CHRISTCHURCH INTERNATIONAL AIRPORT

2011 AIRCRAFT OPERATIONS NOISE MONITORING REPORT

MARSHALL DAY Acoustics

Christchurch International airport Limited

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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. The purpose of the report is to present the annual calculated noise contours and associated monitoring results which have been prepared to assess compliance with the City Plan noise standard for aircraft operations at the Airport. This report is for the 2011 calendar year and includes the calculated noise contours the noise measurement results and information on engine testing activity.

Christchurch International Airport is the main gateway to the South Island with current aircraft movements of between 80,000 to 90,000 per annum.

The total number of commercial aircraft movements for the 2011 calendar year was 79,300. A summary of the movement data input to the INM computer model for producing the 2011 Aircraft Noise Contours is provided in section 2.1 of this report.

1.2 Noise Performance Standards – Aircraft Operations

The Christchurch City Plan refers to airport noise in a number of locations. Rule 11-1.3.6 refers to the Airport's requirement to not exceed 65 dBA L_{dn} outside the airport noise contour shown in the City Plan (Volume 3, Part 2, Appendix 3 - 65 dBA 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 Ldn 65 dBA outside the Ldn 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 dBA L_{dn} District Plan noise contour crosses over three different districts Waimakariri, Selwyn and Christchurch City. In 2007 a new set of District Plan noise contours were formulated, these contours have been implemented, and are operative in the Selwyn and Waimakariri District Plans but the Christchurch City District Plan contains the old District Plan noise contours. In view of that, we will assess the 2011 Annual Aircraft Noise Contours (AANC) and 2011 monitoring results against the new District Plan noise contours in the Waimakariri and Selwyn District Plans and the old District Plan noise contours in the Christchurch City District Plan.

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 Ldn 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 Ldn shall be in accordance with NZS 6805:1992."

2.0 ANNUAL AIRCRAFT NOISE CONTOURS

To ensure compliance is fully assessed, 2011 Annual Aircraft Noise Contours have been calculated based on the average daily movements over the busiest three months. In previous years another contour has been calculated which represents the busiest three months on Runway 29.

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

Although this is not expressly required by the District Plan, we believe that it is necessary as it provides a worst case scenario when confirming noise levels over the City within the 65 dBA L_{dn} contours as identified in the city Plan (Volume 3, Part 2, Appendix 3 - 65 dBA L_{dn} Airport Noise Monitoring Contour - CIAL).

This contour was not needed this year as the overall busiest three months corresponded with the busiest three months on Runway 29.

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

2.1 INM Inputs

The 2011 annual contours have been calculated using the INM version 6.0c which is the same version used to prepare the existing Christchurch City District Plan noise contours.

A record of the aircraft activity for 2011 has been provided by 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.

Noise from these light aircraft does not contribute significantly in terms of noise levels within the 65 dBA 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 dBA Ldn 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 were January, February and March 2011.

The annualised total movements are shown in Table 1 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 + 10 decibel adjustment. A breakdown of the average daily aircraft movements by aircraft type and runway for the calculated contours is included as Appendix B.

Table 1: Summary of Modelled Aircraft Movements

	Busiest 3 Months
Annualised Total Movements	84,116
Annualised Day Time Movements	71,994
Annualised Night Time Movements	12,122

The aircraft movement data provided by CIAL does not contain explicit runway usage data, rather the runway is defined as either the main runway (02/20) or the crosswind runway (11/29). Historical records of aircraft movements at the airport have been analysed to determine the predominant runway usage at the airport. Based on these records the historical runway usage is as follows:

Main Runway: RW 02 = 64 %
RW 20 = 36%

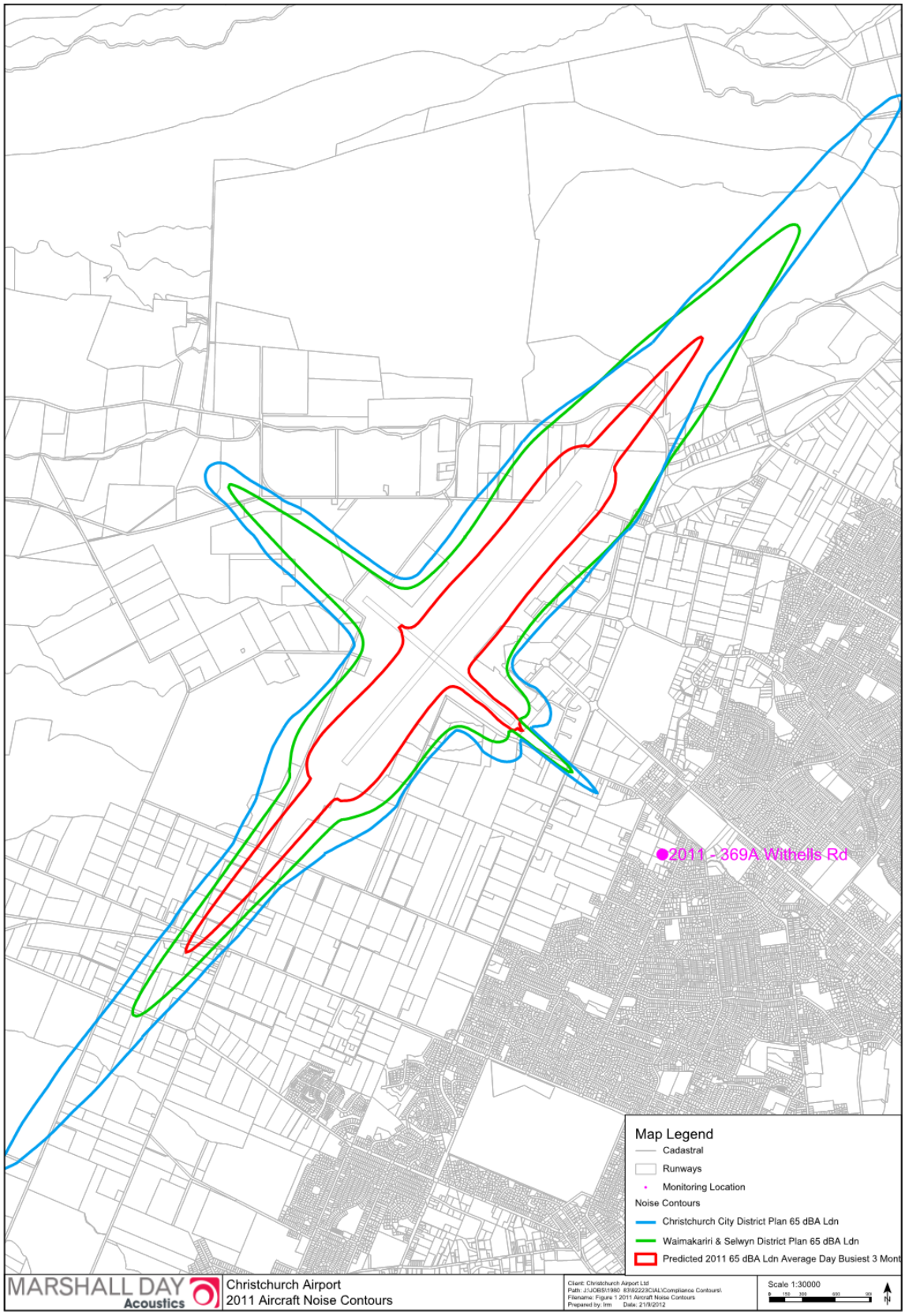
Crosswind Runway: RW11 = 0%
RW 29 = 100%

In the 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 Change 1 to the Regional Policy Statement. It is noted that for the purpose of modelling the location of the 65 dBA 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 dBA L_{dn} contour for 2011 activity, as described above, is shown in Figure 1 below compared with the Waimakariri/Selwyn District Plan and Christchurch City District Plan 65 dBA Ldn 65 dBA L_{dn} noise contours. The 2011 contours comply comfortably with the both District Plan Noise Contours. Accordingly, this report identified compliance with the requirements of Rule 11-1.3.6 'Aircraft Noise'.

Figure 1: Noise from Aircraft Operations 2011 Compared with City Plan Limit



3.0 MONITORED NOISE LEVELS

3.1 Site Locations

Marshall Day Acoustics airport noise monitor was located at 369 Withells Road, Yaldhurst, Christchurch from 5 November 2011 to 29 February 2012 for the purpose of measuring L_{dn} noise levels from aircraft operations. The site is approximately one and a half kilometres from the end of the crosswind runway (RWY 29). The site location relative to the Waimakariri/Selwyn District and Christchurch City District Plan 65 dBA L_{dn} noise contour is shown in Figure 1.

3.2 Airport Noise Monitoring Equipment

Noise monitoring was carried out in general accordance with New Zealand Standard NZS 6805:1992 "*Airport Noise Management and Land Use Planning*". The Marshall Day Acoustics airport noise monitor consists of a Norsonic 1225 sound level meter with an outdoor microphone kit. Data is stored on a memory card and downloaded through the Noise and Weather website.

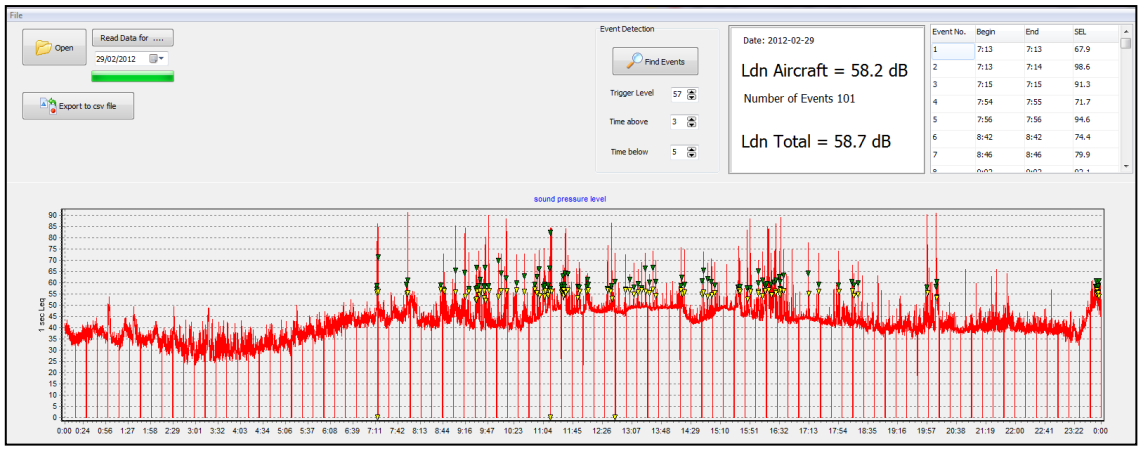
Figure 2 shows the Withells Road site.

Figure 2: Noise Monitor Location

The system uses the aircraft identification software in post processing to isolate any events with aircraft characteristics.

The analysis software allows calculations to be undertaken over a wide range of parameters, and provides graphical noise level traces that can be used in the analysis process. Figure 3 shows a screenshot of the software analysis module.

Figure 3: Analysis Software Screenshot



The measurement results presented in this report have been generated using the above software.

3.3 Monitoring Results

A total of 113 full days of data were recorded, of this 13 days were contaminated by extraneous noise. These days were not used in the assessment and thus 100 days were analysed. We consider that the data is sufficient to provide a robust and reliable assessment of the Airport's operating noise level.

The average, maximum and minimum daily number of noise events is also shown in Table 2.

Table 2: Summary of Monitor Results

	Measured Noise Levels (dB L_{dn})	Number of Events
Minimum	29	4
Maximum	60	201
Average	49	60

Based on interpolation between the Christchurch City District Plan 55 and 65 dBA L_{dn} noise contours, the noise level at the monitoring site is approximately 2 decibels below the level at the Christchurch City District Plan 65 dBA L_{dn} noise contour. For the Waimakariri/Selwyn District Plan contour the noise level at the monitoring site is approximately 4 decibels below the level at the Waimakariri/Selwyn District Plan 65 dBA L_{dn} noise contour.

Following this assumption, the corresponding measured noise levels at the 65 dBA L_{dn} contours would be:

Table 3: Extrapolated Noise Levels at the Operative and Proposed City Plan 65 dBA L_{dn} Contour

	Measured Noise Levels (dB L_{dn})	
	Christchurch City Noise Contour	**Waimakariri/Selwyn Noise Contour**
Minimum	31	33
Maximum	62	64
Average	51	53

Based on the above, the monitoring results demonstrate that noise from aircraft operations during the monitoring period comfortably complied with the noise limit.

4.0 ENGINE TESTING

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 by laws 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 November 2012."*

The software referred to in the NMP has been developed by MDA over the last year and is now able to be used. 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 August 2012 (where ANZL records are available). These historical noise emissions will be compared with appropriate engine testing noise limits. At present there is no actual requirement in the Christchurch by-law 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 will be prepared on the results in due course, including an opinion on the

magnitude of the noise exposure. It intended to pause at this point to allow discussions between CIAL and ANZL over the outcome of the study and to determine what, if any, further work in determining appropriate controls is appropriate. The report will include a comparison of the historical noise emissions with various noise controls and an opinion on the noise exposure for residents surrounding the airport.

Engine testing noise control and actual calculated noise levels are anticipated to be presented in this specific report, and are likely to be reported in this Noise Monitoring Report from 2012 onwards.

5.0 CONCLUSION

Noise contours have been calculated and in-field monitoring carried out to establish whether noise from aircraft operations at Christchurch International Airport during 2011 complied with the Waimakariri, Selwyn and Christchurch City District Plan 65 dBA L_{dn} noise contour limit. Both the contouring exercise and the noise monitoring results confirm that noise from aircraft operations in 2011 comfortably complied with the 65 dBA L_{dn} limit.

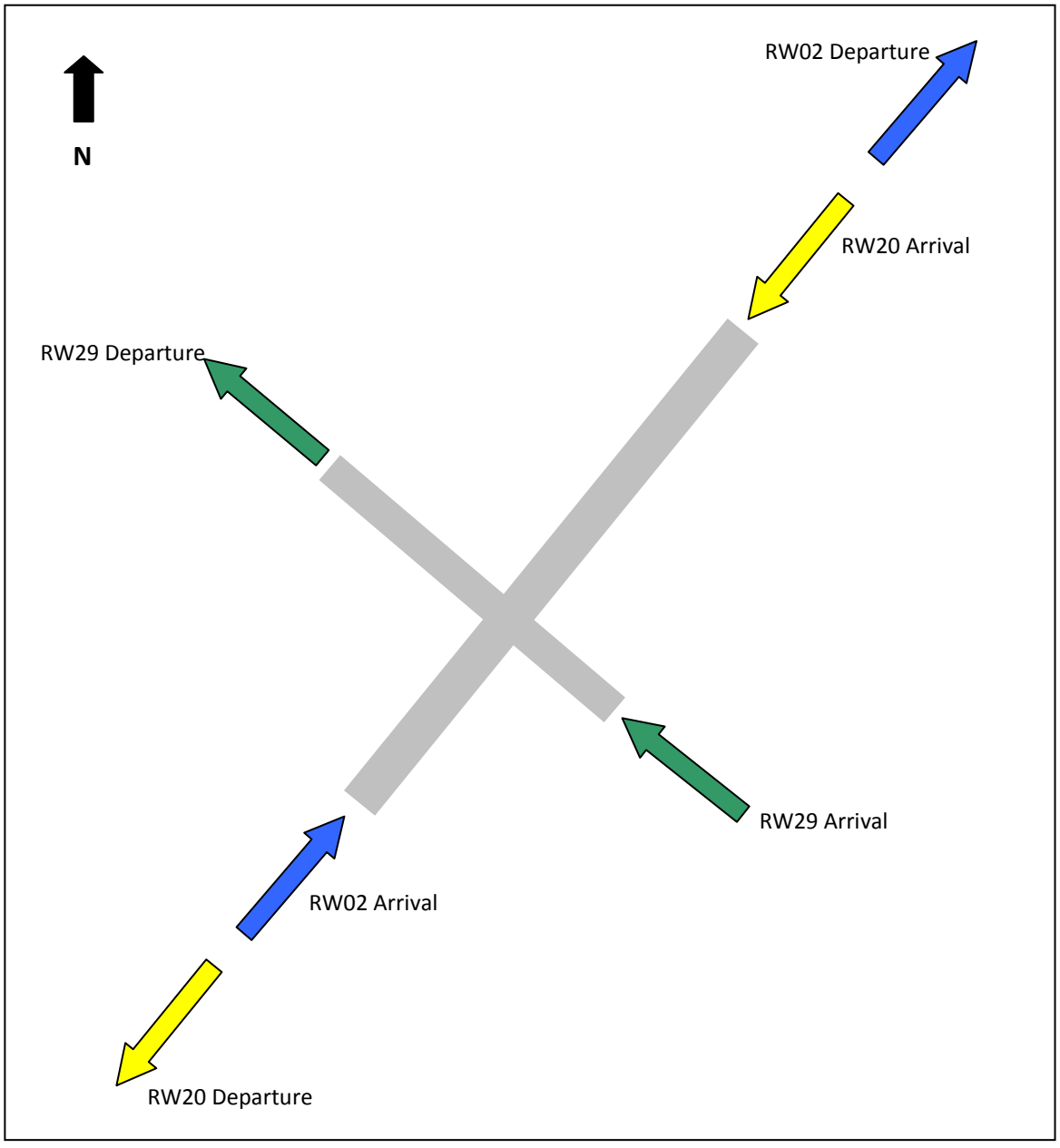
Engine testing noise levels are currently being assessed and will be reported on in due course.

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.

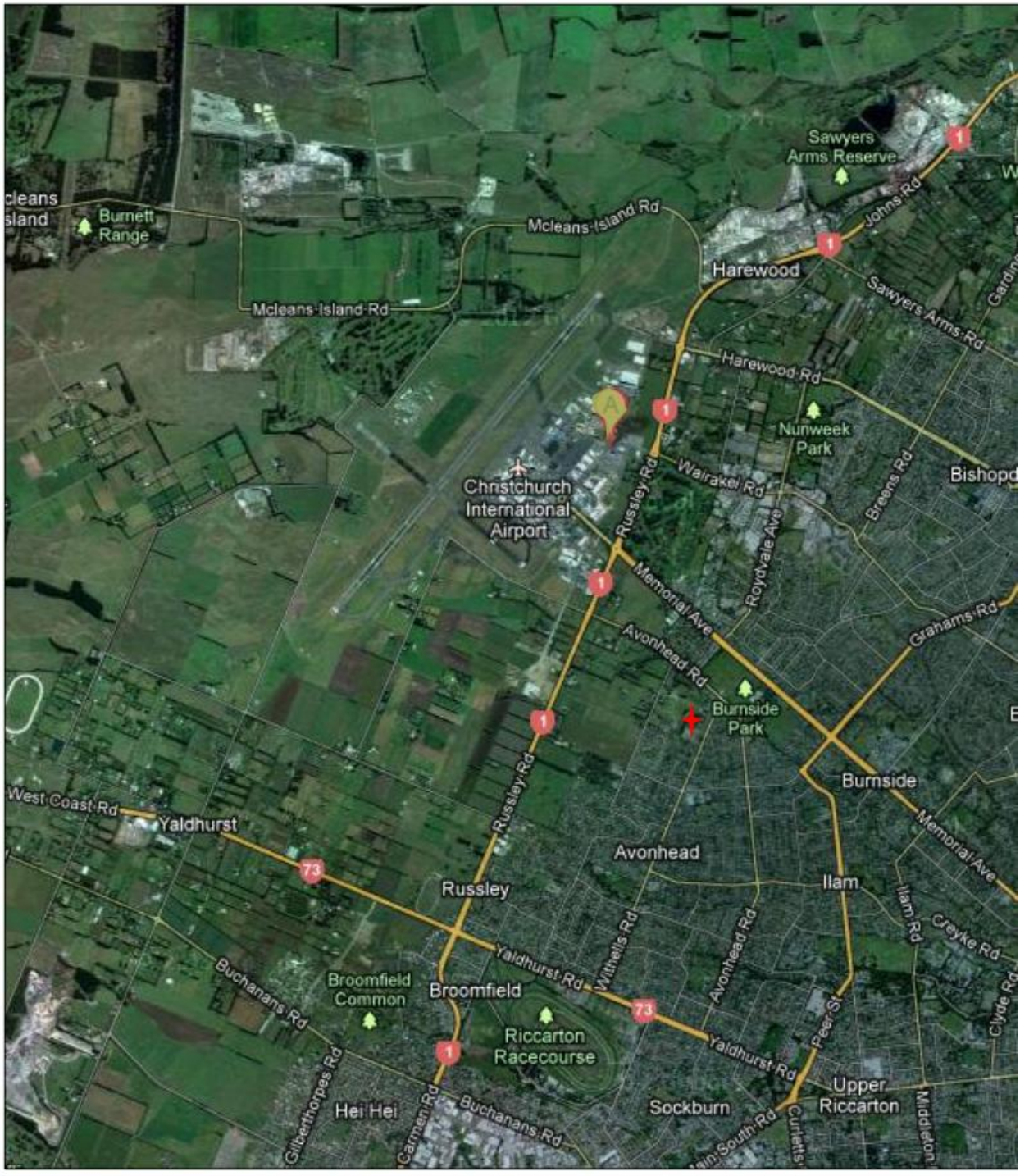
Runway 29 refers to operations using the crosswind runway with a heading of 290 degrees from true north i.e. arrivals from the south east landing in a north westerly direction and departures towards the north west.



APPENDIX B: AIRCRAFT MOVEMENTS FOR BUSIEST THREE MONTH CONTOUR

Aircraft Type	Aircraft	Runway 02		Runway 20		Runway 29	
		Day	Night	Day	Night	Day	Night
Scheduled Jets	737300	32.64	5.74	18.36	3.23	3.63	0.06
	737400	0.01	0.00	0.00	0.00	0.26	0.00
	737700	0.08	0.04	0.04	0.02	0.03	0.00
	747200	0.06	0.03	0.04	0.02	0.11	0.00
	747400	0.26	0.03	0.15	0.02	0.00	0.00
	767300	0.17	0.26	0.10	0.14	0.00	0.00
	777200	3.11	0.04	1.75	0.02	0.00	0.00
	777300	0.06	0.00	0.04	0.00	0.00	0.00
	757RR	0.63	0.01	0.35	0.01	0.01	0.00
	767CF6	0.01	0.45	0.00	0.25	0.00	0.00
	A320	14.61	6.56	8.22	3.69	0.80	0.11
	C135A	0.01	0.00	0.01	0.00	0.00	0.00
	C5	0.01	0.00	0.01	0.00	0.78	0.11
	CNA560	0.01	0.00	0.01	0.00	0.00	0.00
	GII	0.01	0.00	0.01	0.00	0.00	0.00
	GIIB	0.04	0.00	0.02	0.00	0.00	0.00
	IA1125	0.01	0.00	0.01	0.00	0.00	0.00
	LEAR35	0.04	0.00	0.02	0.00	0.00	0.00
	Total	**51.79**	**13.14**	**29.13**	**7.39**	**5.62**	**0.29**
Scheduled Turbo-Props	ATR72	25.70	1.33	14.46	0.75	3.74	0.06
	B190	7.25	0.31	4.08	0.17	1.78	0.16
	DH8C	20.06	0.88	11.28	0.50	2.48	0.18
	Total	**53.01**	**2.52**	**29.82**	**1.42**	**8.00**	**0.39**
Military	C130	0.92	0.04	0.52	0.02	0.06	0.00
	C17	0.39	0.11	0.22	0.06	0.07	0.01
	P3	0.07	0.00	0.04	0.00	0.00	0.00
	Total	**1.38**	**0.16**	**0.78**	**0.09**	**0.12**	**0.01**
Other	BAE146	0.03	0.00	0.02	0.00	0.00	0.00
	BAEJ31	0.28	0.00	0.16	0.00	0.03	0.00
	BEC300	0.01	0.00	0.01	0.00	0.00	0.00
	BEC55	0.01	0.00	0.01	0.00	0.00	0.00
	BEC58	6.15	0.24	3.46	0.14	0.79	0.04
	BEC90	0.01	0.00	0.00	0.00	0.00	0.00
	CL600	0.04	0.00	0.02	0.00	0.00	0.00
	CNA441	0.01	0.00	0.01	0.00	0.00	0.00
	CNA500	0.11	0.04	0.06	0.02	0.00	0.00
	CVR580	1.76	2.87	0.99	1.61	0.03	0.10
	DHC6	0.01	0.00	0.01	0.00	0.00	0.00
	FK27	0.01	0.64	0.00	0.36	0.00	0.04
	GASEPF	0.13	0.00	0.07	0.00	0.01	0.00
	GASEPV	0.56	0.05	0.32	0.03	0.03	0.01
	SA226	1.49	0.99	0.84	0.56	0.10	0.07
	Total	**10.62**	**4.83**	**5.98**	**2.72**	**1.00**	**0.27**
Total		**116.8**	**20.65**	**65.71**	**11.62**	**14.74**	**0.96**

APPENDIX C: MONITORING LOCATION



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 is 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

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