



MARSHALL DAY
Acoustics



QUEENSTOWN AIRPORT
2024 NOISE MONITORING REPORT

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Project: **Queenstown Airport 2024 Noise Monitoring Report**

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1.0 INTRODUCTION

Marshall Day Acoustics (MDA) has been engaged by Queenstown Airport Corporation (QAC) to undertake noise compliance assessment for 2024 with respect to the relevant Queenstown Lakes District Council District Plan (QLDP) obligations.

This 2024 Noise Monitoring Report (NMR) has been prepared by MDA on behalf of QAC and provides an overview of the noise compliance program for 2024 including calculation of noise contours known as the Compliance Annual Aircraft Noise Contours (CAANC) to determine compliance or otherwise with the Airnoise Boundary and Outer Control Boundary and the aircraft noise monitoring related designation conditions applicable to the airport.

A glossary of terms is provided in Appendix A.

2.0 STATUTORY REQUIREMENTS

The relevant Designation conditions relating to airport noise compliance at Queenstown is given below:

Designation D1

Aircraft Noise

7.

- a. *Aircraft noise shall be measured, predicted and assessed in accordance with NZS 6805:1992 Airport Noise Management and Land Use Planning and NZS 6801:2008 Acoustics – Measurement of Environmental Sound, by a person suitably qualified in acoustics. The terms ANB, OCB, ASAN, 2037 Noise Contours and Indoor Design Sound Level shall be as defined in the District Plan.*
- b. *The term Annual Aircraft Noise Contours (AANC) shall be defined as the annual Ldn contours 55 dB, 60 dB, and 65dB that have been derived using aircraft noise prediction software to be determined by the Queenstown Airport Liaison Committee (QALC) in accordance with the Noise Management Plan (NMP) and records of actual aircraft movements for the busiest three consecutive months of the preceding year.*
- c. *The term Compliance AANC shall be defined as the AANC adjusted for any differences between calculated noise levels and measured noise levels described in Conditions 9 and 10 of this designation.*
- d. *The term Projected AANC shall be defined as the Compliance AANC adjusted for annual growth estimated for the following year based on trends derived from historical aircraft movement data.*
- e. *If NZS 6805:1992 is superseded by a revised or new standard, the adoption of this revised/new standard in place of NZS 6805:1992 shall be at the discretion of the QALC under the NMP. Note the detail and the content of the NMP are set out in Condition 23, Condition 24 and Condition 25.*

8. *The Airport shall be managed so that the noise from aircraft operations does not exceed 65 dB Ldn outside the Air Noise Boundary (ANB) and 55 dB Ldn outside the Outer Control Boundary (OCB). The ANB and OCB are as shown on the District Plan Maps. Compliance with the ANB and OCB shall be determined on the basis of the Compliance AANC required*

to be prepared by Condition 9 and 10.

9. *Each year, Queenstown Airport Corporation (QAC), shall produce 55 dB, 60 dB and 65 dB AANC, using aircraft noise prediction software to be determined by the QALC in accordance with the NMP and records of actual aircraft movements for the busiest three consecutive months of the preceding year.*
10. *At least every three years, QAC shall undertake a monitoring programme to compare the measured aircraft noise levels with the AANC. The AANC shall be corrected for any differences arising from the measured levels to produce the Compliance AANC. The monitoring programme shall include the following measurements within a three year period: a minimum of one month summer and one month winter undertaken at a minimum of three points located west, north-east and south of the airport with the exact positions to be determined by the QALC under the NMP.*
11. *Each year the Compliance and Projected AANC (required under conditions 10 and 15 respectively) shall be reported to the QALC. Compliance AANC produced for years when noise measurements have not been undertaken shall be prepared using the same corrections determined from the most recently measured aircraft noise levels undertaken for Condition 10.*

Other Noise

12. *Sound from activities which are outside the scope of NZS 6805:1992, shall comply with the District Plan noise limits set in the zone standards for each zone in which the sound is received. This requirement includes engine testing other than for essential unplanned engine testing of aircraft for scheduled passenger services.*
13. *No noise limits shall apply to essential unplanned engine testing of aircraft for scheduled passenger services. The NMP shall detail noise management practices for unplanned engine testing including preferred locations and times. Following each unplanned engine test the QAC shall report to the next meeting of the QALC why the testing was required and what noise management practices were followed.*

This noise monitoring report details information required under Designation condition D1.8 of the QLDP. The purpose of this report is to assess compliance of aircraft operations with conditions D1.9 and D1.10 for the period of 1 January 2024 to 31 December 2024.

2.1 Noise Limits - Aircraft Operations

Rule D1.8 states that “*The Airport shall be managed so that the noise from aircraft operations does not exceed 65 dB L_{dn} outside the Air Noise Boundary (ANB) or 55 dB L_{dn} outside the Outer Control Boundary (OCB). The ANB and OCB are as shown on the District Plan Maps.*”

The noise boundaries are shown on the QLDP planning map in Figure 1 and overlaid on aerial photography in Figure 2.

Figure 1: QLDP noise boundaries

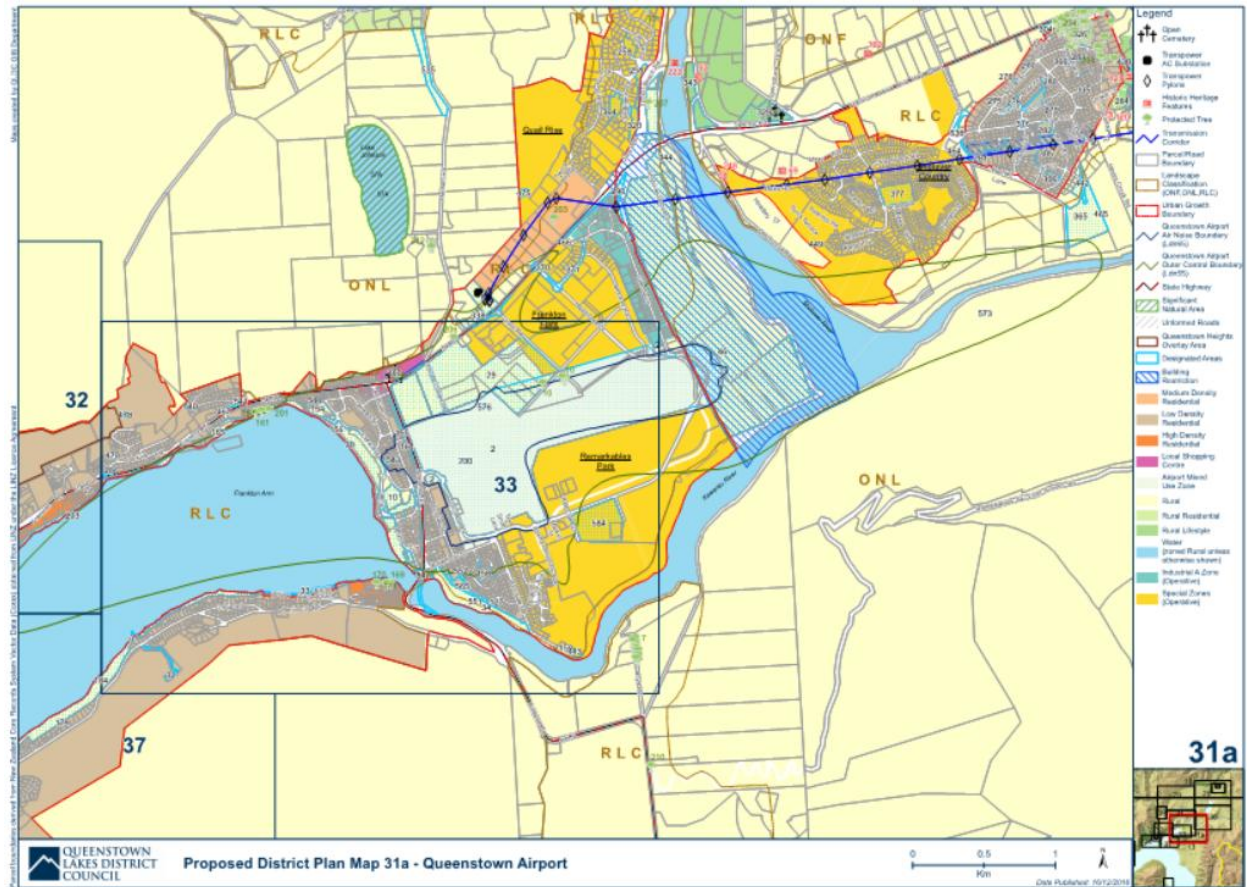
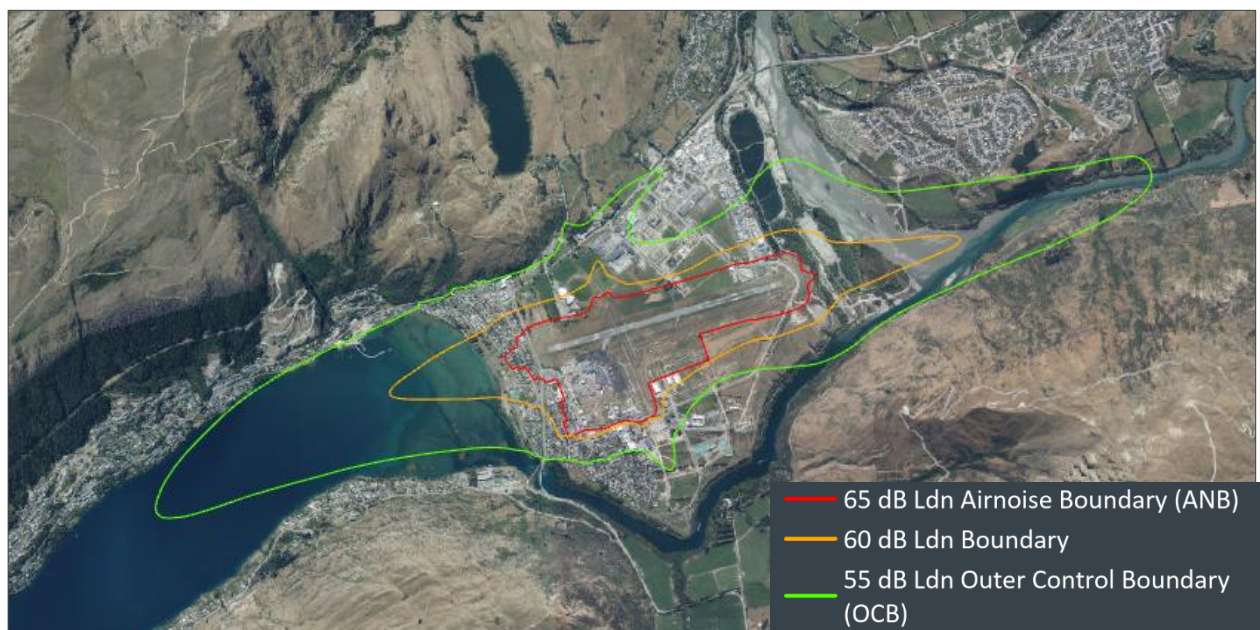


Figure 2: Queenstown Airport noise boundaries



3.0 OPERATIONAL NOISE MODELLING

3.1 Summary of Operational Aircraft Movements

Based on the information provided by QAC and derived from AIMM data, for the year 2024 there were 32,441 fixed-wing (scheduled and non-scheduled) movements and 27,248 helicopter movements at Queenstown, with a total number of 59,726. This was 1,102 less than for 2023.

The decrease in the number of aircraft movements in 2024 compared to 2023 was small, less than 2%.

Total number of aircraft movements in 2024 started high, slowed down during the winter months, and increased again towards the end of the year. This represents typical activity for Queenstown Airport with the busiest months being the summer months.

The busiest three consecutive months for aircraft movements in 2024 were January, February and March, with significant increases in General Aviation activity during this period. A summary of the movement data input into the Aviation Environmental Design Tool (AEDT) used to produce the 2024 Annual Aircraft Noise Contours (AANC) is provided in section 3.2 of this report.

3.2 Modelling Methodology

In 2023, MDA recommended that the AEDT is the most appropriate tool for modelling aircraft noise levels. AEDT version 3e has been used for this compliance assessment.

The Queenstown Airport Liaison Committee (QALC) approved the AEDT software to be used in all future compliance contour modelling, beginning with the 2023 AANC.

The total movements for the modelled scenario are shown in Table 1 as well as a breakdown of the day and night-time movements, and a comparison with last years data. Night-time movements are those that occur between 10pm and 7am. The number of night-time movements is relevant as night-time activity has an associated +10 decibel adjustment.

Table 1 Summary of Modelled Aircraft Movements for 2024 NMR

	Busiest 3 Months (January, February, March 2024)	Busiest 3 Months (January, February, March 2023)
Total Movements	16,904	17,661
Day Time Movements	16,900	17,654
Night-Time Movements	4	7

The total movements for the modelled scenario broken down into categories for 2023 and 2024 - are shown below in Table 2.

Table 2: Summary of Modelled Aircraft Movements by Category

	2024AANC (busiest 3 months Jan, Feb, Mar)	2023 AANC (busiest 3 months Jan, Feb, Mar)
Scheduled	4,350	4,890
Other Fixed Wing	5,215	4,641
Helicopter	7,339	8,130
Total	16,904	17,661

For runway usage splits, data provided by AIMM now includes actual runway usage data which has been used in the preparation of the 2024 AANC. . Runway splits broken down into categories are shown in Tables 3 and 4.

Table 3: Fixed Wing Aircraft Runway Splits 2024

	RW05		RW23		RW14		RW32	
Operation	A	D	A	D	A	D	A	D
Scheduled/Corp Jet	10%	8%	90%	92%				
Other Fixed Wing	23%	36%	28%	15%	46%	45%	3%	4%

The runway splits for the crosswind runway are much higher in the actual data presented in Table 3 above than the previous assumptions used in the 2023 CAANC. This has caused a change in the contour extents in the vicinity of the crosswind runway.

Table 4: Helicopter Pad Splits 2024

	General Aviation Precinct environs		Northern Helicopter Hangars	
Operation	A	D	A	D
Helicopter	78%	76%	22%	24%

The flight tracks used in the model are the same regular flight tracks that were used for the development of the noise control boundaries. Minor updates have been made over time to the percentage those tracks are used, based on discussions with Airways. It is considered that the tracks used in the noise modelling remain the best approximation of long-term average flight tracks flown.

We observe that Runway 14 has been used significantly more—both in percentage terms and therefore in absolute numbers.

In addition, data provided by AIMM allows us to model Runway 14 departures as ‘No Short 14’ or ‘Short 14’. ‘Short 14’ represents 35% of all departure operations in the Runway 14 direction, and the remaining 65 % assumed to be ‘No Short 14 – (further assumed to be standard RWY 14 departures (from the threshold)).

The updated calculation percentages are as follows:

Table 5: Fixed Wing Aircraft Runway Splits 2024 with ‘Short 14’

	RW05		RW23		RW14		Short RW14	RW32	
Operation	A	D	A	D	A	D	D	A	D
Scheduled/Corp Jet	10%	8%	90%	92%					
Other Fixed Wing	23%	36%	28%	15%	46%	29%	16%	3%	4%

3.3 2024 Annual Aircraft Noise Contour

The 2024 AANC, prepared using the methodology described above, is shown in Figure B1 in Appendix B.

It can be seen that the predicted 65 dB L_{dn} contour remains inside the ODP ANB, but does get relatively close to the North, in the vicinity of the RWY 14 threshold. The predicted 55 dB L_{dn} lies near the OCB to the south generally along the extended crosswind runway centreline.

However, there is a requirement in Rule D1.9 that *“The AANC shall be corrected for any differences arising from the measured levels to produce the Compliance AANC.”*

The following sections detail the noise measurement programme and the derived adjustments. Section 5 reports the 2024 Compliance AANC.

4.0 NOISE MEASUREMENT PROGRAMME

Noise measurements are required so that QAC can monitor noise from aircraft operations at the Airport in accordance with the rules set out in Rule D1.11 of the QLDP. The purpose of the noise measurements is to verify the noise contouring calculations as well as to confirm compliance or otherwise with Rule D1.9.

For the 2021, 2022 and 2023 NMRs an overall 1 decibel adjustment was applied to the AANC to produce the CAANC. After the Covid-19 pandemic, the compliance measurements program has now returned to the normal schedule in accordance with rule D1.9. The 2024 compliance measurements can be used to validate the accuracy of the AEDT model for compliance purposes, and specific adjustments to the AEDT applied for individual aircraft of concern.

Noise measurements are required every 3 years in accordance with rule D1.9, the most recent specific compliance noise measurements were in Winter 2024. Noise monitoring terminals were installed from 7 June 2024 to 30 October 2024. The positions were 262 Peninsula Road, 2 km away from the airport and the runway 05 threshold, 82 McBride Street – 200 m away from runway 05, and “Tennis Court” located close to the Queenstown Events Centre on the airfield safety fence boundary. This is a side position from the main 05-23 Runway, but is also relatively close to the runway 14 threshold.

4.1 Adjustments to 2024 AANC

As stated in Section 4.0 the AEDT 3e program contains an up-to-date fleet database including the latest aircraft currently flying at Queenstown airport. The accuracy of this database along with the modelling methodology set out in Section 3.2 improves the accuracy of the model.

A review of the Winter measurement data has been undertaken, and our findings are described below.

Noise loggers were used to determine the noise levels of individual aircraft and to compare the measured values with the modelled results. It is accepted industry practice to calibrate noise models where sufficient empirical data demonstrates the model is inaccurate. We have applied the following calibration measures to the 2024 AEDT model inputs based on measurement data.

Overall, the following aircraft adjustments were applied following measurement verification analysis to more accurately predict these specific aircraft noise models in AEDT.

Aircraft	Issue	Calibration Applied	Empirical Data
Boeing 737-800	AEDT overpredicts noise emissions on departure - Domestic and International (Stage length 3)	All departures modelled as Boeing 737-300	Large sample of in-field measurements at McBride Street, and 2632 Peninsula Road in Winter 2024
Eurocopter EC-series helicopters (EC-20 and EC-30)	AEDT overpredicts noise emissions	Movement numbers reduced by factor equivalent to the dB overprediction (8 decibels) (Factor = 0.1666)	Large sample of in-field measurements at multiple sites
Cessna 208 and Caravan GA8	AEDT overpredicts noise emissions	Movement numbers reduced by factor equivalent to the dB overprediction 0.9 decibels (Factor = 0.795)	Large sample of in-field measurements at Queenstown NMTs

5.0 2024 COMPLIANCE ANNUAL AIRCRAFT NOISE CONTOUR (CAANC)

The Compliance AANC (CAANC) are obtained after the adjustments derived in the previous section are applied to the AANC.

The 2024 CAANC, prepared using the methodology described in Section 4.1 above, is shown in Figure B2 in Appendix B. The 2024 CAANC demonstrates aircraft operations comply with the 65 dB L_{dn} Airnoise Boundary and 55 dB L_{dn} Outer Control Boundary. The 55 dB L_{dn} CAANC contour is within 1 decibel of the 55 dB L_{dn} Outer Control Boundary in proximity to the Runway 32 extended centreline,.

Overall, we conclude that the QAC is compliant with its District Plan aircraft noise emission compliance obligations.

6.0 2024 (2025) PROJECTED ANNUAL AIRCRAFT NOISE CONTOUR (PAANC)

Once the CAANC are produced, then in accordance with Rule D1.14 the Projected AANC (PAANC) can be prepared. This requires QAC to provide future year growth estimates so that these can be applied to the CAANC to produce the PAANC.

For this 2024 NMR, the 2024 CAANC provides the baseline for the 2024 (2025) PAANC. The 2024 (2025) PAANC is shown as Figure B3 in Appendix B. This shows the projected contours for 2025, based on the 2024 CAANC.

For this 2024 NMR the PAANC is prepared using actual 2025 operational data for January to March 2025. This is because this data was available at the time of the preparation of the PAANC. Further, records of aircraft activity over a number of years' compliance assessments shows that the Jan-Mar period is generally the busiest three consecutive months. However, this cannot be confirmed until the end of the 2025 calendar year. We note that if aircraft movement activity remains similar to previous years, and Jan-Feb-Mar is confirmed as the busiest three consecutive months of 2025, then the PAANC noise emissions for the 2024 (2025) PAANC shown in this report would become the 2025 compliance contours in the 2025 compliance reporting¹.

Figure B3 in Appendix B shows the 2024 (2025) PAANC.

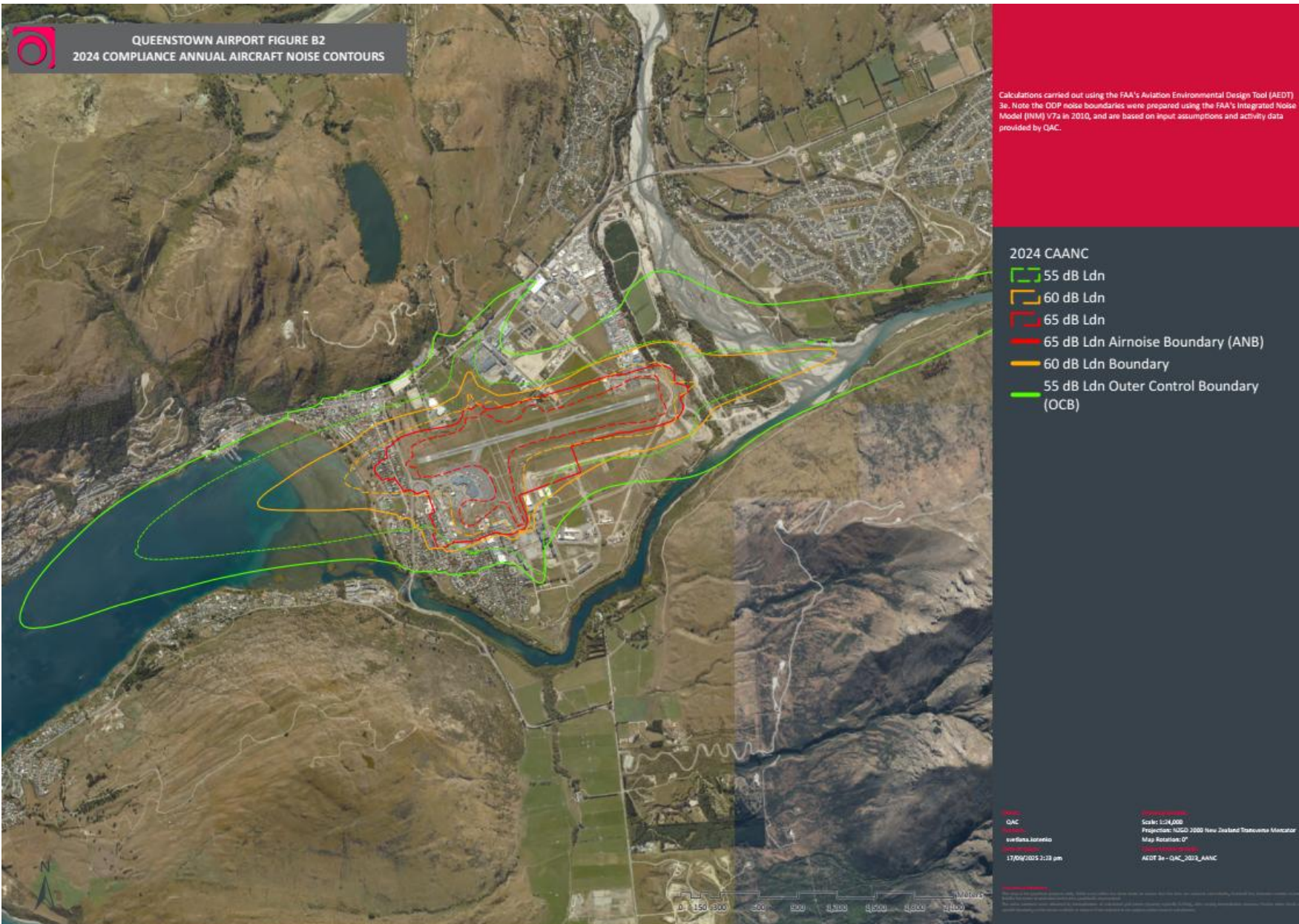
¹ Subject to any further model calibration and refinement analysis that may subsequently be carried out.

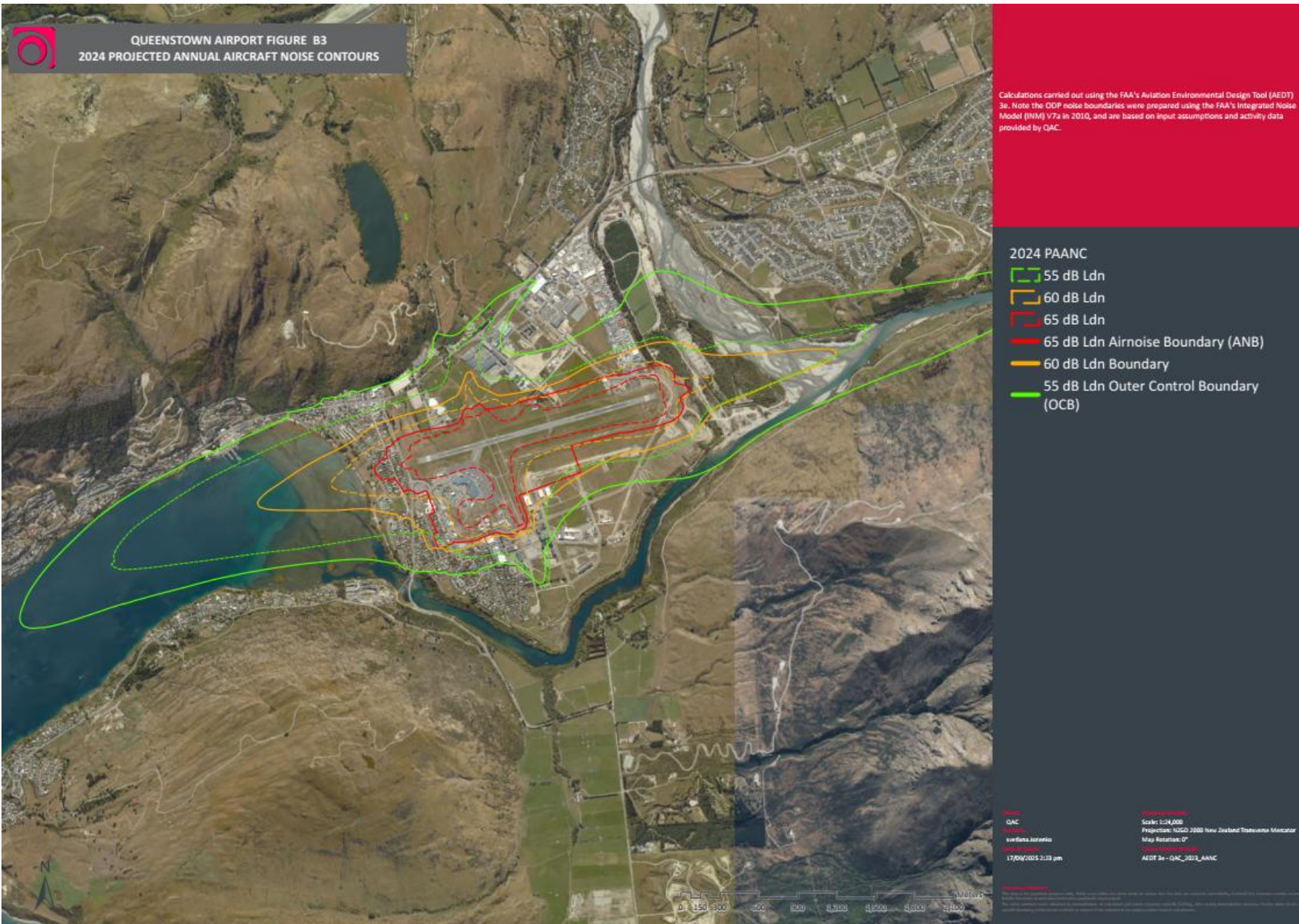
APPENDIX A GLOSSARY OF TERMINOLOGY

Noise	A sound that is unwanted by, or distracting to, the receiver.
dBA	The unit of sound level which has its frequency characteristics modified by a filter (A-weighted) so as to more closely approximate the frequency bias of the human ear.
A-weighting	The process by which noise levels are corrected to account for the non-linear frequency response of the human ear.
L_{dn}	The day night noise level which is calculated from the 24 hour L _{Aeq} with a 10 dB penalty applied to the night-time (2200-0700 hours) L _{Aeq} .
SEL or L_{AE}	<u>Sound Exposure Level</u> The sound level of one second duration which has the same amount of energy as the actual noise event measured. Usually used to measure the sound energy of a particular event, such as a train pass-by or an aircraft flyover
NZS 6805:1992	New Zealand Standard NZS 6805:1992 <i>“Airport Noise Management and Land Use Planning”</i>
ANB	Means a boundary as shown on the District Plan web mapping application, the location of which is based on the predicted day/night sound level of 65 dBL _{dn} from airport operations in 2037.
OCB	Means a boundary, as shown on the District Plan web mapping application, the location of which is based on the predicted day/night sound levels of 55 dBA L _{dn} from airport operations in 2036 for Wānaka Airport and 2037 for Queenstown Airport.
ASAN	Activity sensitive to aircraft noise
AANC	ANNUAL AIRCRAFT NOISE CONTOUR
CAANC	COMPLIANCE ANNUAL AIRCRAFT NOISE CONTOUR
PAANC	PROJECTED ANNUAL AIRCRAFT NOISE CONTOUR
Aircraft operation	Means the operation of aircraft during landing, take-off and taxiing but excludes: - aircraft operating in an emergency; - aircraft using the Airport as an alternative to landing at a scheduled airport; - military aircraft movements; and - engine testing.
NMP	Noise Management Plan

APPENDIX B FIGURES







APPENDIX C CALCULATION OF L_{DN}

The graphs below show how L_{dn} is calculated. The average hourly aircraft noise level (L_{Aeq}) is determined and a 10 decibel penalty applied to night time aircraft events (10pm-7am). The average of the hourly L_{Aeq} values is determined over a 24 hour period which then gives the L_{dn} .

The first graph shows an hour's worth of L_{Aeq} data. From this, the data which corresponds to aircraft noise is identified and the 1 hour L_{Aeq} noise level from aircraft noise is calculated. This 1 hour aircraft L_{Aeq} represents one of the bars on the second graph. After applying the 10 dB Penalty to night-time hours, all of the bars on the second graph are then averaged to calculate the overall daily L_{dn} value. For Queenstown Airport the noise limits are based on the busiest consecutive 3 months of aircraft movements and hence the L_{dn} is also based on a value averaged over this busiest 3 months.

