# CHRISTCHURCH INTERNATIONAL AIRPORT

# 2016 AIRCRAFT OPERATIONS NOISE MONITORING REPORT

MARSHALL DAY Acoustics

CHRISTCHURCH AIRPORT bringing the world South

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## 1.0 INTRODUCTION

### 1.1 General

This Noise Monitoring Report is required to be prepared annually by Rule 1.2.4.2 in Part 11 of the Christchurch City Plan (CCP). The purpose of this report is to assess compliance of the 2016 annual operational noise contours and any associated monitoring results against the Christchurch City Plan (CCP).. This report includes the calculated noise contours for 2016, discussion regarding noise measurements and information on engine testing activity.

The Christchurch Replacement District Plan Hearings have concluded with the Christchurch Replacement District Plan Decision (CRDP) notified on November 21st 2016. The requirements of the CRDP generally apply to noise emissions in 2017, when the CRDP will become operative. As such, the matters presented in this report follow the requirements of the still operative Christchurch City Plan. The 2017 Noise Monitoring Report will be prepared in accordance with the new rules.

Christchurch International Airport is the main gateway to the South Island with current *total* aircraft movements of 95,000 to 105,000 per annum over the last 5 years. There were 100,445 total aircraft movements in 2016

Based on information provided by Airways Corporation NZ, the total number of *scheduled commercial* aircraft movements for the 2016 calendar year was 74,130, as shown in Table 1 below. A summary of the movement data input to the Integrated Noise Model (INM) computer model for producing the 2016 Aircraft Noise Contours is provided in section 2.1 of this report.

**Table 1: Scheduled Commercial Aircraft Movements**

| Aircraft Movements | 2016 | 2015 | 2014 | 2013 | 2012 | 2011 |
|---|---|---|---|---|---|---|
| Scheduled Commercial Movements | 74130 | 74144 | 75072 | 71715 | 73184 | 75529 |

### 1.2 Noise Performance Standards – Aircraft Operations

The CCP refers to airport noise in a number of locations. Rule 11-1.3.6 refers to the Airport's requirement to not exceed 65 dB $L_{dn}$ outside the airport noise contour (Volume 3, Part 2, Appendix 3 – 65 dB $L_{dn}$ Airport Noise Monitoring contour - CIAL). The rule states:

> *"1.3.6 Aircraft Noise*
>
> *Critical Standard*
>
> *CIAL shall manage the Christchurch International Airport so that the noise from aircraft operations does not exceed $L_{dn}$ 65 dBA outside the $L_{dn}$ 65 dBA airport noise contour shown in Appendix 3 to Part II.*

*Noise from aircraft operations shall be based on noise data from the Integrated Noise Model (INM) and records of actual aircraft operations at CIA. The noise level shall be calculated over the busiest three month period of the year.*

*Aircraft operations means:*

- *the landing and take off of aircraft at CIA*
- *aircraft flying along any flight path associated with a landing or take off at CIA*

*The following activities are excluded from the definition of Aircraft Operations:*

- *aircraft operating in an emergency for medical or national/civil defence reasons*
- *air shows*
- *military operations not associated with the Antarctic programme*
- *aircraft using the airport as an alternative to a scheduled airport elsewhere*
- *aircraft taxiing*
- *aircraft engine testing.*

*Exceedance by up to 1 dBA of the noise limit is permitted provided CIAL demonstrates at the request of, and to the satisfaction of, the Council that any such exceedance is due to atypical weather patterns."*

The Christchurch Airport 65 dB $L_{dn}$ District Plan noise contour is contained entirely in the Christchurch City District. In 2007 a new set of noise contours were formulated (commonly referred to as the "Expert Panel Contours"), including the 50 dB $L_{dn}$ and 55 dB $L_{dn}$ contours used for land use planning purposes. These new contours have been implemented, and are operative in the Selwyn and Waimakariri District Plans.

For Christchurch City, the Land Use Recovery Plan (LURP) (2013) adopted the Expert Panel 50 dB $L_{dn}$ contour for land use planning purposes in the district. However the LURP is not concerned with airport noise compliance and the relevant rule relating to airport noise control is still contained in the CCP (rule 1.2.4.2). This rule continues to refer to the older noise contours.

The CRDP Hearings have now concluded. During the course of the Hearings on the chapters relevant to aircraft noise, the 2007 50, 55 and 65 dB $L_{dn}$ contours were formally adopted for both land use planning and airport noise compliance. However, these noise contours are now considered operative following the public notification of the Decision version of the CRDP on November 21st 2016. Notwithstanding this, until the CCP is formally withdrawn and the CRDP is formally made Operative, the CCP countours and rules still apply.

In view of this, the 2016 Annual Aircraft Noise Contours (AANC) are assessed against the noise contours in the CCP.

From 2017 onwards, noise compliance will be assessed using the noise contours formally adopted in the CRDP.

Under the CCP, Rule 11 – 1.2.4.2 sets out the airport's obligation to provide annual calculations of the aircraft noise levels and the results of noise measurements where necessary.

> *"1.2.4.2 Aircraft noise monitoring*
>
> *CIAL shall annually provide to the Council's Environmental Services Manager the result of calculations based upon monitored aircraft movements for the preceding year and the known noise characteristics of those aircraft. These calculations will be performed by a person with appropriate qualifications and experience in airport noise modelling and acoustic assessments. The provided result shall be verified by noise measurements and shall be in the form of a 65 dBA $L_{dn}$ contour representing the noise created by aircraft operations over that year (other than movements of a kind excluded in the Aircraft Noise Rule 1.3.5) superimposed upon a copy of the plan forming Appendix 3 to Part II of this Plan. The measurement of aircraft sound exposure and the resultant derivation of a 65 dBA $L_{dn}$ shall be in accordance with NZS 6805:1992."*

## 2.0 ANNUAL AIRCRAFT NOISE CONTOURS

To ensure compliance is assessed in a robust manner, 2016 Annual Aircraft Noise Contours(AANC) have been calculated based on the average daily movements over the busiest three months in accordance with rule 1.3.6 of the CCP. In previous years an additional contour has been calculated which represents total aircraft movements during the busiest three months of operations on Runway 11-29.

The purpose of calculating noise contours for the busiest three months on Runway 11-29 is to assess compliance for the period of time when the north-west winds are prevalent and aircraft utilise Runway 11-29 more than usual.

Although this is not expressly required by the District Plan, CIAL consider it is necessary as it provides a worst case scenario when confirming noise levels over the City within the 65 dB $L_{dn}$ contours as identified in the CCP.

Analysis of this scenario is particularly critical for 2016 due to runway maintenance works spanning from 2015 into 2016 on the main runway, causing a requirement to shift operations to the crosswind runway for long periods of time. The effect of changing operations in this way could be especially significant because the works occurred at night in which case a 10 dB penalty applies to night-time movements. Such runway maintenance works are unusual and do not occur often.

However, MDA has analysed the movement data and determined that the busiest three consecutive months for Runway 02-20 were February, March, April. For 2016, the busiest three months for Runway 11-29 operations were also February, March April. Therefore, for 2016 only one compliance noise contour has been produced.

A diagram of the Christchurch Airport runway system is included as Appendix A for reference.

## 2.1 INM Inputs

The 2016 annual contours discussed in section 2.0 above have been calculated using the Integrated Noise Model (INM) developed by the US Federal Aviation Authority, version 6.0c which is the same version used to prepare the existing Christchurch City District Plan noise contours.

The INM software (like most software), has been upgraded regularly over the last 15 years. The updates to the INM program produce slightly different results. Historically the noise effects were considered and consented during the regulatory process using the contours produced by this software and subsequently placed in the CCP. As the contours were also used as the basis of determining appropriate land use planning controls and the selection of mitigation treatment, it is therefore considered that this same software version should also be used to prepare compliance contours.

A record of the aircraft activity for 2016 has been provided by Airways on the behalf of CIAL for input in to the INM in the form of monthly movements by aircraft type, operation, runway and time of day. This data is recorded by Airways Corporation and includes all movements of aircraft that are fitted with a transponder. As some general aviation (GA) aircraft do not have transponders, not all GA movements are accounted for.

GA aircraft are generally speaking, light aircraft. Noise from these light aircraft does not contribute significantly to total noise levels within the 65 dB $L_{dn}$ contour. For that reason, the nature and frequency of GA flights on the overall noise exposure would not affect the location of the 65 dB $L_{dn}$ noise contour significantly. The effect of general aviation aircraft on the overall noise exposure and compliance with the District Plan noise contours is identified in Appendix D

MDA has analysed the movement data and determined that the busiest three consecutive months for Runway 02-20 were February, March, April. For 2016, the busiest three months for Runway 11-29 were also February, March April. Therefore, for 2016 only one compliance noise contour has been produced.

The annualised total movements for the modelled scenario is shown in Table 2 as well as a breakdown of the annualised day and night time movements. The number of night time movements is relevant as night time activity has an associated + ten decibel adjustment. A breakdown of the average daily aircraft movements by aircraft type and runway is included as Appendix B.

**Table 2: Summary of Modelled Aircraft Movements**

| | **Busiest 3 Months Feb-April** |
|---|---|
| **Annualised Total Movements** | 107938 |
| **Annualised Day Time Movements** | 96648 |
| **Annualised Night Time Movements** | 11289 |

The aircraft movement data is defined as using either the main runway (02/20) or the crosswind runway (11/29). During the generation of the CRDP contours, historical records of aircraft movements at the airport have been analysed to determine the predominant runway usage at the airport. This predominant usage has historically been used to generate the compliance contours. Data provided by Airways now includes actual runway usage data and this has been used in the preparation of the 2016 compliance contours. The main runway is used to a more significant extent than the crosswind runway. Based on the Airways records the runway usage is as follows:

| | |
|---|---|
| Main Runway: | RW 02 = 71 % |
| | RW 20 = 29% |
| Crosswind Runway: | RW11 = 19% |
| | RW 29 = 81% |

In the INM model, aircraft movements have been distributed across flight tracks which were developed in 2007 during the review of the airport noise boundaries. The contour outcomes of the 2007 review are implemented in the Canterbury Regional Policy Statement.

It is noted that for the purpose of modelling the location of the 65 dB $L_{dn}$ contour, the flight track details beyond 4 km from the runway are irrelevant as the contour does not extend further than this. Therefore the approach taken is considered to be robust, valid and appropriate.

### 2.2 Calculated Contours

The calculated 65 dB $L_{dn}$ contour for 2016 activity, as described above, is shown in Figure 1, Appendix C for the busiest 3 months on Runway 02-20 and Figure 2, Appendix C for the busiest 3 months on Runway 11-29, both compared with the Christchurch City District Plan 65 dB $L_{dn}$ noise contour.

The results of the analysis demonstrate that compliance with the CCP 65 dB $L_{dn}$ noise contour was acheived during 2016 flight operations. It is noted that Figure 1 shows compliance is only narrowly achieved in the vicinity of Runway 11-29. This is primarily due to runway maintenance works and the resulting shift of operations onto the runway 11-29 and exacerbated by the 10 dB penalty for night time operations. Accordingly, this report confirms compliance with the requirements of Rule 11-1.3.6 'Aircraft Noise'.

## 3.0 MEASURED NOISE LEVELS

No noise measurements were carried out in 2016, primarily because the replacement district plan hearings were occurring, and were considered to be a priority.

The Christchurch Internaitonal Airport Limited (CIAL) Noise Management Plan (NMP) discusses the noise measurement regime and states that the rules do not specifically state how frequently noise measurements occur. The NMP therefore stipulates that measurements should occur on a three yearly cycle. Over the last five years, noise measurements have occurred in 2012, 2013, 2014, and 2015.

Noise mesurements undertaken during preceding years demonstrate measured levels are consistent with predicted noise levels calculated for the AANC's. As such, it is considered that predictions are an accurate representation of noise levels received in the community. It is therefore considered that the 2016 calculated noise levels should be considered accurate.

## 4.0 ENGINE TESTING

The current version of the Noise Management Plan discusses the methods used to manage noise from engine testing at Christchurch Airport. The Noise Management Plan States:

> *"3.0 Engine Testing*
>
> *Under the bylaws and the Airside operations Agreement details of each night-time engine testing event are recorded by the aircraft operator and forwarded to CIAL. CIAL will record the details of each event in a purpose made engine testing noise monitoring application. This software will be used to calculate noise levels in the wider community resulting from night time 'on wing' engine testing. The noise levels received at the most affected dwellings shall be calculated and monitored over a period of not less than 3 months for the purpose of carrying out an assessment of engine testing noise effects. Following the assessment of noise effects, consideration will be given to developing additional or alternative controls on engine testing and land use management should the outcome of the assessment signal that this is appropriate. The target completion date of the assessment of engine testing noise effects is March 2014."*

The effects assessment referred to above was placed on hold, and was updated and presented in a different form through the RDP Hearings in 2016. The software referred to in the NMP has been developed by MDA over the last 7 years and is now being used to collect and analyse engine testing data. Outputs from the software were used extensively in 2016 during the Hearings for the CRDP. The outputs were scrutinised by the Commissioners during the plan hearing process.

The MDA software (Engine Testing Monitoring Software - ETMS) is being used to calculate and assess the noise levels emitted over the period November 2010 to the present time . The ETMS was originally populated excusively by Air New Zealand data received from the maintenance base ground run engineers. The requirements to collect engine testing data have now been broadened as a result of the CRDP.

The historical noise emissions have been compared with appropriate engine testing noise limits. At present there is no actual requirement in the Christchurch International Airport By-Laws Approval Order 1989 regarding engine testing noise levels. This is the reason that the software is being used in reviewing the calculated noise levels in relation to controls used elsewhere in NZ.

A report has previously been prepared on the results (Marshall Day Acoustics Report (Rp 001 R042012503A, dated 20 October 2015), including an opinion on the magnitude of the noise exposure. The report includes a comparison of the historical noise emissions with various noise controls with respect to ground

running of aircraft engines in the Russley area and an opinion on the noise exposure for residents surrounding the airport.

The CRDP has now incorporated new engine testing noise contours and operational restrictions that Christchurch Airport must comply with. Compliance with these contours will rely on the development of engine testing monitoring software and the imposition of engine testing restrictions. These requirements will come into effect when the CRDP is formally made operative. As such, analysis of compliance will be provided when the CRDP is made operative in both quarterly and annual reports, as required by Rule 6.1.6.2.6.

### 4.1 Measured Engine Testing Noise Levels

No engine testing noise level measurements were conducted in 2016. As part of the new District Plan engine testing rules, noise verification measurements will be carried out. Noise Monitoring Terminals have been deployed in February 2017 for this purpose, and are expected to be on selected sites, as identified in the CRDP, for approximately 6 months.

## 5.0 COMPLAINTS

Noise Complaints are occasionally received as a result of both general airport operations and specifically related to engine testing. CIAL currently investigate complaints in the following manner:

The CIA Noise Complaints Procedure provides individuals with the ability to express, and have recorded, their concerns about aviation noise (activities) or to ask questions regarding noise at CIA.

Noise complaints may be made by using forms available on the CIAL website or by calling the CIAL Integrated Operation Centre (IOC) office which is manned 24 hours a day (on phone 353 7777). IOC staff document noise complaints by obtaining information from the caller about the nature of the complaint, time of the occurrence, location of callers residence and the activity that caused disturbance. This information is used to determine the probable activity that was responsible for the complaint.

CIAL firstly screens complaints to determine if the complaint can be dealt with in-house or if further investigation or analysis of data by Marshall Day Acoustics needs to be undertaken in order to provide a satisfactory outcome.

A follow up phone call will be made followed by a written response / e-mail if requested by the caller detailing the complaint and details of the activity responsible, the meteorological conditions and the runway in use at the time of the disturbance. A notice of action taken by CIAL in respect of the complaint will be included. Typically it will take CIAL staff up to 2 days to make a follow up phone call and up to 7 days to respond in writing if where required

The following is a summary of the 244 noise complaints received in 2016:

| Complaints Type | Number |
|---|---|

| | |
|---|---|
| Low flying aircraft | 215 |
| Night-time aircraft | 10 |
| Unknown | 8 |
| Engine testing | 7 |
| Helicopters | 2 |
| General Aviation (GA) | 1 |
| Other | 1 |

### 5.1 Specific Complaint investigation

No Specific noise complaint investigations were carried out in 2016 by Marshall Day Acoustics, as no specific complaint response investigation was deemed necessary. Where required, desktop complaint responses were provided by CIAL in accordance with the provisions of section 5, above.

## 6.0 CONCLUSION

Noise contours have been calculated to establish whether noise from aircraft operations at Christchurch International Airport during 2016 complied with the CCP 65 dB $L_{dn}$ noise contour limit. The modelling confirms that noise from aircraft operations at Christchurch International Airport meet compliance restrictions.

Engine testing noise levels will be reported on as part of the new rules introduced in the CRDP once it becomes formally operative. It is expected the engine testing noise assessment in the 2017 Noise Monitoring Report will be expanded and take account of the new District Plan requirements.

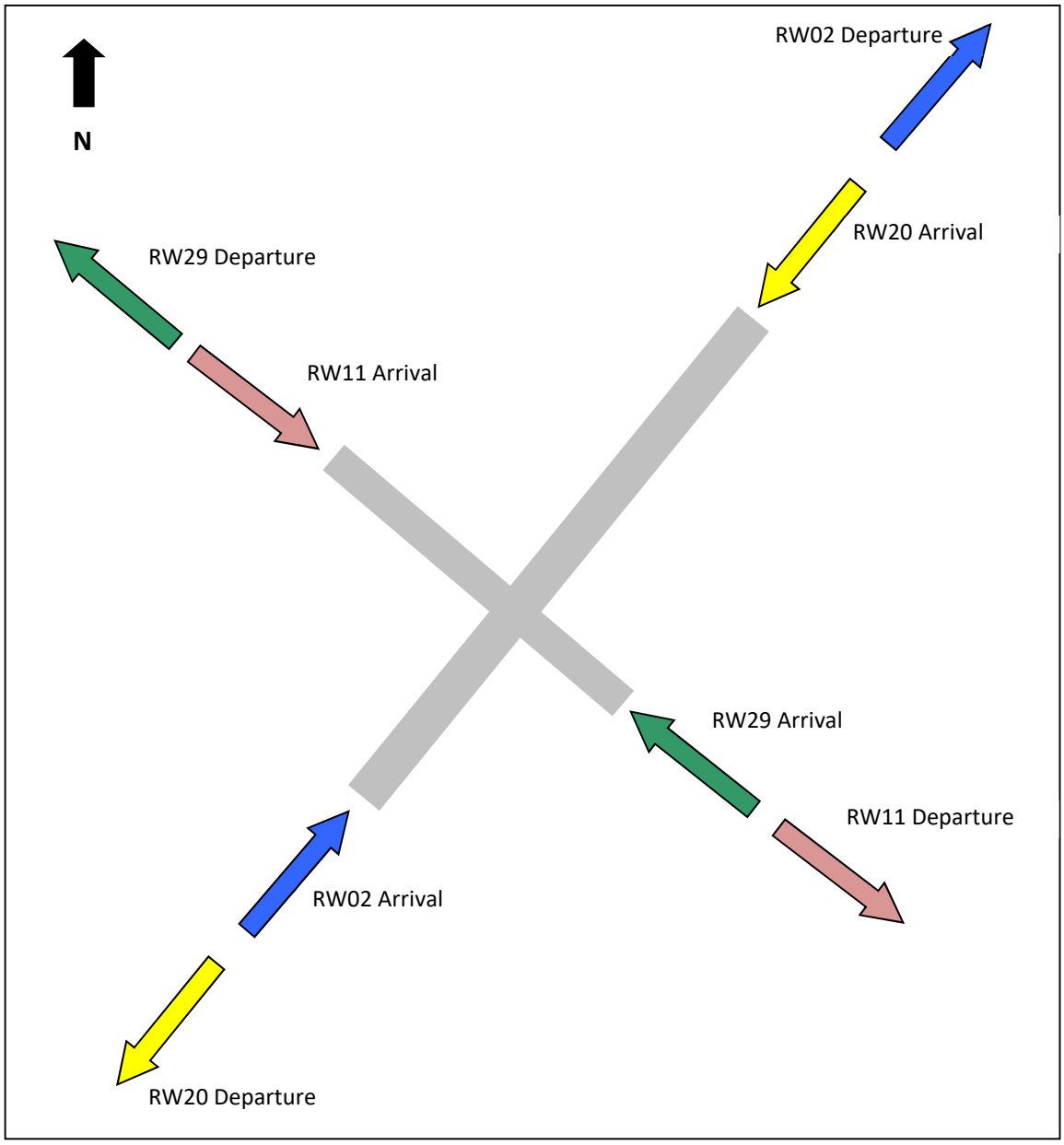
## APPENDIX A: CHRISTCHURCH AIRPORT RUNWAY VECTORS

**Runway 02** refers to operations using the main runway with a heading of 20 degrees from true north i.e. arrivals from the south west landing in a north easterly direction and departures towards the north east.

**Runway 20** refers to operations using the main runway with a heading of 200 degrees from true north i.e. arrivals from the north east landing in a south westerly direction and departures towards the south west.

**Runway 11** refers to operations using the crosswind runway with a heading of 110 degrees from true north i.e. arrivals from the north west landing in a south easterly direction and departures towards the south east.

**Runway 29** refers to operations using the crosswind runway with a heading of 290 degrees from true north i.e. arrivals from the south east landing in a north westerly direction and departures towards the north west.



## APPENDIX B: MODELLED AIRCRAFT MOVEMENTS

### *Aircraft movements for busiest three month contour (Figure 1)*

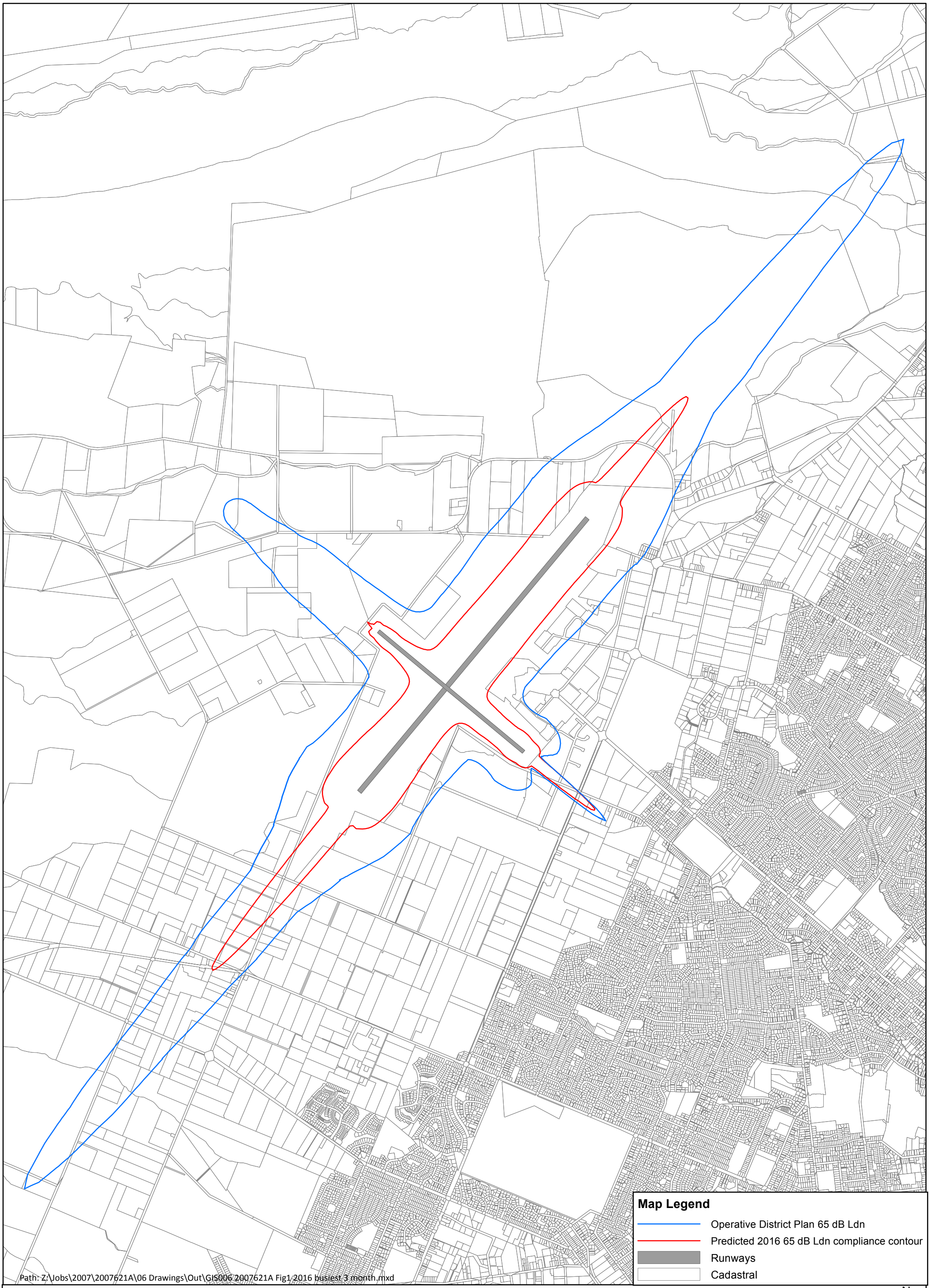
| | | Runway 02 | | Runway 11 | | Runway 20 | | Runway 29 | |
|---|---|---|---|---|---|---|---|---|---|
| **Aircraft Type** | **Aircraft** | **Day** | **Night** | **Day** | **Night** | **Day** | **Night** | **Day** | **Night** |
| **Scheduled Jets** | A320 | 47.67 | 5.67 | 0.59 | 0.74 | 14.70 | 2.40 | 2.77 | 0.83 |
| | A333 | 0.88 | 0.00 | 0.00 | 0.00 | 0.14 | 0.00 | 0.02 | 0.00 |
| | B733 | 0.00 | 0.27 | 0.00 | 0.18 | 0.02 | 0.11 | 0.00 | 0.29 |
| | B734 | 0.28 | 1.13 | 0.10 | 0.53 | 0.06 | 0.40 | 0.14 | 0.74 |
| | B738 | 2.82 | 2.59 | 0.00 | 0.56 | 0.96 | 1.09 | 0.09 | 0.77 |
| | B752 | 0.04 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | B763 | 0.62 | 0.68 | 0.00 | 0.01 | 0.20 | 0.46 | 0.00 | 0.01 |
| | B772 | 1.58 | 0.00 | 0.00 | 0.00 | 0.54 | 0.00 | 0.01 | 0.00 |
| | B77W | 1.53 | 0.00 | 0.00 | 0.00 | 0.47 | 0.00 | 0.00 | 0.00 |
| | B788 | 0.42 | 0.26 | 0.00 | 0.00 | 0.13 | 0.02 | 0.00 | 0.01 |
| **Scheduled Turbo-Props** | AT72 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | AT75 | 18.90 | 0.29 | 0.09 | 0.03 | 5.61 | 0.39 | 1.24 | 0.01 |
| | AT76 | 29.80 | 0.22 | 0.13 | 0.02 | 9.72 | 0.33 | 1.33 | 0.02 |
| | B190 | 7.33 | 0.00 | 0.62 | 0.00 | 2.51 | 0.00 | 0.57 | 0.01 |
| | BE20 | 0.09 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.02 | 0.00 |
| | CVLT | 0.77 | 1.28 | 0.00 | 0.97 | 0.26 | 0.71 | 0.03 | 1.13 |
| | DH8C | 22.37 | 0.13 | 0.67 | 0.00 | 7.27 | 0.01 | 1.44 | 0.00 |
| | PA31 | 0.08 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 |
| | SW4B | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **General Aviation** | B190 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 |
| | BE20 | 0.41 | 0.03 | 0.01 | 0.01 | 0.17 | 0.00 | 0.01 | 0.03 |
| | BE36 | 0.16 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 |
| | BE40 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| | BE9L | 0.58 | 0.02 | 0.04 | 0.00 | 0.23 | 0.00 | 0.01 | 0.00 |
| | C130 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | C150 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | C172 | 3.36 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | C180 | 0.51 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | C182 | 0.30 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | C185 | 0.44 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | C206 | 0.43 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | C208 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | C402 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | C441 | 0.21 | 0.02 | 0.01 | 0.01 | 0.06 | 0.02 | 0.06 | 0.02 |
| | C510 | 0.04 | 0.00 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 |
| | C650 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | C680 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | C72R | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | DA40 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | DA42 | 0.07 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 |
| | DC3 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | DH8C | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | E550 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | F2TH | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | F406 | 0.17 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| | FA7X | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 |
| | GA8 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | GLEX | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| | GLF6 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 |
| | H25B | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | JPRO | 0.16 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | JS32 | 0.01 | 0.01 | 0.00 | 0.01 | 0.02 | 0.00 | 0.00 | 0.00 |
| | LJ35 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | M6 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | MCR4 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | MU2 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | P210 | 0.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | P28A | 18.69 | 3.37 | 0.00 | 0.00 | 0.34 | 0.00 | 0.01 | 0.00 |
| | P28B | 0.24 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | P28R | 1.11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | P28T | 0.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | P51 | 0.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | P68 | 4.64 | 0.10 | 0.01 | 0.02 | 1.02 | 0.00 | 0.07 | 0.02 |
| | P750 | 0.18 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | PA18 | 0.74 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | PA24 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | PA31 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | PA32 | 0.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | PA34 | 4.83 | 0.31 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | PA38 | 9.32 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | PA46 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | PC12 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 |
| | R200 | 20.53 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | RALL | 0.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | RV4 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | RV6 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | RV7 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | SIRA | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | SR22 | 0.07 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.01 | 0.00 |
| | SVNH | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | SW4B | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | T18 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | T6 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | TOBA | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | TRIN | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | VAMP | 0.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Non-Scheduled** | A319 | 0.06 | 0.00 | 0.00 | 0.00 | 0.04 | 0.01 | 0.00 | 0.00 |
| | A320 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 |
| | AT75 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | AT76 | 0.01 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.01 | 0.00 |
| | B734 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 |
| | B737 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | B738 | 0.09 | 0.11 | 0.00 | 0.00 | 0.03 | 0.02 | 0.01 | 0.01 |
| | B744 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | B752 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | B763 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.02 | 0.00 | 0.00 |
| | B788 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | B789 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | BE20 | 0.58 | 0.03 | 0.01 | 0.01 | 0.10 | 0.02 | 0.03 | 0.01 |
| | BE30 | 0.06 | 0.02 | 0.01 | 0.02 | 0.04 | 0.01 | 0.02 | 0.00 |
| | BE40 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| | BE9L | 0.10 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 |
| | C208 | 0.02 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | C25C | 0.10 | 0.00 | 0.00 | 0.00 | 0.06 | 0.02 | 0.01 | 0.00 |
| | C402 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | C441 | 0.24 | 0.04 | 0.01 | 0.00 | 0.17 | 0.01 | 0.03 | 0.00 |
| | C510 | 0.04 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | CL60 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | CVLT | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| | DC3 | 0.01 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 |
| | F27 | 0.02 | 0.12 | 0.00 | 0.08 | 0.00 | 0.01 | 0.00 | 0.08 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | F2TH | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | FA20 | 0.01 | 0.00 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 |
| | GLEX | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | GLF4 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | JS32 | 0.13 | 0.00 | 0.00 | 0.00 | 0.03 | 0.02 | 0.01 | 0.03 |
| | PA31 | 0.19 | 0.00 | 0.00 | 0.01 | 0.03 | 0.00 | 0.00 | 0.01 |
| | PA34 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | PAY4 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | PC12 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 |
| | SW4B | 0.02 | 0.17 | 0.00 | 0.06 | 0.02 | 0.07 | 0.00 | 0.11 |
| **Military** | A332 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | B737 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | B752 | 0.30 | 0.00 | 0.01 | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 |
| | BE20 | 0.32 | 0.00 | 0.00 | 0.00 | 0.16 | 0.00 | 0.00 | 0.00 |
| | C130 | 0.90 | 0.01 | 0.00 | 0.00 | 0.19 | 0.01 | 0.01 | 0.00 |
| | C17 | 0.19 | 0.02 | 0.00 | 0.00 | 0.02 | 0.00 | 0.01 | 0.00 |
| | CL60 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | P3 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | T6 | 0.03 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.01 | 0.00 |

## APPENDIX C: NOISE COMPLIANCE CONTOURS

**Figure 1: Noise from Aircraft Operations – 2016 AANC**




MARSHALL DAY Acoustics

**Figure 1 - Christchurch Airport**
**2016 Annual Aircraft Noise Contours - 2016 Compliance Contour**

Prepared By: SJP
Date: 27/01/2017
Time: 3:59:17 p.m.

Scale @ A3: 1:30,000
0 250 500 1,000 m

N

## APPENDIX D: THE EFFECT OF GA ACTIVITY ON THE NOISE CONTOURS

General Aviation (GA) aircraft are light piston powered propeller driven aircraft typically operated by small businesses, private operators and aero club members. There are a considerable number of GA aircraft operating from Christchurch Airport but the noise emission of a GA aircraft is significantly lower than a commercial jet. Neither the existing City Plan noise boundaries nor the recently developed 'Expert Panel' noise boundaries include GA activity in the modelling. The Expert Panel agreed that the contribution of GA aircraft to the Airport's noise contours was insignificant and therefore it was not necessary to include this activity in the modelling.

To validate this assertion, the noise contours for the busiest three months in 2008 were calculated both with and without GA activity. The actual aircraft type for each GA movement was not identified in the available records therefore the calculations were based on the noisier GA aircraft types operating at the airport. The inclusion of GA in the model resulted in an increase of approximately 0.1 dB in Ldn which is considered to be a negligible change. Due to the small contribution to overall noise from the GA aircraft, it is considered reasonable to exclude this activity from the INM calculations.

The effect that GA activity has on the noise contours in the future will depend on the ratio of GA movements to large commercial aircraft movements. To monitor any significant change in this ratio, the table below lists the annualised busiest three months of airport operations by aircraft category. Each year the table will be updated in order to develop a historical record and highlight any significant changes in GA activity ratios.

**Annualised Busiest Three Months of Aircraft Movements by Aircraft Category**

| | Jet | Turbo-Prop | General Aviation |
|---|---|---|---|
| 2008 | 47,000 | 40,000 | 30,000 |
| 2009 | 39,000 | 40,000 | 54,000 |
| 2010 | 37,000 | 40,000 | 47,000 |
| 2011 | 39,000 | 35,000 | 44,000 |
| 2012 | 42,000 | 44,000 | 42,000 |
| 2013 | 36,000 | 51,000 | 37,000 |
| 2014 | 34,000 | 41,000 | 36,000 |
| 2015 | 36,000 | 47,000 | 25,000 |
| 2016 | 35,000 | 42,000 | 30,000 |

Note: Figures are rounded to the nearest 1000 movements and are not exact