

Before the Queenstown Lakes District Council

In the Matter of **the Resource Management Act**

And

In the Matter of **of the Proposed Queenstown Lakes District Plan
(Chapter 36)**

**Statement of Evidence of
Christopher William Day
for Queenstown Airport Corporation
Limited (Submitter Number 433 and
Further Submitter 1340)**

Dated: 2 September 2016

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INTRODUCTION

Qualifications and Experience

1. My full name is Christopher William Day. I am a founding partner and Director of Marshall Day Acoustics Limited.
2. I have the qualification of Bachelor of Engineering (Mechanical) from Monash University in Melbourne, Australia. For the past 40 years I have worked in the field of acoustics, noise measurement and control in England, Australia and New Zealand, specialising in transportation noise and acoustics for the performing arts. My work over the last 35 years has included noise control engineering and town planning work for various major corporations and City Councils within New Zealand, and I have been engaged on numerous occasions as an expert witness before the Environment Court.
3. I have been significantly involved with airport noise at all the three major airports in New Zealand as well as many of the smaller regional airports, including Queenstown Rotorua, Whangarei, Dunedin, Invercargill, Wanaka, Ardmore, Hamilton, Tauranga, Nelson, Omaka, Paraparaumu, Gisborne, Masterton, and Taupo.
4. At Auckland Airport my firm has been engaged by the Manukau City Council and the Airport Company, at Wellington by the Board of Airline Representatives of New Zealand (**BARNZ**) and Wellington International Airport Limited (**WIAL**), and at Christchurch by Christchurch International Airport Limited (**CIAL**). Our work has involved noise predictions, computer modelling, noise boundary development and automated noise monitoring.
5. I have been engaged by Queenstown Airport Corporation (**QAC**) since 1992 to advise on various noise issues including the preparation of the original noise contours to form the basis of the airport noise provisions in the District Plan in the 1990s. MDA has carried out periodic noise monitoring at Queenstown Airport over the last five years, and carried out the recalculation of the noise contours for PC35, which involved a remodelling of future operations and subsequent noise contour modelling.

Code of Conduct

6. Although this is not an Environment Court hearing, I note that in preparing my evidence I have reviewed the code of conduct for expert witnesses contained in part 7 of the Environment Court Practice Note 2014. I have complied with it in preparing my evidence. I confirm that the issues addressed in this statement of evidence are within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

References

7. In preparing this evidence I have reviewed the following:
- (a) Section 42A Hearing Report 17 August 2016 and Appendix 1;
 - (b) Evidence of Dr Stephen Chiles 17 August 2016;
 - (c) Evidence of Mr Scott Roberts 2 September 2016;
 - (d) New Zealand Standard NZS 6805:1992 "Airport Noise Management and Land Use Planning";
 - (e) New Zealand Building Code Clause G4 "Ventilation".

SCOPE OF EVIDENCE

8. My brief by QAC for this hearing has been to review the mechanical ventilation and sound insulation requirements in Chapter 36 of the Proposed District Plan (**PDP**). Accordingly, my evidence will deal with the following:
- (a) Background and role;
 - (b) Summary of NZS 6805 and land use planning controls;
 - (c) Review of the airport related mechanical ventilation provisions;
 - (d) Review of airport related sound insulation provisions;
 - (e) General comments on the noise rules.

EXECUTIVE SUMMARY

9. Inappropriate land use planning around airports allowing residential encroachment exposes communities to the adverse effects of aircraft noise and exposes the airport operator to onsequential reverse sensitivity effects.
10. The Operative Queenstown Lakes District Plan (**ODP**) has included land use planning controls and noise controls from NZS 6805:1992 “Airport Noise Management and Land Use Planning” for many years.
11. The District Plan Review proposes to update various airport related provisions and this evidence comments on some of these;
 - (a) I agree with the proposal to upgrade the airport related ventilation requirement to include air conditioning;
 - (b) I agree with Mr Roberts recommendation to remove the reference to Clause G4 of the Building Code;
 - (c) I recommend the measurement distance for noise from these mechanical systems should be confirmed as 2m.
 - (d) I agree the table of standard sound insulation constructions should be upgraded to included double glazing;
 - (e) I have made a number of comments on drafting ambiguities in the Chapter 36 noise rules.

NEW ZEALAND STANDARD NZS 6805

12. Worldwide, the lack of appropriate land use planning around airports has historically caused significant numbers of people to be exposed to the adverse effects of airport noise and has initiated operational constraints on airports due to reverse sensitivity effects.
13. In 1992, the Standards Association of New Zealand published New Zealand Standard NZS 6805:1992 “Airport Noise Management and Land Use Planning” with a view to providing a consistent approach to noise planning around New Zealand airports with a goal to minimise these adverse effects. The Standard has been used by virtually every district

council since 1992 and it is one of the few noise standards that has not been put up for revision or amendment.

14. The Standard uses the “Noise Boundary” concept as a mechanism for local authorities to:
 - (a) “establish compatible land use planning around an airport”; and
 - (b) “set noise limits for the management of aircraft noise at airports.”
15. The Noise Boundary concept involves fixing an Outer Control Boundary (**OCB**) and a smaller, much closer Airnoise Boundary (**ANB**) around an airport. Inside the ANB, new noise sensitive uses (including residential) are recommended to be prohibited. Between the ANB and the OCB, the Standard recommends new noise sensitive uses should also be prohibited unless a district plan permits such uses, subject to acoustic insulation. The Standard also recommends noise controls to ensure an airport doesn’t exceed the noise levels that the ANB and OCB have been based upon.
16. The Standard uses the Day/Night Sound Level (L_{dn}) parameter for the assessment of noise. L_{dn} is a measure of noise exposure and uses the cumulative ‘noise energy’ that is produced by all flights during a typical day with a 10 decibel penalty applied to night flights to allow for the increased sensitivity to noise at night (see Appendix A for a full list of terminology). L_{dn} is used extensively overseas for airport noise assessment and it has been found to correlate reasonably with community response to aircraft noise.
17. The location of the ANB is usually based upon the projected 65 dB L_{dn} contour, and the location of the OCB is generally based on the projected 55 dB L_{dn} contour. These noise contours are normally calculated using the FAA Integrated Noise Model (INM) software and projections of future aircraft operations. In my evidence I generally refer to the ANB and the OCB as ‘boundaries’ and the INM predictions (e.g. 55 dB L_{dn}) as ‘contours’. The Standard recommends that a minimum of a 10 year period be used as the basis for the projections.
18. In my opinion, land use planning is an important and effective way to reduce population exposure to noise around airports. Aircraft technology and flight management, although an important component in abating noise, will not be sufficient alone to eliminate or adequately control aircraft noise.

Uncontrolled development of noise sensitive uses around an airport can unnecessarily expose additional people to high levels of noise and can constrain, by public pressure as a response to noise, the operation of this significant regional and national resource.

19. The Standard (clause 1.4.1.1) recommends land use controls to *“avoid, remedy or mitigate any adverse effects on the environment, including effects on community health and amenity values whilst recognizing the need to operate an airport efficiently”*.
20. Tables 1 & 2 of the Standard (page 15) lay out in detail the recommended land use controls summarised earlier in paragraph 13 above.
21. In addition to land use controls, the Standard recommends maximum noise emission limits for an airport, but does not specify operational procedures or how these limits are to be achieved. This is consistent with the general approach to noise control in New Zealand, in that it is left to the airport operator to best decide how to manage its activities to comply with an agreed level of noise.

Queenstown Airport Noise Contours

22. In 1995 airport noise boundaries were introduced into the Queenstown Lakes District Plan with a view to establishing compatible land use planning around the Airport and to set noise limits for the management of aircraft noise in accordance with NZS 6805.
23. The noise boundaries were based on future levels of airport operations based on projected growth out to 2015 and noise predictions using the INM modelling tool. The process included significant debate over whether the planning horizon was too long and the consequential noise contours too large. A compromise was negotiated with reductions in the size of the contours in some areas.
24. Compliance monitoring was carried out at the Airport over the following years and it became apparent that the Airport had been operating for a number of years close to ‘capacity’ for the noise limits contained in the District Plan via the airport noise boundaries.
25. In 2007 MDA was engaged by QAC to assist its planning team to update the airport noise provisions in the District Plan. This ‘updating’ was

required as the Airport had reached the District Plan noise limits, new aircraft types had been introduced and the software used to calculate the noise contours had been updated several times since 1995.

26. Updating the noise boundaries involved new forecasts of airport operations projected out until 2037, a new aircraft fleet mix and the relocation of the General Aviation (GA)/Helicopter base.
27. As expected, the noise boundaries were larger than the existing boundaries in some areas, to accommodate growth in the scheduled aircraft operations at the Airport.
28. The contours were thus the best prediction of future airport noise levels that was available at that time. These contours were adopted in PC35 and PC35 was subsequently confirmed by the Environment Court (subject to the location of the noise boundaries in the vicinity of Lot 6, which I understand has been addressed by legal counsel previously).

LAND USE PLANNING

29. As discussed above, NZS 6805 lays out recommended procedures for land use planning around airports, in an effort to avoid the land use conflicts that result in people being exposed to the adverse effects of aircraft noise and airports experiencing reverse sensitivity effects from surrounding communities.
30. The various local authority district plans around New Zealand have implemented the land use planning recommendations in NZS 6805 in different ways. The process is influenced by a number of factors including the extent of existing residential development inside the noise contours and the availability of land elsewhere in the District for future residential development.
31. By way of example, in Christchurch a significant green belt has been established around the airport as there has been no shortage of residential land at other locations around Christchurch. The Christchurch City Plan rules discourage noise sensitive activities inside the 50 dB Ldn noise boundary. Wellington on the other hand has over 600 existing houses inside the ANB and a shortage of residential land in the area and thus very little is provided in terms of land use controls. The airport noise issue is

addressed at Wellington by sound insulation requirements and noise controls (on the airport).

32. Queenstown Airport is relatively well located in terms of avoiding the adverse effects of noise on the community. Apart from the Frankton residences to the west, the noise affected area (OCB) for Queenstown falls predominantly over Lake Wakatipu, the river flats to the east and generally non residential land to the north and south of the main runway. It is thus important that land use controls are implemented to avoid new noise sensitive activities becoming exposed to aircraft noise.
33. The Operative Queenstown Lakes District Plan (**ODP**) as amended by PC35 includes land use controls for a number of zones which are affected by aircraft noise associated with the OCB and ANB for Queenstown Airport. The ODP also specifies noise mitigation in the form of sound insulation and ventilation in certain situations.

SOUND INSULATION AND VENTILATION

34. Generally, any new noise sensitive activity (**ASAN**) seeking to establish within the airport noise boundaries, (where permitted to do so), must ensure that an indoor sound level of 40 dB L_{dn} can be achieved in all Critical Listening Environments. This necessitates the provision of sound insulation and/or mechanical ventilation, depending on the particular location of the new activity within the noise boundaries.
35. To further explain, a new dwelling of modern construction located between the OCB (which is based on the 55 dB L_{dn} noise contour) and the ANB (based on the 65 dB L_{dn} noise contour), will generally only require the windows to be closed to achieve the indoor sound level of 40 dB L_{dn} . The standard construction provides sufficient sound insulation. However, with the windows closed, some form of ventilation and/or cooling is required to maintain appropriate thermal comfort in the variable Queenstown climate.
36. Within the higher noise environment of the ANB (based on the 65 dB L_{dn} noise contour), both sound insulation and mechanical ventilation are required. Sound insulation is required in addition to mechanical ventilation in this location, as a standard house construction needs improved sound insulation in order to achieve the indoor design sound level of 40 dB L_{dn} .

Proposed Rule 36.6.3 Table 5

37. Appendix 13 of the Operative District Plan (as amended by PC35) sets out the requirements for mechanical ventilation systems (without air-conditioning). I understand these requirements are proposed to be carried over in the PDP as Rule 36.6.3, Table 5. I understand that QAC submitted on this rule to address practical and cost issues that have become apparent since the inception of the original rule.
38. I understand that in response to QAC and others' submissions, the Section 42A Report Writer, relying on the evidence of Dr Chiles, has recommended that Rule 36.6.3 be amended to more appropriately deal with the Queenstown climate by requiring air-conditioning in addition to a smaller amount of ventilation.
39. While this is outside the area of my immediate expertise, I agree with this move in concept – it provides a better opportunity for occupants to keep their windows closed and thus avoid the effects of airport noise.
40. More specifically, I have read the evidence of Mr Scott Roberts and agree with his recommendation to delete the reference to G4 of the Building Code in Rule 36.6.3. In my opinion, there is no need to specify compliance with G4 in this rule – the legislation requires compliance in any case. In addition, the reference to G4 could confuse the situation as it refers to openable windows as an option to mechanical ventilation – this is not an option in the airport situation.
41. Furthermore, G4 specifies a minimum air flow rate and thus the high flow rate setting specified in Rule 36.6.3 would comply with G4. The intention of the low flow setting in Rule 36.6.3 is to ensure occupants can turn the flow rate down during winter so they don't experience cold draughts.
42. I agree with Dr Chiles' recommendations in respect of the acceptable sound levels from the ventilation equipment itself. Specifically, that the ventilation system should not exceed operating noise levels of 35 dB LAeq(30sec) on high speed and 30 dB LAeq(30sec) on low speed.
43. The ODP specifies that these operating noise levels should be measured at 1-2 meters from the unit. Dr Chiles has modified this to 1m in his recommended Table. I agree that it should be specified at a single

distance as 1-2m is ambiguous, but recommend that it should be measured at 2m. This distance is more appropriate as people are not generally located closer than 2m to a high wall heat pump unit or to a ducted grille.

Proposed Rule 36.6.2 Table 4

44. Table 4 of Rule 36.6.2 in the Proposed Plan provides sound insulation 'acceptable solutions' for a standard construction located inside the ANB to achieve the agreed internal design level of 40 dB L_{dn} . Alternative constructions can obtain approval following calculations by an appropriately qualified acoustic engineer.
45. Table 4 needs minor updating and I agree with the evidence of Dr Chiles where he recommends (in response to a submission by QLDC) changing the glazing specified to thermal double glazing. Also, I affirm his comments that dispel the urban myth that thermal double glazing provides superior acoustical performance – it doesn't. However, the specified double glazing (4mm+12mm+4mm) should achieve the required performance.

OTHER ISSUES

46. When reviewing Chapter 36 of the PDP for the purposes of preparing my evidence, I noted numerous discrepancies, ambiguities and inconsistencies within the Chapter. I acknowledge that not all of these are addressed by QAC's submission, however, given my role as an independent expert, I consider it appropriate that I bring them to the Panel's attention, as set out below.
47. Rule 36.3.2.5 states:
- In addition to the above, the noise from the following activities listed in Table one shall be Permitted activities in all zones (unless otherwise stated). For the avoidance of doubt, the activities in Table 1 are exempt from complying with the noise standards set out in Table 2.*
48. In my opinion, noise is not an 'activity' that can be classified as permitted or controlled or restricted discretionary etc, as the first part of the above rule

attempts to do. The intent of this clause is to exempt the noises listed in Table 1 from the noise standards in Table 2, as stated in the last sentence. I therefore recommend that the first sentence be deleted from the rule leaving only, *“The activities in Table 1 are exempt from complying with the noise standards set out in Table 2.”*

49. Following the same reasoning, i.e. the sounds listed in Table 1 are not ‘activities’, I recommend that the right-hand column of Table 1 be deleted.
50. Rules 36.23.2.8 and 36.4.6 duplicate the requirement for noise from Queenstown Airport and Wanaka Airport to be excluded from the general noise rules in Table 2. One of these rules could be deleted.
51. In my opinion, the headings in Table 2 and the sound source descriptions are extremely confusing. I recommend this table be significantly redrafted.
52. The rules generally interchange the words ‘noise’ and ‘sound’ randomly throughout the Chapter. The rules would benefit from a consistent use of one or the other – as the heading for Chapter 36 is noise, possibly noise is the logical choice.
53. I have discussed these issues in a general sense with Ms O’Sullivan, and I understand she may address them further in her evidence.

Christopher William Day

2 September 2016