to the effects on the Metcalfe property (Lot 2 DP 456538) I previously prepared an advice note (7 March 2019) describing the acoustic insulation requirements that would be required for new dwellings on the Metcalfe site. The property is a large site that lies between the revised future 55 and 60 dB L_{dn} contours for Te Kowhai Aerodrome. The likely acoustic upgrades amount to providing a domestic ventilation system for habitable rooms and upgrading wall and ceiling linings in habitable rooms to 13mm plasterboard. The existing two dwellings on the property sit at 55 and 60 dB L_{dn} therefore the future annoyance effects are predicted to be 11% and 19% of people highly annoyed at these dwellings respectively. Annoyance effects on future residents are predicted to range from 11 to 19% of people highly annoyed. One of the existing houses on the Metcalfe property is impacted by the 95 dB LAE contour used to identify sleep disturbance effects, however most of the property is not. In my opinion, the proposed additional controls on night-time operations would manage sleep disturbance effects on the existing dwelling and the rest of the site to a reasonable level. In summary, future residents would be subject to moderate but reasonable noise effects and the cost of building new houses would be moderately increased due to the acoustic insulation requirements.

63 These effects are considered with in line with other existing airports and aerodromes in New Zealand and the mitigation measures proposed are acceptable in my opinion.

64 Submitter 369 (Ranby / Watson) opposes Chapter 9.2 and Chapter 27 for reasons including the lack of controls or limits on aircraft noise. I agree the pWDP is deficient, as it lacks a limit on noise from aircraft using the Aerodrome. The NZTE submission seeks to add a noise limit in accordance with NZS 6805. Further, NZTE proposes additional restrictions on night-time

circuit training and night-time departures. In my view this will appropriately address the deficiency in the pWDP.

SECTION 42A REPORT

65 In the Section 42A report the planning officer recommends several changes to the airport noise and land use control provisions sought by NZTE for the Aerodrome. The Section 42A recommendations that I disagree with are as follows:

(a) Alternative noise boundaries based on 15,000 annual movements as modelled by Tonkin and Taylor.

(b) A rule limiting the number of annual movements to 15,000.

(c) A rule defining the operational hours of the Aerodrome to be 7am to 10pm.

(d) A rule excluding engine testing between 10pm and 7am.

(e) Non-complying status of circuit training and a flight school.

(f) Non-complying status of activities sensitive to noise inside the ANB within the TKAZ.

(g) A rule requiring noise from aircraft operations to comply with the 55 and 65 dB L_{dn} limits at the OCB and ANB respectively within the TKAZ.

(h) Increased frequency of compliance modelling and monitoring.

66 I'll address each of these points in the above order.

Smaller noise boundaries

67 The planning officer has recommended that noise from aircraft operations should comply with smaller noise control boundaries than those submitted by NZTE. The smaller noise boundaries would provide for 10 years of projected growth at the Aerodrome. I do not support the smaller boundaries based on a 10-year projection.

68 Tonkin and Taylor was requested to calculate the alternative noise control boundaries based on 15,000 annual movements. I have reviewed the Tonkin and Taylor documents appended to the Section 42A report. Table 4 of **annexure D** to my evidence summarises the differences between my noise model (submitted by NZTE) and Tonkin and Taylor's model. Some of the different model inputs have little impact on the size of the contours so in the table I have described the significance of each difference.

69 The differences are that the Tonkin and Taylor contours have fewer movements, use a smaller peak 3-month factor, do not include taxiing, and use different aircraft types. The smaller peak 3-month factor would make a negligible difference to the size of the contours. The different aircraft types used in the Tonkin and Taylor model are reasonable, and I do not oppose these. Contrary to the Tonkin and Taylor report, I have found that noise from aircraft taxiing does have a small influence on the size of the contours within the Airpark. In my view, it would be inappropriate to exclude taxiing when calculating the noise boundaries if taxiing is to be included for compliance. This matter would be resolved if noise from aircraft operations is not required to comply with the OCB and ANB within the TKAZ. Taxiing does not affect the location of the boundaries outside the Airpark. The main difference affecting the size of the Tonkin and Taylor contours is fewer movements. The Marshall Day Acoustics model is based on 19,645 annual movements with a peak 3-month factor of 30% (i.e. 70 movements per day). The Tonkin and Taylor model is based on 15,000 annual movements with a peak 3-month factor of 22% (i.e. 50 movements per day).

70 The planning officer considers the Tonkin and Taylor noise boundaries are more appropriate than the Marshall Day Acoustics ones for two reasons (para 523):

(a) 33 fewer properties would be affected by the Tonkin and Taylor OCB; and

(b) The Tonkin and Taylor contours are based on 15,000 annual movements which represents 10 years growth which aligns with the life of the district plan.

71 I note that of the 33 properties affected by the Marshall Day Acoustics OCB but not the Tonkin and Taylor OCB, 13 properties are only just touched by the Marshall Day Acoustics OCB and in practice there would be no impact on development within these properties. At some New Zealand airports, noise boundaries have been drawn around property boundaries where appropriate to clearly distinguish where land use controls apply. I do not oppose this approach in concept.

72 The question of how much aircraft activity should be provided for in the pWDP requires consideration of many factors and NZS 6805 provides some guidance on these.

73 The planning officer has recommended that growth of aircraft operations at the Aerodrome should be limited to 10 years growth as this aligns with the period of time before the pWDP is reviewed. She has referenced the growth projection graph in Appendix 13 of the Section 32 report which forecasts 15,000 annual aircraft movements in the year 2031 and based on this, she recommends that growth of aircraft operations should be limited to 15,000 annual movements. The graph shows that the Airpark would not be fully developed in 2031 with only half the number of potential hangers built. The Appendix 16 report states that the projected 21,000 annual movements with 200 hangers is conservative as there is no guarantee the Airpark will reach full capacity.

74 The planning officer states (paragraph 754) that in her opinion 21,000 annual aircraft movements are not an appropriate number in a permitted activity rule that applies to the planning timeframe of the pWDP. The planning officer has mistakenly assumed that my contours are based on 21,000 annual movements. This is understandable, as I did not specify otherwise in my consultant advice note included in the NZTE submission. As set out in paragraph 39 of this evidence, the future contours were based on 19,645 annual movements with a 3-month peak factor of 30%. This number of annual movements is projected to occur with the Airpark partially developed (< 150 hangers) in approximately year 2039. Therefore, NZTE has not sought noise boundaries for the maximum projected aircraft movements, but rather a moderate growth scenario.

75 The main reason the planning officer has recommended smaller noise boundaries based on 15,000 annual movements is that this growth projection aligns with the 10-year life of the district plan. In paragraph 755 she states that if the number of aircraft movements were to exceed this, the plan still provides a consenting path where effects on amenity can be assessed and conditions imposed if need be.

76 I have no planning expertise. However, I do have 18 years' experience working on airport noise and land use management throughout the country. I have undertaken many NZS 6805 assessments where noise from an airport changes and this impacts on residential activity in the vicinity. In some cases, the residential activity was recently developed. The life of an airport is far greater than 10 years, as is the life of residential dwellings. In my view, restricting an airport to 10 years growth and promoting noise sensitive development in the vicinity is inviting a conflict in 10 years' time. Rather than providing more certainty, I consider a 10-year planning horizon for an airport results in less certainty for both the airport and surrounding landowners. In practice, seeking a resource consent in the future to increase aircraft movement numbers without updating the planning maps or airport rules does not seem efficient or practicable.

77 I note that the Aerodrome and Airpark are essentially private use in contrast to a regional airport providing a service for the wider community. Therefore, the balance of benefits to the wider community is not the same. The Aerodrome is an established facility that provides for the aviation community. I, therefore, consider it is appropriate to protect the long-term future of the facility. I also consider it is appropriate to protect potential future residents in future neighbouring developments from an almost inevitable expansion of the noise boundaries in as little as 10 years' time. NZS 6805 recommends a minimum of 10 years growth should be allowed for but, in my experience, 10 years is too short and a longer planning horizon provides more long-term certainty for an airport and landowners alike.

78 In summary, I do not support the Tonkin and Taylor noise boundaries for the Aerodrome for the following reasons:

(a) The projected number of movements in the Tonkin and Taylor model does not sufficiently provide for the long-term future of the Aerodrome or the fully developed Airpark.

(b) 15,000 annual movements would provide for only half of the projected number of aircraft to be hangered at the Airpark

(c) I consider that a 10-year planning horizon for an airport is too short

(d) Taxiing is not included in the Tonkin and Taylor model which could cause an unintended compliance issue if aircraft noise is required to comply within the TKAZ.

Cap on annual aircraft movements

79 In addition to smaller noise boundaries, the planning officer recommends a rule that restricts the number of aircraft movements to 15,000 per annum. For the reasons discussed above and the additional reasons below, I do not support this.

80 NZS 6805 provides scope for a Territorial Authority to include additional controls to provide a higher level of protection (for an airport and/or the community) where appropriate. In practice, additional controls could include more stringent land use controls or controls on aircraft operations. Many airports in New Zealand have additional controls to manage specific effects such as night-time movements, particularly loud aircraft and circuit training during sensitive times. These have been addressed at some airports on a case-by-case basis with additional controls such as time restrictions, single event noise limits and maximum number of movements. However, I am not aware of any airport that has an overall cap on annual number of movements as an additional control to the noise boundaries.

81 The Tonkin and Taylor report[10] mentions that for general aviation aircraft the number of movements has been shown to be a controlling factor of the noise disturbance and that controls using both noise boundaries and caps on movement numbers are often used for small airfields / aerodromes. There are no references given in the Tonkin and Taylor report for either of these

[10] Section 5 Additional Controls.

statements. Also, I note that Tonkin and Taylor does not recommend any additional controls such as an annual cap as being necessary for the Aerodrome. The planning officer has decided that a limit on annual aircraft movements is appropriate based on the 10-year life of the district plan rather than an objective measure of noise impacts relating to the number of movements.

82 I am aware of research relating community annoyance with number of aircraft movements above a certain noise level particularly at smaller airports[11]. This research, which was completed in 1997, does not propose a control method based on aircraft movements as an alternative to the noise exposure method used extensively worldwide. As far as I am aware, the concept has not been progressed or adopted by environmental noise agencies or other researchers. Whereas the noise exposure approach (using Ldn, Lden, ANEF) continues to be referenced and applied internationally for airport noise assessment.

83 In Australia, "Number Above" contours are prepared to supplement airport noise effects assessments. The Number Above contours show the projected number of aircraft movements above a certain level (usually 70 dB L_{Amax}). Contours showing the number of events above 70 dB are plotted to represent an average day or a peak hour or sensitive times such as night-time. The purpose of these contours is solely to inform the community so that residents can understand what the forecast operations will mean in practice – they are not used as controls. Like New Zealand, the Australian approach to airport noise management uses noise exposure contours for land use planning and there are no defined limits on the number of movements.

84 In summary I do not support a rule restricting the number of annual aircraft movements in addition to the noise control boundary limits for the following reasons:

(a) There is no noise effects basis for limiting the number of aircraft movements to 15,000 annually.

[11] Rylander and Bjorkman 'Annoyance by aircraft noise around small airports' 1997.

(b) NZS 6805 does not promote controlling aircraft operations by the number of movements. Rather, the standard promotes the noise exposure approach which requires airport operators to manage average noise exposure levels within given limits.

(c) In my opinion the noise exposure method set out in NZS 6805 is appropriate for managing aircraft noise at smaller airports and has been implemented at several New Zealand airports similar to Te Kowhai[12] without capping annual movements.

(d) Restricting annual movement numbers does not allow the airport operator the flexibility to manage aircraft operations to comply with the defined noise boundaries (e.g. encouraging quieter aircraft, restricting night flying).

Hours of operation rule

85 In paragraphs 737 to 740, the planning officer recommends a new rule defining the hours of operation for Aircraft Operations being 7am to 10pm. Emergency related operations would be exempt but otherwise no other aircraft could take-off or land between 10pm and 7am.

86 In the absence of further information regarding night-time operations or the sleep disturbance effects I can see how the planning officer came to this position. Subsequent to the pWDP submissions closing, I have assessed the potential sleep disturbance effects for existing residents as discussed in this evidence at paragraphs 44 to 55. I found that theoretically there is the potential for unreasonable sleep disturbance effects. However, this level of night flying is unlikely to occur in practice as it would restrict the allowable day time activity too much. To provide certainty, I have recommended limiting the number of night-time departures to 40 over a 3-month period.

87 In summary, I consider the proposed hours of operation rule, as recommended in the Section 42A report, is unnecessary and overly restrictive. Rather than a curfew, I consider it is possible to manage the effects of occasional night-time movements by controlling the number of night-time departures and restricting circuit training at night.

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[12] Rangiora, Omaka, Ardmore, Waipukarau, Omarama. Kapiti Coast.

Engine testing rule

88 In paragraphs 640 – 641 the planning officer recommends a separate noise control on aircraft engine testing and maintenance activities in the TKAZ. The recommended rule would not allow these activities between 10pm and 7am and require noise received outside of the Airpark to comply with the receiving zone permitted noise levels.

89 I do not oppose a separate engine testing noise rule. Without specifying a separate rule, this activity would be subject to the general noise limits. It is often necessary to provide for this activity separately as often it cannot practicably comply with general noise limits assessed over 15-minute periods. Engine testing noise rules are usually a combination of longer averaging periods (from 1 hour to 7 days), maximum noise levels and/or a limited number of events.

90 In this case I have not predicted noise from engine testing at the Aerodrome, so I do not have a view on what level of activity could comply with the general noise limits. However, I consider that if engine testing can comply with the general noise limits in receiving zones at any time of the day or night then it is not necessary to disallow it at night as recommended by the planning officer.

91 In summary, I agree with adding a separate engine testing noise rule as recommended. However, I do not consider the restriction between 10pm and 7am is necessary. Also, I do not support including engine testing and maintenance activities in the Aircraft Operations Rule 27.2.7A. In my view, it should be added to 27.2.6 Noise Other than Aircraft Operations.

Flight School and Circuit Training non-complying status

92 In paragraph 158 the planning officer recommends that flight training school (as defined in paragraph 168) is a non-complying activity in the TKAZ.

93 In paragraph 159 the planning officer recommends that circuit training (as defined in paragraph 169) is a non-complying activity in the TKAZ.

94 The reason for these recommendations is that the noise effects from circling aircraft may not be adequately determined or controlled by the NZS 6805 noise exposure and noise control boundary method.

95 I understand that circuit training is a fundamental activity at a general aviation airport and that circuit training has taken place at the Aerodrome for many years. My calculated noise contours include approximately 23% of movements using circuit flight tracks. The location of the 55 dB L_{dn} contour is barely affected by these movements, showing that noise from circuiting aircraft is not significant.

96 Aircraft flying in the circuit either on approach, departure or performing touch and goes, is part and parcel of the activity at general aviation airports and as such have been accounted for and controlled through ANCB.

97 Defining flight training schools as non-complying also seems unreasonably restrictive and not an efficient use of the airport. The noise boundaries would control the scale of any flight training taking place. Therefore, it would not be feasible to introduce a large scale flight school. I am not aware of any airports where circuit training and flight schools are non-complying.

98 Many general aviation airports in New Zealand are managed using the NZS 6805 noise exposure approach[13]. Neither Tonkin and Taylor nor the planning officer have suggested an alternative approach is more appropriate to assess the noise effects of circuiting aircraft.

99 In summary, I do not agree with defining circuit training and flight training schools as non-complying in the TKAZ.

Non-complying status for Noise Sensitive Activities in the ANB in TKAZ

100 In paragraph 501, the planning officer recommends that noise sensitive activities inside the TKAZ that are within the ANB should be non-complying. The reasons given are to ensure consistency with other zones and to protect community health and amenity values.

[13] Ardmore, Omaka, Rangiora, Waipukurau, Omarama.

101 In general, I consider that noise environments of 65 dB L_{dn} or greater are not suitable for residential activity. In the case of an Airpark where dwellings are intended for members of the aviation community to live or holiday amongst hanger homes and taxiways, I think there is scope to allow higher noise levels for these receivers. However, I do not recommend hanger homes are built in areas exposed to greater than 70 dB L_{dn}.

102 I expect residents of an Airpark would have a different expectation of amenity compared with those in rural or residential zones. This is based on the assumption that people will choose to purchase dwellings at the Airpark for the purpose of using the Aerodrome and will therefore have an expectation and acceptance of a high level of aircraft noise.

103 With respect to health effects, the matters for consideration are annoyance and sleep disturbance. I have addressed sleep disturbance earlier in this evidence and consider the recommended controls would manage sleep disturbance effects to a reasonable level for all residents including those inside the ANB in the TKAZ. Annoyance is influenced by a receiver's attitude towards a noise source (as already discussed). I expect residents who are Aerodrome users to be more tolerant of aircraft noise than the average receiver. However, I do not consider dwellings at levels greater than 70 dB L_{dn} is appropriate even for invested receivers.

104 I agree with the planning officer's recommendation to require acoustic insulation of noise sensitive activities inside the ANB in the Airpark and therefore internal noise levels will be reasonable.

105 In summary, I do not support regular residential housing inside the ANB in the TKAZ. However, I consider it would be reasonable for acoustically insulated hanger homes intended for Aerodrome users to be built in areas between 65 and 70 dB L_{dn}.

Noise Limits applying at OCB and ANB inside the TKAZ

106 In paragraphs 632 – 634, the planning officer recommends that noise from aircraft operations should comply with the 55 and 65 dB L_{dn} limits at the OCB and ANB respectively within the TKAZ. The reasons given are to protect the health and amenity values of Airpark residents.

107 The NZTE submission sought that these limits would not apply inside the TKAZ. The reason for not requiring compliance with the noise boundaries inside the Airpark is that ground based aircraft activity within an airport can be quite variable making it difficult to predict and monitor. To avoid a situation where a minor localised exceedance occurs in a non-sensitive area within an airport, it is common for airport noise rules to not apply inside the airport property or for the ANB to be expanded out to follow the airport property boundary. I recognise that in this case, the Airpark will include residential precincts making the situation slightly different.

108 In practice I consider an exceedance within the Airpark is unlikely and that the significance of an exceedance is low, particularly as Airpark residents would be more tolerant of aircraft noise. Nonetheless to provide a reasonable balance between flexibility for aerodrome operations and noise management for residents, I recommend that the rule be amended to state "These limits do not apply in Precincts A and B of the Te Kowhai Airpark zone."

109 In this situation, it is important that if taxiing is to be included in aircraft operations noise, then it should be included when modelling the noise boundaries.

Frequency of noise modelling and monitoring

110 In paragraphs 649 to 652, the planning officer recommends changes to the proposed compliance monitoring rule for aircraft operations noise. The changes would require noise modelling for compliance to commence immediately rather than be triggered by 4,500 movements in a 3-month period. The changes would also increase the frequency of modelling and in-field monitoring from the proposed three years to two years. The reasons given include:

(a) There was no justification provided for the 4,500-movement trigger for compliance modelling.

(b) The 4,500-movement trigger for compliance modelling "creates an unnecessary delay in the commencement of producing noise contours".

(c) In-field monitoring should be every two years to be conservative and ensure any non-compliance is dealt with in a timely manner.

111 The cost of modelling and in-field monitoring of aircraft noise is not insignificant. Therefore, I prefer to recommend methods of compliance assessment that balance the cost with the risk of non-compliance particularly for smaller, more cost sensitive aerodromes. Where the movement numbers at an airport are substantially below the number allowed for in the noise boundaries, I consider that modelling and measuring to demonstrate compliance is usually and unnecessary exercise.

112 NZTE commissions Automated Intelligent Movement Monitoring (**AIMM**) to undertake monitoring of aircraft movements at Te Kowhai and provide regular reports. In my opinion this information is adequate to track aircraft activity on a rolling 3-month basis and detailed noise assessment by modelling is only necessary when numbers reach a reasonable proportion of those provided for in the noise boundaries. In this case, the proposed trigger of 4,500 movements over 3 months is approximately 70% of the movements included in the proposed noise boundaries. The 2019 contours appended to this evidence at **annexure B** show that with movement numbers at 50% of those in the proposed noise boundaries, noise levels comfortably comply. This demonstrates that noise modelling for compliance reporting is not necessary immediately and can be delayed until movement numbers increase further.

113 Theoretically, there is a risk of non-compliance below 70% of the anticipated movements if many aircraft are noisier than those included in the boundaries. However, I consider the risk of this occurring is relatively low. Special compliance verification can be undertaken if aircraft types using the Aerodrome change significantly.

114 I am not strictly opposed to the frequency of modelling and in-field monitoring decreasing from 3 year to 2 years. However, I do not consider it is necessary. The purpose of the in-field monitoring, in my view, is to verify the modelling and provide base data for dominant aircraft so that the model can be calibrated. Tonkin and Taylor suggested the 2-year frequency to be conservative and demonstrate ongoing compliance. I consider that the AIMM aircraft movement data and noise modelling is sufficient to

demonstrate ongoing compliance and that in-field monitoring every 3 years for the purpose of verification and calibration is appropriate.

115 I support a rule requiring an annual report to Waikato District Council on the compliance monitoring results (similar to that in paragraph 651). I recommend the rule is reworded such that on years where modelling or monitoring do not take place, the report would provide information on the recorded aircraft movement numbers only.

Noise limits for activities other than Aircraft Operations

116 In paragraphs 682 to 683 the planning officer recommends that noise from activities in the TKAZ, other than aircraft operations and engine testing, should be required to comply with the permitted noise limits in the receiving zone outside the Airpark. I agree with this.

Acoustic insulation for Noise Sensitive activities in the TKAZ

117 In paragraphs 574 the planning officer recommends that noise sensitive activities inside the OCB in the TKAZ should also be required to install acoustic insulation as set out in Appendix I. I agree with this. In paragraph 582 she also suggests the same for noise sensitive activities inside the ANB in the TKAZ. I also agree with this.

CONCLUSION

118 I have assessed the noise effects of the proposed future growth of the Aerodrome and Airpark activities. Future aircraft noise levels at existing dwellings[14] are predicted to reach up to 60 dB L_{dn}. Noise exposure between 55 and 60 dB L_{dn} is of a moderately high level but not unreasonable for residential activity.

119 To manage potential sleep disturbance effects of night-time departures, I have recommended an additional control that restricts the number of departures between 10pm and 7am to 40 over a 3-month period. NZTE also proposes to restrict circuit training between 10pm and 7am. I consider these are pragmatic and manageable controls that provide certainty to residents that night-time noise would be controlled and reasonable.

[14] Excluding the property belonging to the Readmans.

120 In my opinion the NZS 6805 noise exposure approach to managing aircraft noise is appropriate for the Aerodrome and I have recommended some additional night-time controls to manage potential sleep disturbance effects. However, I do not consider that the following additional controls recommended in the Section 42A report are appropriate or necessary to manage the noise effects:

(a) Cap on annual aircraft movements (15,000).

(b) Hours of operation (7am – 10pm).

(c) Non-complying status of circuit training and flight schools.

121 I do not support the smaller OCB and ANB recommended in the Section 42A report as these noise boundaries are based on a 10-year planning horizon which I consider too short for an airport and does not provide for the long term future of the Aerodrome and Airpark.

122 In summary, I consider that the noise boundaries proposed by NTZE in its submission and the associated rules discussed in this evidence are appropriate to manage the health and amenity effects of aircraft noise on the community whilst providing for the efficient use of the Aerodrome and Airpark.

Laurel Smith

Dated 15 February 2021

Appendix A Marshall Day Acoustics Consultant Advice Note for NZTE Submission

CONSULTANT ADVICE

MARSHALL DAY Acoustics

Project:	Te Kowhai Airpark	**Document No.:**	Ca 002 r01		
To:	NZTE	**Date:**	8 October 2018		
Attention:	NZTE Directors	**Cross Reference:**			
Delivery:	Shutchings@greenwoodroche.com	**Project No.:**	20180994		
From:	Laurel Smith	**No. Pages:**	4	**Attachments:**	4
CC:					
Subject:	Proposed Airport Control Noise Boundaries				

INTRODUCTION

MDA has prepared future airport noise contours for Te Kowhai Airfield generally in accordance with New Zealand Standard NZS 6805:1992 "*Airport Noise Management and Land Use Planning*". It is recommended that these contours form the basis for revised Airpark Noise Control Boundaries in the Proposed Waikato District Plan.

This document sets out the noise model inputs and assumptions behind the future noise contours and the recommended airport noise and land use controls.

NOISE MODEL INPUTS AND ASSUMPTIONS

Future noise contours have been calculated using the Integrated Noise Model (INM) version 7d for a future operating scenario prepared by NZTE. The noise contours are based on the L_{dn} noise metric. This metric is the sum of the sound energy from all aircraft noise events averaged over 24 hours. The night weighting means that noise events that occur between 10pm and 7am are "weighted" or penalised with an additional 10 decibels. For input to the noise model, an 'average day' of movements is calculated based on forecast future movements during the busiest three months of the year. The modelled contours for Te Kowhai Airfield are based on the following assumptions:

Table 1: Runway Assumptions

Runway Length	Current length 983 m
Runway Usage	65% Runway 23 35% Runway 05
Taxiways	As per proposed Airpark taxiways

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The aircraft movements included in the model are listed in Table 2.

Table 2: Future Aircraft Movements in Noise Contour Calculation

		Busy Average Day Movements		
User Category	**Aircraft Type**	**Arrivals and Departures**	**Touch and Goes[1]**	**Total**
High Use Commercial (crop-dusting/parachute)	Cessna 206	16.0	0.0	16.0
Moderate Use Commercial (flight school)	Generic variable pitch propeller aircraft[2]	10.0	4.3	14.2
Hobby Flight Training	Generic fixed pitch propeller aircraft	3.0	1.3	4.3
Private Residents	Generic variable pitch propeller aircraft[2]	14.8	6.4	21.2
Itinerant	Generic variable pitch propeller aircraft[2]	10.0	4.3	14.2
Busy Average Day Total		**53.8**	**16.2**	**70.0**
Annualised Busy Average Day		**19,632**	**5,906**	**25,538**

1 This figure is the total movements (i.e. two movements are included for a touch and go)
2 This generic aircraft type also covers smaller twin piston engine propeller aircraft

All of the movements in the model occur during the day time (7am – 10pm) however this does not prevent operations from occurring between 10pm and 7am. A movement at night time is equivalent to 10 day time movements so in practice if movements do take place at night these would just use up more of the noise budget.

The flight tracks used in the model are shown in the attached Figure 2. It has been assumed that arrival and departure tracks are straight in and out aligned with the runway centreline. We have been advised that circuit tracks are left hand for Runway 23 and right hand for Runway 05 and generally follow the ground track shown in Figure 2.

Aircraft taxiing movements have also been included in the calculated noise contours. The proposed taxiways around the Airpark have been included in the model as taxi tracks and these are shown in the attached Figure 2. It has been assumed that only private resident aircraft would use the Airpark taxiways and all other aircraft would use the taxiway adjacent to the runway. As the Airpark taxiways lead to private residences, the distribution of taxiing movements on the taxiways will depend on the frequency of flying carried out by individual residents. To allow for this unknown distribution of taxiing movements we have applied a safety factor of 1.5. For each private resident aircraft movement in the model there is one taxiing movement adjacent to the runway and 1.5 taxiing movements on the Airpark taxiways (evenly distributed).

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CALCULATED NOISE CONTOURS AND RECOMMENDED NOISE CONTROL BOUNDARIES

The 55 and 65 dB L_{dn} noise contours for the future operating scenario described above are shown in attached Figure 1. It is recommended that these contours are smoothed out and form the basis for the Air Noise Boundary (65 dB L_{dn}) and the Outer Control Boundary (55 dB L_{dn}) in the Waikato District Plan. Figure 3 shows the recommended boundaries based on smoothed out contours from Figure 1. The Outer Control Boundary has been extended out to the Airpark Zone boundary to the south to provide for taxiing within the zone and to limit the noise at the zone boundary rather than within the Airpark.

Figure 4 provides the future L_{dn} contours in two decibel increments to be used for acoustic insulation design purposes. It is recommended that this figure is included in Appendix 1 Section 3.

RECOMMENDED NOISE CONTROLS (CHAPTER 27)

NZS 6805 recommends that noise from aircraft operations is limited to the levels defined by the noise boundaries and that noise sensitive land use is restricted within the noise boundaries.

The Proposed District Plan (PDP) includes Rule 27.2.7 which controls noise from aircraft on taxiways within Te Kowhai Airpark. It recommended that this rule is replaced with the following:

27.2.7 Noise – Aircraft Operations

Noise from aircraft operations in ALL PRECINCTS, including aircraft movements on taxiways, shall not exceed 55 dB L_{dn} outside the Outer Control Boundary and 65 dB L_{dn} outside the Air Noise Boundary as shown in the Planning Maps. These limits do not apply inside the Te Kowhai Airpark Zone. For the purpose of this control aircraft noise shall be assessed in accordance with NZS 6805:1992 "*Airport Noise Management and Land Use Planning"* and logarithmically averaged over a three month period. For the purposes of this rule aircraft operations shall include aircraft taking-off, landing, taxiing and flying on circuit flight paths. The following operations are excluded from the calculation of noise for compliance with the noise limits:

- Aircraft engine testing and maintenance
- Aircraft landing or taking off in an emergency
- Emergency flights required to rescue persons from life threatening situations or to transport patients, human vital organs or medical personnel in a medical emergency
- Flights required to meet the needs of a national or civil defence emergency declared under the Civil Defence Emergency Management Act 2002
- Aircraft using the airfield due to unforeseen circumstances as an essential alternative to landing at a scheduled airport elsewhere
- Aircraft undertaking firefighting duties
- Air Shows (for one air show per year)

Aircraft movements shall be recorded monthly and once the total movements in the busiest three month period reaches 4,500, noise contours for the purpose of assessing compliance with Rule 27.2.7 shall be calculated once every three years. When the calculated noise levels are within one decibel of the limit, noise contours for the purpose of assessing compliance with Rule 27.2.7 shall be calculated annually and verified with infield monitoring once every three years.

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RECOMMENDED LAND USE CONTROLS (CHAPTERS 22 AND 24)

The PDP includes acoustic performance standards for new dwellings built inside the Te Kowhai Airfield Outer Control Boundary which applies in the Rural and Village zones. It is recommended these be modified to align with the recommendations of NZS 6805. NZS 6805 recommends the following land use planning criteria:

Inside the ANB (>65 dB L_{dn}):

- New noise sensitive uses (including residential) should be prohibited;
- Existing residential buildings and subsequent alterations should have appropriate sound insulation;

Between the ANB and the OCB (55 - 65 dB L_{dn}):

- New noise sensitive uses (including residential) should be prohibited unless a District Plan permits such use subject to appropriate sound insulation; and
- Alterations or additions to existing noise sensitive uses (including residential) should include appropriate sound insulation.

Ideally to provide the Airfield with the best level of protection from reverse sensitivity, new noise sensitive development inside both the Air Noise Boundary and the Outer Control Boundary should be prohibited. An alternative method that provides less protection but is less onerous on neighbouring landowners is to permit new noise sensitive development subject to acoustic insulation between the Outer Control Boundary and the Air Noise Boundary and to apply a Non-Complying activity status to new noise sensitive development inside the Air Noise Boundary.

ACOUSTIC INSULATION (APPENDIX 1)

Appendix 1 Section 3 sets out acoustic insulation performance standards that apply to new noise sensitive activities developed within the Te Kowhai Airpark Outer Control Boundary and Noise Buffer.

Inside the Outer Control Boundary the design criterion of 40 dB L_{dn} is reasonable and appropriate and the octave band adjustments are appropriate for the types of aircraft operating at Te Kowhai Airpark. It is also appropriate to require a ventilation system and the associated acoustic criteria are reasonable. It would be appropriate to include a map showing the noise contours in two decibel increments in order to identify the outdoor design levels on affected properties. It is recommended that Figure 4 be included in Appendix 1 Section 3 for this purpose.

It is recommended that the Noise Buffer and associated acoustic standards be removed if the revised Airpark Noise Control Boundaries are accepted. The revised boundaries include noise from taxiing aircraft therefore the Noise Buffer becomes unnecessary.

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MARSHALL DAY Acoustics

Figure 1 - Te Kowhai Airpark Predicted Future Noise Contours for Aircraft Operations

Prepared By: LJS
Date: 8/10/2018
Time: 9:01:46 p.m.

Scale @ A3: 1:10,000
0 100 200 400 m

N

MARSHALL DAY Acoustics

Figure 2 - Te Kowhai Airfield Noise Model Flight Tracks

Prepared By: LJS
Date: 28/09/2018
Time: 2:29:16 p.m.

Scale @ A3: 1:10,000
0 100 200 400 m

N

MARSHALL DAY Acoustics

Figure 3 - Proposed Te Kowhai Airpark Noise Control Boundaries

Prepared By: LJS
Date: 8/10/2018
Time: 8:36:20 p.m.

Scale @ A3: 1:10,000
0 100 200 400 m

N

MARSHALL DAY Acoustics

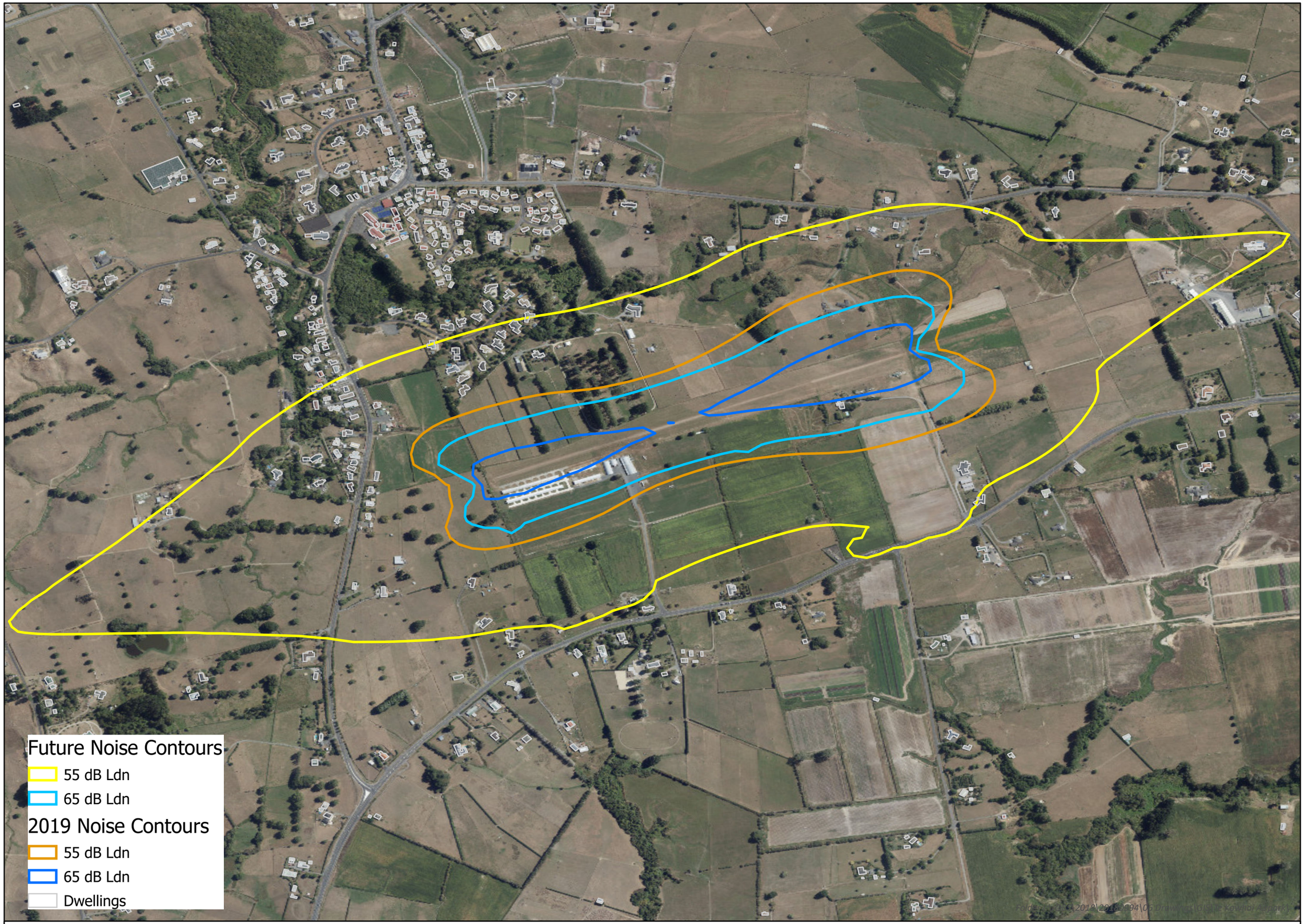
Figure 4 - Te Kowhai Airpark Future Noise Contours for Acoustic Insulation

Prepared By: LJS
Date: 8/10/2018
Time: 8:40:43 p.m.

Scale @ A3: 1:10,000
0 100 200 400 m

N

Appendix B Figure 5 2019 Aircraft Operations Noise Contours



MARSHALL DAY Acoustics

Figure 5 - Current (2019) and Future Aircraft Noise Contours

Prepared by Laurel Smith
Date: 14/12/2020

Scale @ A3: 1:9,736
0 0.05 0.1 0.19 0.29 0.38 km

N

Appendix C Figure 6 Worst Case Night-time 95 dB L_{AE} Contour

MARSHALL DAY Acoustics

Figure 6 - Combined Worst Case 95 dB LAE Contour

Prepared by Laurel Smith
Date: 15/12/2020

Scale @ A3: 1:9,214
0 0.050.09 0.18 0.27 0.36
km

N

Appendix D Table 4 Comparison of Marshall Day Acoustics and Tonkin and Taylor Aircraft Noise Models

Table 4 Comparison of the MDA and T+T Aircraft Noise Models

Feature	Details	Significance
Software	MDA used INM 7d T+T used AEDT	Insignificant.
Runway Usage	MDA 65% use of Runway 23 T+T 65% use of Runway 23	No difference.
Circuit tracks	MDA includes 23% of movements T+T none	Insignificant. The location of the 55 contour is not influenced by the circuit track
Night time movements (10pm-7am)	MDA includes none T+T includes none	Insignificant. However, it doesn't mean night flights don't occur. Historically 0.26% of movements have been between 9pm and 7am. This would have negligible influence on the contours so although night flights were not modelled this doesn't mean they should be prohibited.
3 Month Peak Factor	MDA = 30% T+T = 22%	Slight. Data shows historically peak 3 months is 30% more than annual average. If 30% applied to 15,000 annual movements then busy average day in T+T model should be 53
Taxiing	MDA included taxiing alongside the runway and within the Airpark T+T has not included any taxiing	Moderate. If thinner contours such as T+T ones are used, then taxiing within the Airpark will influence the size. If compliance is required within the Airpark zone and taxiing to be included, then this will create a compliance issue.
Number of Movements	MDA busy average day 70 movements (19,645 annually) T+T busy average day 50 movements (15,000 annually)	Appreciable. 2019 movements were 35 for the busy average day and 9,925 annually. MDA model is a 100% increase and T+T model is a 40% increase on current activity (based on busy average day).
Aircraft Types	MDA used CNA206, GASEPF & GASEPV T+T used CNA206, CNA150 & CNA400	Appreciable. GASEPV has a shorter fatter departure footprint than the CNA400. CNA400 is appropriate for modern variable pitch aircraft but a range of aircraft will operate at Te Kowhai. Ideally a mix of these two aircraft types in the model would be appropriate.