PART B

Rules and Regulations

1. Wellington City District Plan

1.1 Chapter 10 Airport and Golf Course Recreation Precinct

http://wellington.govt.nz/~/media/your-council/plans-policies-and-bylaws/district-plan/volume01/files/v1chap10.pdf?la=en

1.2 Chapter 11 Airport Precinct Rules and Golf Course Precinct Rules

http://wellington.govt.nz/~/media/your-council/plans-policies-and-bylaws/district-plan/volume01/files/v1chap11.pdf?la=en

1.3 Chapter 3.10 Definitions

http://wellington.govt.nz/~/media/your-council/plans-policies-and-bylaws/district-plan/volume01/files/v1chap03.pdf?la=en

1.4 Map 35 Air Noise Boundary

http://wellington.govt.nz/~/media/your-council/plans-policies-and-bylaws/district-plan/volume03/files/v3map35.pdf?la=en

2. Civil Aviation Rules

2.1 CAR Part 91: General Operating and Flight Rules

https://www.caa.govt.nz/rules/Rule_Consolidations/Part_091_Consolidation.pdf

2.2 CAR Part 93: Special aerodrome traffic rules and noise abatement procedures

https://www.caa.govt.nz/rules/Rule_Consolidations/Part_093_Consolidation.pdf

3. Noise abatement procedures

3.1 NZWN 31.3

http://www.aip.net.nz/pdf/NZWN_31.3_31.4.pdf

3.2 NZWN 31.4

http://www.aip.net.nz/pdf/NZWN_31.3_31.4.pdf

3.3 NZWN 31.5

http://www.aip.net.nz/pdf/NZWN_31.5_31.6.pdf

3.4 NZWN 31.6

http://www.aip.net.nz/pdf/NZWN_31.5_31.6.pdf

PART C

Noise Management Procedures and Controls

1. Noise Monitoring System

Purpose

To describe the collection and reporting of noise monitoring information used for demonstrating ANB compliance and investigating noise complaints.

Airport Noise and Operations Monitoring System (ANOMS)

Aircraft noise monitoring at Wellington Airport is provided under a Services Agreement between WIAL and WCC and Brüel & Kjær EMS Pty Ltd. The following components are delivered under this agreement:

- Hosted ANOMS service, including technology upgrades, software and data backup and software upgrades
- Lease of three 3639-A fixed noise monitoring terminals located on the Air Noise Boundary
  - NMT-1 Rongotai
  - NMT-2 Maupuia
  - NMT-3 Kekerenga
- Installation, commissioning and setup of supplied equipment and services
- NMT hardware insurance (fixed locations), fault repairs and preventative maintenance
- Monthly reporting as specified
- All equipment (including noise monitoring terminals and tilt masts) remain the property of Brüel & Kjær
- All data collected remains the property of WIAL

ANOMS data and reporting

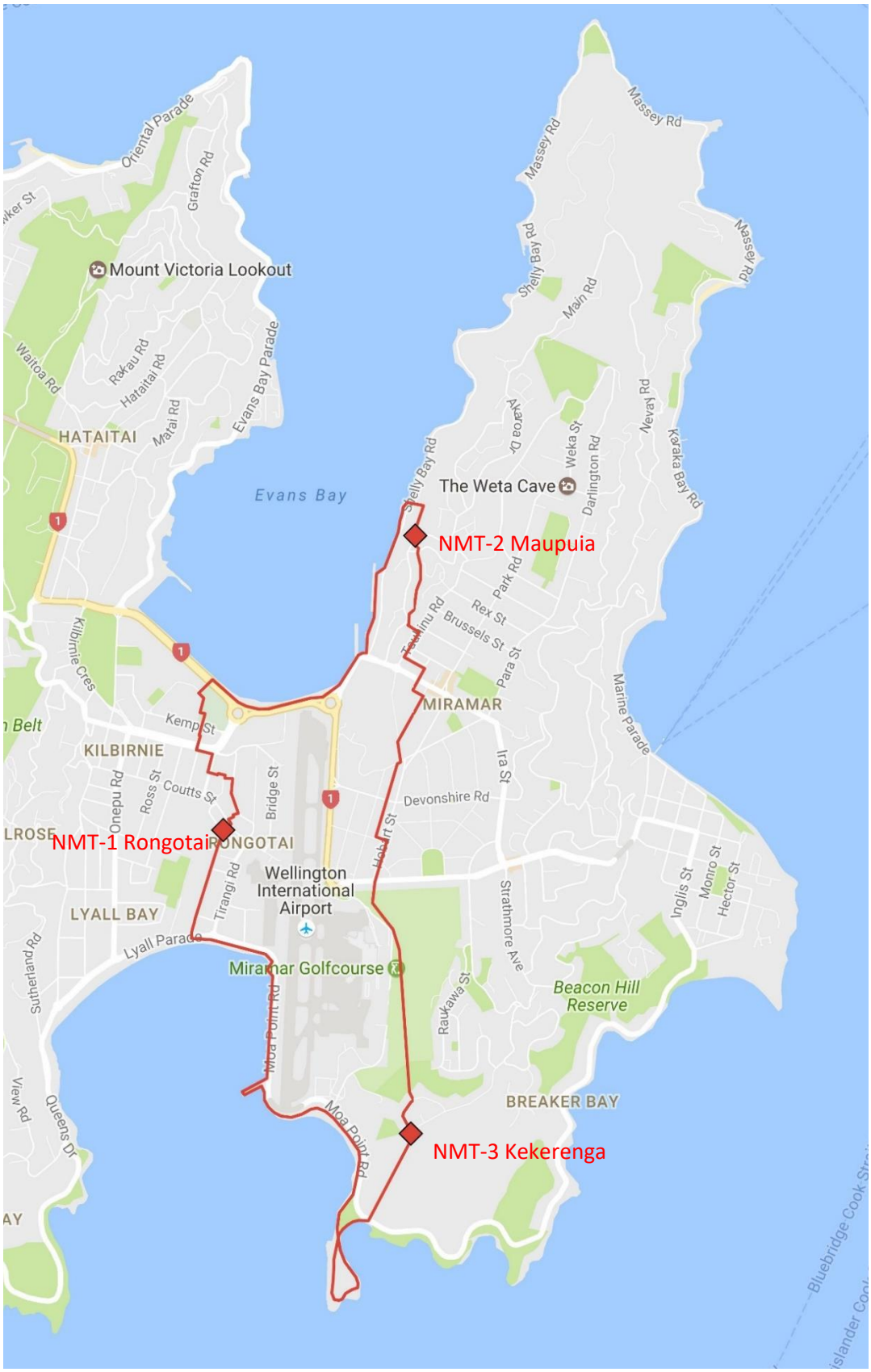
The following reports are produced monthly by Brüel & Kjær EMS Pty Ltd:

- 90 day LDN (by NMT)
- Daily LDN (by NMT)
- Night movement (curfew) report
- Aircraft Operations (operation type and aircraft type)
- Uncorrelated Aircraft Analysis
- Calibration report (by NMT)

These reports and graphs are included in the ANMC agenda.

The ANMC Curfew Reports incorporate flight observation data provided by ACNZ Tower re compliance with curfew provisions. ACNZ Tower observations confirm exempt flights (including medical), disrupts and international flights. Refer *Curfew Flight Observation* procedure.

1.1 Wellington Airport NMT locations



MANAGING NOISE TO ENABLE AIRPORT GROWTH

ANOMS™

Brüel & Kjær
BEYOND MEASURE

AIRPORT NOISE AND OPERATIONS MANAGEMENT

Airport expansion, airspace redesign, changing community sensitivities and operational inefficiencies are increasingly affecting an airport's ability to grow.

In today's fast-paced and complex world, how you partner with your community is as important as what you're doing. ANOMS (Airport Noise and Operations Management System) provides 24/7 noise monitoring to help manage environmental impact and build community support.

The sophisticated system links a number of noise monitors located around the airport with radar and flight systems. ANOMS fuses the data to provide insight into:

- **Noise exposure** – Know the noise level of every aircraft arriving and departing the airport
- **Flight track compliance** – Identify which aircraft are flying and where, and detect which are failing to meet prescribed flight procedures
- **Operational and air traffic control reports** – Understand what's really happening to develop future policies and plans
- **Complaint handling** – Record every community enquiry and automatically compile a response that identifies which aircraft caused a complaint
- **Community relations** – Analyze data over time to report on trends, and know exactly how operations are changing to help set community expectations and build understanding

Measuring

ANOMS delivers top-quality, real-time and complete noise and track information that enables noise office staff to efficiently communicate with stakeholders.

Managing

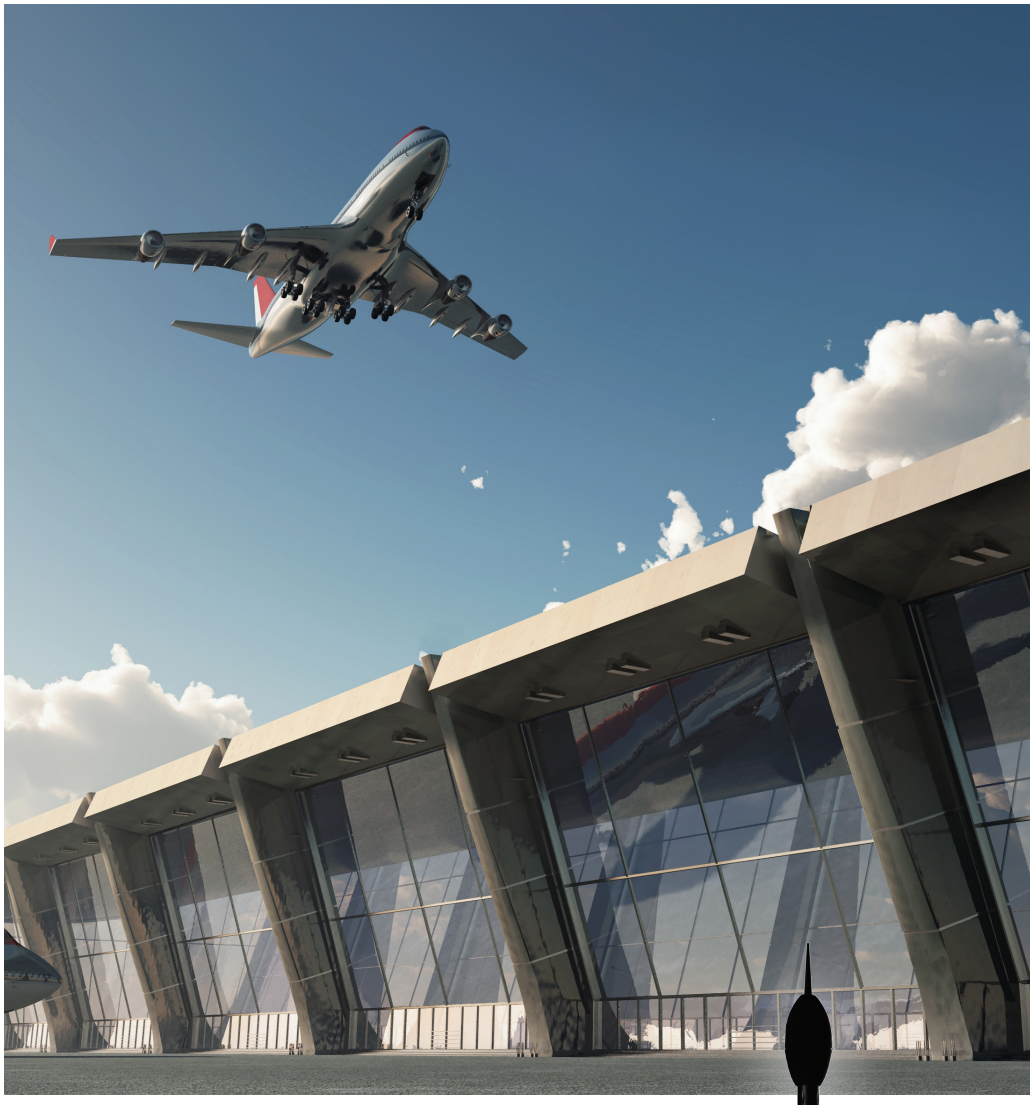
ANOMS' simple, tailored workflows help to quickly investigate issues and determine corrective action where appropriate for pilots violating noise abatement procedures.

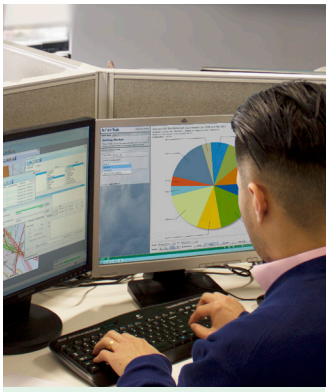
Reporting

ANOMS reports clearly show where you're meeting regulations and how well noise mitigation initiatives are working. The implications of non-standard operating procedures and performance of individual airlines are available at the press of a button.

Neglecting to reliably measure, manage and report on your environmental impact can result in operating restrictions and constrained growth.

You work hard to reduce aircraft noise, but if your community perceives things differently they may not support planned changes. Manage noise levels and keep stakeholders informed with ANOMS' market-leading best practices.





Brüel & Kjær

Brüel & Kjær is the global leader of solutions for the emerging new breed of noise management programs.

For more than four decades we've provided products and services built on unmatched R&D and best practices from more than 250 global clients.

Our cost-effective, extensive solution suite includes noise monitoring, community engagement, complaint management and operational efficiency solutions.

We offer tailored services and flexible delivery and financial models to meet individual needs. Join the Brüel & Kjær network and benchmark yourself against the best.

Best-practice approach

ANOMS is a result of decades of partnership with the industry. It helps some of the world's most forward-thinking airports maintain their licence to grow – maximizing their environmental capacity.

ANOMS works seamlessly with other products in our continually evolving airport suite, including WebTrak. WebTrak engages directly with the community by transparently sharing noise and flight track data online, which builds the public's knowledge and trust. ANOMS also works with a wide range of external solutions for noise modelling, receiving complaints and other functions.

www.bksv.com/ANOMS

Brüel & Kjær Sound & Vibration Measurement A/S
DK-2850 Nærum · Denmark
Telephone: +45 77 41 20 00 · Fax: +45 45 80 14 05
www.bksv.com · info@bksv.com
Local representatives and service organizations worldwide

BG 1810 – 13 12/2015

Brüel & Kjær

BEYOND MEASURE

PROCEDURE

Wellington Airport

Title:	**CURFEW FLIGHT OBSERVATIONS**		
Issue date:	5 August 1999	**Effective date:**	9 August 1999 Revised Apr 2007
		Expiry date (if any)	
Purpose:	WIAL is responsible for managing the airnoise management plan at Wellington. This includes monitoring flights during the curfew period , investigating all flights for compliance and advising the Wellington City Council of those which are technically considered to breach the curfew provisions. The ACNZ Tower fax to WIAL every day, details of flights that were conducted between the hours of 2400L to 0600L. The purpose of this procedure is to explain how this information is to be processed.		

Method:

1 The ACNZ Tower will email/fax a Curfew Observation Form each morning prior to 0800hrs local. This should be uplifted from the fax machine at some stage during the morning for processing.

2 Each flight should be reviewed to ensure that it strictly complied with the curfew provisions of the WCC District Plan ie. all flights complied without utilising the disrupt provisions.

3 The next stage is to segregate those flights that operated legally. Some flights are exempt because they are (a)medical/rescue flights or (b) they have an approved noise exemption which is operator/aircraft combination and landing only specific. The current exempt operators are shown as examples on appendix 2. Beside each corresponding line write down whether the flight is exempt by being an ambulance flight "med" or noise exempt "exempt".

4 Diverted flights are also exempt. In these circumstances write down next to each corresponding line applicable "Divert due" and the reason why it diverted here, eg fog in CHC.

5 Next identify the International flights to ensure that they complied. If they did write down next to each applicable corresponding line "Int"

6 For flights that have operated using the disrupt provisions, these must be

clarified to ascertain whether the explanations are acceptable. Refer Annex 1 for definition of disrupted flight. Disrupt provisions are mostly used by the International flights. The contact for these is the Air NZ DM. They can be contacted by email at "WLGDutyManagers@airnz.co.nz". Seek an explanation of the delay which must include details of the time delays and reasons for each, over the previous four flight sectors that contributed to the final total delay time. Attached is a copy of a request for information shown as appendix 3

7 Once an explanation is recieved ensure that each of the time delays is acceptable under the disrupt definition. If necessary deduct those delay times that are considered acceptable from the arrival or departure time. If at the end of this process the flight still flew within the disrupt provision period it is considered a "breach"

8 The same process applies to other operators except that explanations will need to be sought directly from those operators. Email is the best method.

9 If a flight is considered to have breached the curfew either because of exceeding the time or there explanation does not meet the definition of a disrupt, they must be brought to the attention of the Airside Services Manager. The Airside Services Manager will review the data and if confirmed will advise Mathew Borich of the WCC

10 Any matters that you are uncertain of should be raised with the Airside Services Manager or the Airport Planner.

11 Once this procedure is complete - the forms are to be forwarded each day to the Airside Operations Administrator for statistical reporting purposes and corelation with other noise data monthly from ACNZ.

12 If the process cannot be completed within one day - the form should be sent to the Airside Operations Administrator anyway with an explantion next to the corresponding line "being investigated"

13 A copy of the form and any data collected pending completion of an investigation should be kept in the noise management folder. If you started an investigation, it is your responsibility to ensure that it is completed and the Airside Operations Administrator and the Airport Planner advised of the outcomes.

Person issuing: Chris Dillon **Title:** Airport Planner

Distribution

Standard:		Others:
Airside Services Manager	☒	Airside Operations Administrator
Airside Operations Coordinator	☒	Airport Planner
Duty Managers	☐	
Airport Service Officers	☐	
Terminal Services Manager	☐	
Terminal Services Coordinator	☐	
Maintenance Manager	☐	
Chief Fire Officer	☐	
Crew Chief	☐	
Quality Assurance Manager	☐	

2. WCC Airport Area Rules – Noise

A. Aircraft operations in general

MEASURING AIRCRAFT NOISE

Aircraft noise is measured in accordance with NZS 6805:1992. It is based on the Day/Night Sound Level (Ldn) which measures the cumulative 'noise energy' produced by all flights (landing or take-off) during a typical day, evenly measured over a rolling 90 day period, with a 10 decibel penalty applied to flights from 10pm to 7am to take account of the increased disturbance caused by noise at night.

AIR NOISE BOUNDARY (MAP 35)

The Air Noise Boundary is the area around Wellington Airport identified in the Wellington City Council District Plan where it is projected that a noise limit of 65dBA Ldn will fall in 2020, as based on projected aircraft volumes and types, growth estimates, topography etc.

The noise boundary is defined by the future 65dB noise contour, but mapped having regard to road and property boundaries.

Wellington Airport must manage aircraft operations so that sound exposure does not exceed 65dBA Ldn outside the Air Noise Boundary. The Ldn is calculated and modelled annually, with the Annual Noise Contour (ANC) representing the location of the 65dB Ldn contour for that year. Refer *Annual Noise Contours*.

NON-NOISE CERTIFIED JET AIRCRAFT OR CHAPTER 2 JET AIRCRAFT BAN COMPLIANCE

Effective Date: 6 Nov 2003

Any civil non Chapter 3 jet operation would firstly require an exemption from the Director of Civil Aviation (Section 37 Civil Aviation Act) from the provisions of CAA Rule Part 91.803.

Secondly, if the above requirement was met, the operator would require a Resource Consent. Civil non Chapter 3 jet aircraft would not comply with Wellington District Plan Rule 11.1.1.1.3. Activities that do not comply with this activity noise standard are a Discretionary Activity (Restricted) under Rule 11.3.1 in respect of noise.

Subsonic jet aircraft are classified in three categories, according to Chapter 1, 2 and 3 of International Civil Aviation Organisation Convention Annex 16.

Chapter 2 jet aircraft are those which are certified with noise levels defined in the International Civil Aviation Organisation Convention Annex 16.

Non noise certified jet aircraft are those which have no certification within the context of the International Civil Aviation Organisation Convention Annex 16 - Environmental Protection, Volume 1 (Aircraft Noise) Chapters 2 (second edition 1988) or United States Federal Aviation Regulations Part 36, Stage 2.

B. Night flying operations

CURFEW

The curfew at Wellington Airport applies to aircraft operations during the times below, subject to exemptions.

- Domestic operations (arrivals and departures)
  2400 to 0600
- International operations
  Departures 2400 to 0600
  Arrivals 0100 to 0600

CURFEW EXEMPT AIRCRAFT

Rule 11.1.1.1.6(h) allows certain quiet aircraft to operate at Wellington Airport during the curfew. Exempt aircraft under Rule 11.1.1.1.6(h) are:

- Cessna 406
- Cessna Caravan

Refer *Criteria for Curfew Exempt Operations* for exemption certification procedure.

REQUESTS FOR EXEMPTIONS FROM CURFEW

Effective date: 1 October 1998

The authority to grant any exemptions rests with Wellington City Council pursuant to the Resource Management Act 1991.

As a general rule, exemptions would only be contemplated when

- Circumstances are unusual, compelling, and are unlikely to be repeated
- The environmental effect is minor
- There are broad social or environmental benefits
- Where possible there has been a process of consultation.

Enquiries in the first instance should be directed to Planning Manager or Airside Services Manager, Wellington Airport.

C. Engine testing

Further to Rule 11.1.1.1.6 procedures for engine testing at Wellington Airport have been developed in consultation with ANMC. Refer *Engine Testing Policy*.

D. Ground power and auxiliary power units (GPUs/APUs)

MARSHALL DAY Acoustics

Figure 1: Wellington Airport 2014, FY15 and FY16 Annual Noise Contours

Prepared By: Laurel Smith
Date: 8/08/2016
Time: 8:23:31 a.m.

2.2 Curfew Procedure

Night flying operations at Wellington International Airport must comply with the Wellington City Council (WCC) District Plan rules.

The restrictions in place for the curfew at Wellington International Airport mean that aircraft operations must not occur during the following hours:

DOMESTIC OPERATIONS: From 00:00hrs to 06:00hrs

INTERNATIONAL DEPARTURES: From 00:00hrs to 06:00hrs

INTERNATIONAL ARRIVALS: From 01:00hrs to 06:00hrs

For the purpose of the curfew rule 'operations' means the start of a take-off roll or touch down on landing.

EXCEPTIONS TO THE CURFEW RULE

While the curfew restrictions apply to the majority of aircraft operations, there are number of exceptions provided for in the District Plan.

The Curfew restrictions <u>are amended</u> in the following situations:

A. DISRUPTED FLIGHTS

In the case of disrupted flights, operations are permitted for an additional 30 minutes beyond the applicable time.

A disrupted flight is defined in the Noise Management Plan as:

A flight which is delayed on arrival or departure at Wellington through unforeseen circumstances that could not reasonably be catered for by prudent timetabling, such delay having originated at Wellington or within the previous 4 sectors, as a result of:

- Weather (at origin, en-route, or destination causing cancellations, diversions, delays, missed approaches or holding); or
- Air Traffic Control (congestion, start delays, en-route holding or approach delays); or
- Closure of a departure or destination aerodrome; or
- Diversion for in-flight medical condition or flight safety reason to another aerodrome other than the flight planned aerodrome; or
- Aircraft unserviceability (e.g. mechanical breakdown); or

- An aircraft being required to wait for crew from a flight delayed as a result of any of the above.

Note:

- An aircraft which has been substituted for an aircraft delayed as a result of any of the above also comes within the definition of disrupted flight
- An aircraft may not depart Wellington Airport after midnight and before 0600hrs to act as a substitute aircraft for another that has become unserviceable at a location other than Wellington

B. STATUTORY HOLIDAY PERIODS

The start time of the curfew is also extended by 60 minutes during statutory holiday periods. Aircraft operations are permitted during the following hours:

DOMESTIC OPERATIONS: Permitted between 06:00hrs and 01:00hrs

INTERNATIONAL DEPARTURES: Permitted between 06:00hrs and 01:00hrs

INTERNATIONAL ARRIVALS: Permitted between 06:00hrs and 02:00hrs

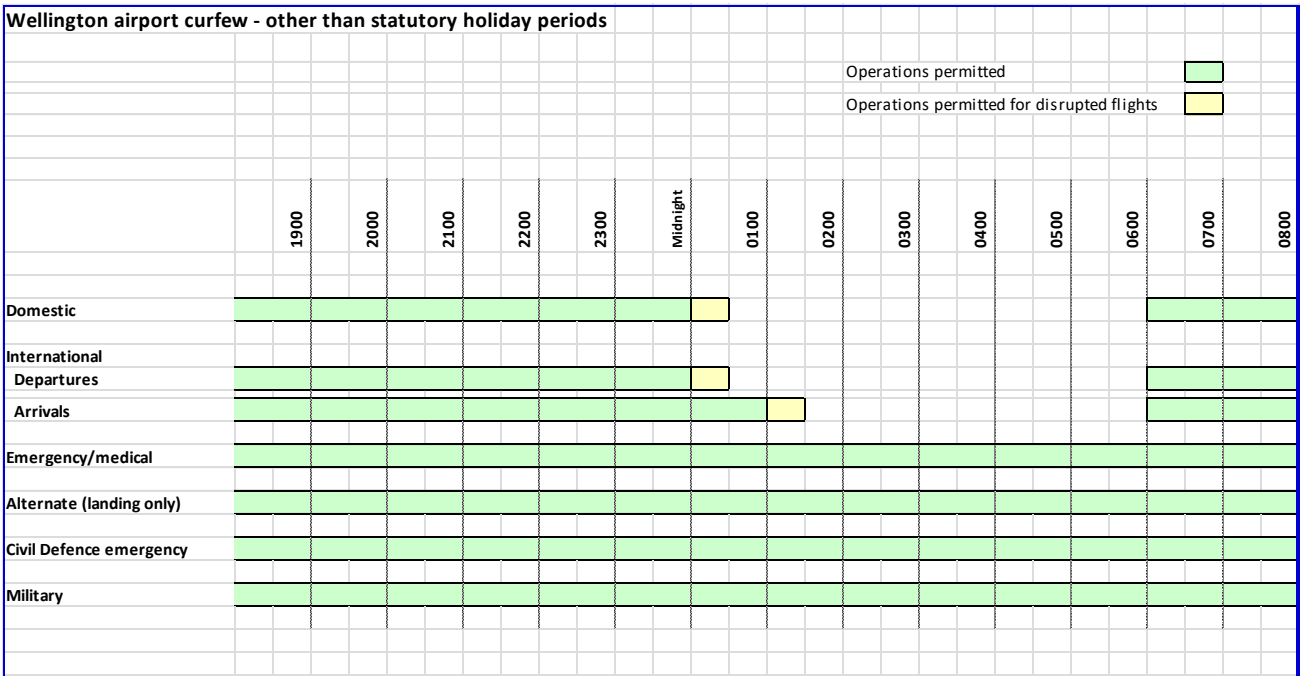
Statutory holiday period means:

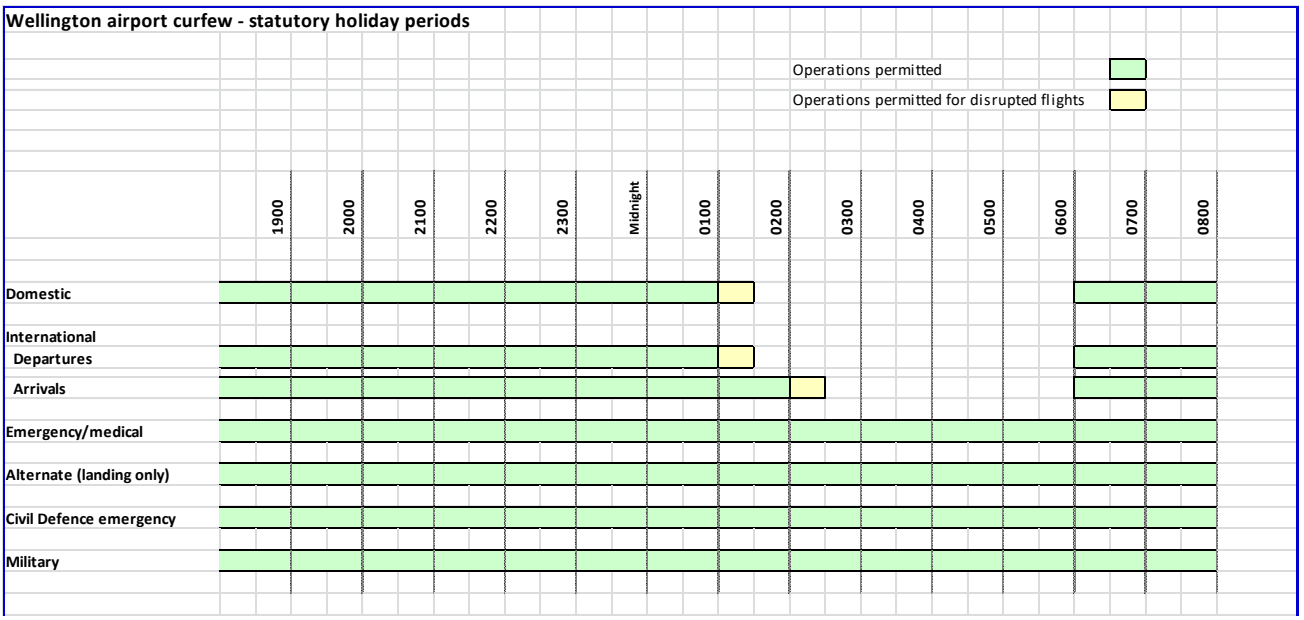
1. The period from 25 December to 02 January inclusive. Where 25 December falls on either a Sunday or Monday, the period includes the entire of the previous weekend.
2. The Saturday, Sunday and Monday of Wellington Anniversary weekend, Queens Birthday weekend and labour weekend.
3. Good Friday to Easter Monday inclusive.
4. Waitangi Day.
5. ANZAC Day.

   Where Waitangi Day or ANZAC Day falls on a Friday or a Monday, the adjacent weekend is included in the statutory holiday period.

6. The hours from midnight to 06:00am immediately following the expiry of each statutory holiday period defined above.

Curfew Restriction Diagram





The restrictions put in place by the Curfew do not apply in the following situations:

- Aircraft landing in an emergency
- Aircraft using WLG as a planned alternate (such aircraft cannot take off until otherwise permitted under the curfew rule)
- Emergency medical flights
- Unscheduled flights to meet the needs of a declared Civil Defence emergency
- Aircraft carrying Heads of State
- To Curfew Exempt Operations (refer WIAL Noise Management Plan for list of Exempt Operations)

Requests for Exemptions to Curfew

The authority to grant exemptions rests with the Wellington City Council pursuant to the Resource Management Act 1991.

As a general rule, exemptions would only be considered when

- Circumstances are unusual, compelling, and are unlikely to be repeated
- The environmental effect is minor
- There are broad social or environmental benefits
- Where possible there has been a process of consultation

Enquiries in the first instance should be directed to the Wellington International Airport Planner, phone (04) 385 5106 or Airside Services Team, Wellington International Airport Limited, phone (04) 385 5164.

2.3 Curfew exempt operations

Curfew exempt operations

Rule 11.1.1.1.6(h) of the WCC District Plan allows 4 aircraft movements per night that meet the established noise criteria. These slots are allocated to operators by the Wellington Air Noise Management Committee.

Criteria for curfew exempt operations under Rule 11.1.1.1.6(h)

The criteria below assume the aircraft has measured compliance with the rules.

ANMC Technical Committee needs to codify testing and revalidating standards.

Requests for Curfew Exempt Operations, confirmation of allocation and supporting Noise Investigation Reports for exempted aircraft are held on the Master Copy of the NMP.

1. Must be aircraft and operator specific, e.g., C208 operated by SoundsAir.
2. Purpose of the activity is not relevant.
3. In assessing priority if demand exceeds available slots the following rules apply:
   - 3.1 priority will be given to aircraft/operator combination with best acoustic performance.
   - 3.2 parties with existing complying operations have precedence over new applicants
   - 3.3 local operator or operator with other infrastructure at WIA has priority over non-local
4. Exemption certificate will lapse in the event of:
   - 4.1 operator ceasing trading
   - 4.2 operator failing compliance check on 3 separate occasions.

Curfew exempt operations effective March 2017

As at 22 March 2017 one of the four available slots is allocated to:

- Soundsair (1 slot), for 1 landing per night, specific to the C208 aircraft only.
  Effective 27 July 1999

2.5 GPU Compliance Certifications

GPU Indicative Noise Compliance Certificate
WELLINGTON INTERNATIONAL AIRPORT

Malcolm Hunt Associates
Noise & Environmental Consultants
P O Box 11-294, Wellington

Operator: ANSETT NEW ZEALAND

GPU Engine Make:
1. Ansett GPU Serial no. ZQE842
2. Ansett GPU Serial no. ZQE739

Certificate Number: 98008

Assessed By: Malcolm Hunt Associates
Report dated 30/4/98

On the basis of measured noise emission levels, this document certifies that the above two (2) Ground Power Units operated by Ansett NZ Ltd can be operated within the area shown (hatched) on the attached map in compliance with WCC District plan rule 11.1.1.1.8 under normal operating parameters.

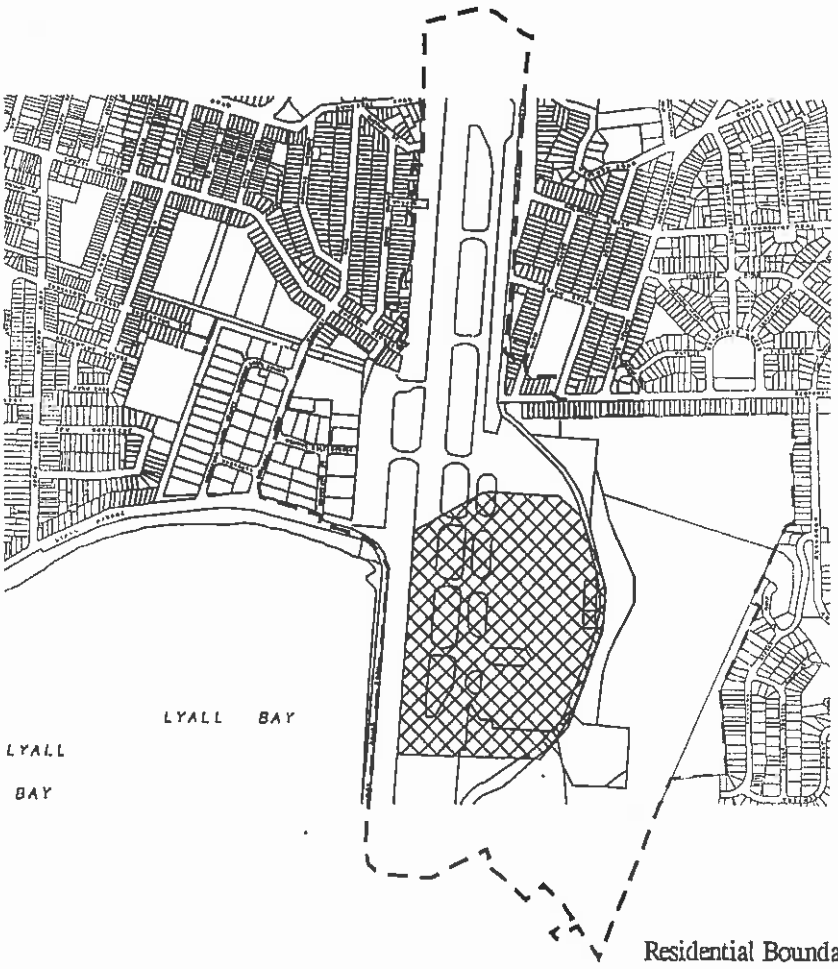
This certificate is based on indicative compliance only and it shall be the responsibility of the operator to ensure the equipment is maintained and operated so that GPU noise emissions do not exceed L10 45 dBA at, or within, any residentially zoned site between the hours of 10 pm to 7 am and all day Sundays.

Attached map document no. 98008-1

Signed: M G Hunt
Malcolm Hunt

Dated: 1/7/98

Map Showing Area for GPU Compliance



mapgpu.sf

Document No. 98008-1

GPU Indicative Noise Compliance Certificate
WELLINGTON INTERNATIONAL AIRPORT

Malcolm Hunt Associates
Noise & Environmental Consultants
P O Box 11-294, Wellington

Operator: ANSETT New Zealand

GPU Engine Make:
1. Number 1 Hobart Serial No. ZQE 842
2. Number 2 Hobart Serial No. ZQE 739

Certificate Number: 98008

Assessed By: Malcolm Hunt Associates
Report dated 17/9/98

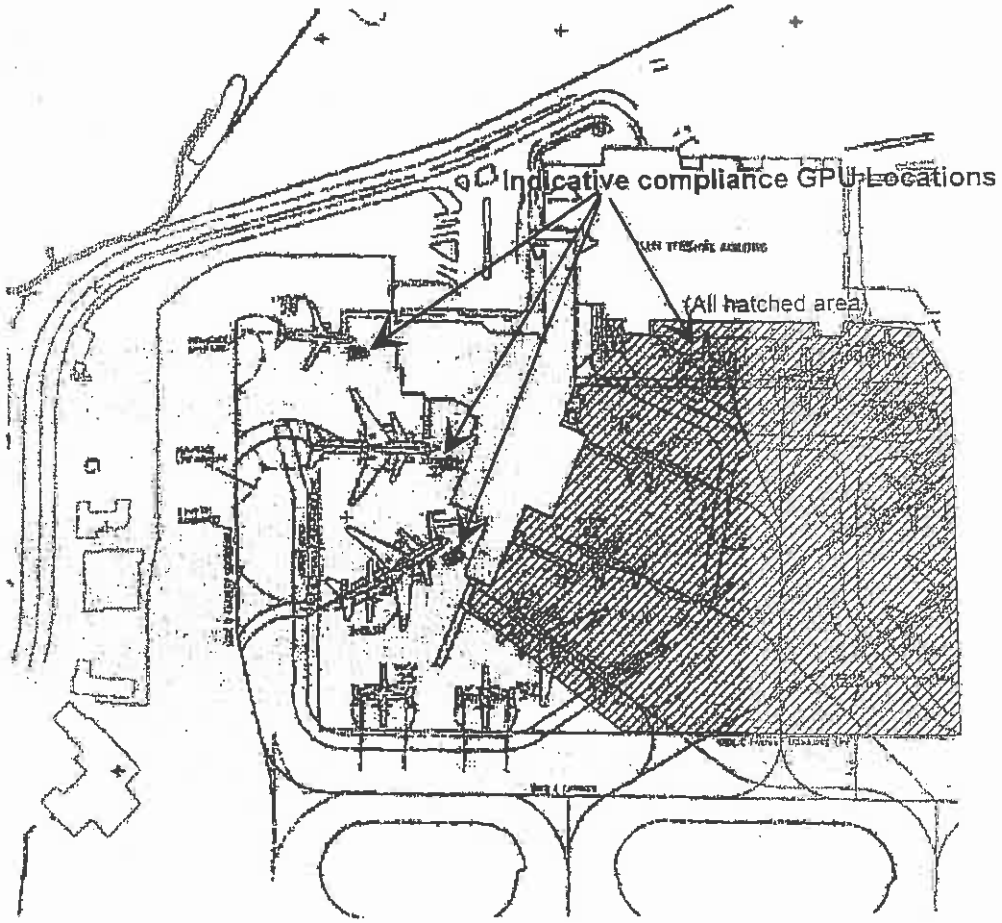
On the basis of measured noise emission levels, this document certifies that the above two (2) Ground Power Units operated by Ansett New Zealand can be operated in compliance with WCC District plan rule 11.1.1.1.8 under normal operating parameters, at positions indicated on the attached maps.

This certificate is based on indicative compliance only and it shall be the responsibility of the operator to ensure the equipment is maintained and operated so that GPU noise emissions do not exceed L10 45 dBA at, or within, any residentially zoned site between the hours of 10 pm to 7 am and all day Sundays.

Signed:

Malcolm Hunt

Dated: 22/9/98


Indicative compliance GPU Locations
(All hatched area)

GPU Indicative Noise Compliance Certificate
WELLINGTON INTERNATIONAL AIRPORT

Malcolm Hunt Associates
Noise & Environmental Consultants
P O Box 11-294, Wellington

Operator: ANSETT New Zealand

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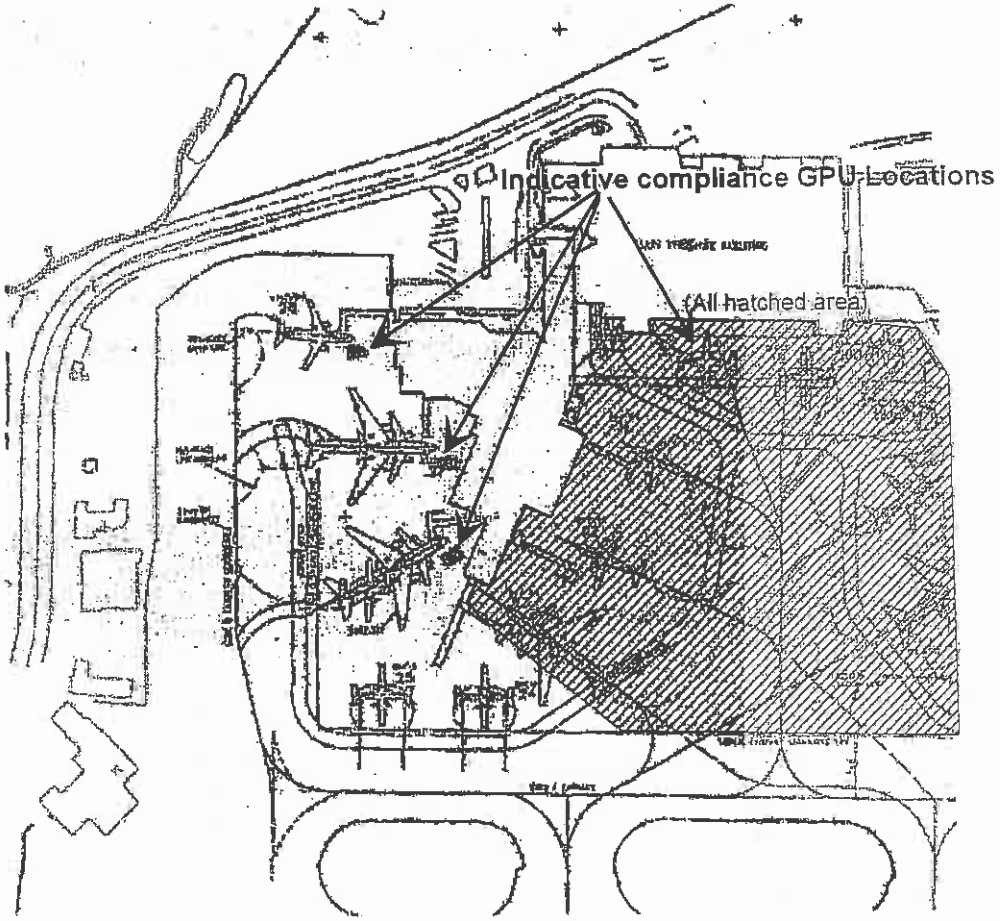
Signed:

Malcolm Hunt

Dated: 22/9/98


Indicative compliance GPU Locations
(All hatched area)

MARSHALL DAY ASSOCIATES
CONSULTANTS IN ACOUSTICS

File

Christopher W Day
B. Eng, Grad.IPENZ, MAAS
Keith Ballagh
B.Eng (Hons)
A Harold Marshall
B.Arch, B.Sc, Ph.D, FASA, FNZIA, FRAIA
Con Wassilieff
B.Sc, B, Sc (Hons), Ph.D

1st Floor, BNZ Chambers
Cnr Cuba & Manners Streets
PO Box 11 442
Wellington
New Zealand
Telephone 0-4-499 3016
Facsimile 0-4-499 3018

18 December 1998

Air New Zealand Terminal Services
PO Box 21 004
Wellington Airport

Attention: Steve Gosnell

REPORT ON NOISE SURVEY OF GROUND POWER UNITS AT WELLINGTON AIRPORT

Dear Steve

Further to our two noise survey of GPUs at residential boundaries around Wellington Airport, we would like to report as follows.

1.0 INTRODUCTION

Marshall Day Associates were asked by Air New Zealand Terminal Services to measure the noise levels of the various Ground Power Units (GPU) in use by Air New Zealand at Wellington Airport.

The Wellington City Proposed District Plan as at 03/03/1998 has the following noise rules in respect of noise from GPU's at Wellington Airport.

11A AIRPORT AREA RULES

11.1.1.1.8 Land based activities

Noise emission levels, from any activity within the Airport area, other than aircraft operations, engine testing and the operation of GPUs and APUs (as provided for in rule 11.1.1.1.9) when measured at any residential site shall not exceed the following limits:

Monday to Saturday 7am to 10pm	*55dBA L10*
At all other times	*45dBA L10*
All days 10pm to 7am	*75dBA Lmax*

(Noise measurements are made in accordance with New Zealand Standard NZS 6801:1991 "Measurement of Sound", and assessed in accordance with New Zealand Standard NZS 6802:1991 "Assessment of Environmental Sound".)

11.1.1.1.9 Ground power and auxiliary units (GPUs/APUs)

(a) GPUs are exempt from controls otherwise imposed by rule 11.1.1.1.8 until 31 December 1998. After 31 December 1998 GPUs must comply with the noise limits in rule 11.1.1.1.8

(b) With the exception of:

- *aircraft under tow*
- *the first 90 minutes after the aircraft has stopped on the gate*
- *60 minutes prior to scheduled departure*
- *the use of APUs to provide for engine testing pursuant to rule 11.1.1.1.7*

APUs must comply with the noise limits in rule 11.1.1.1.8

2.0 GPU LOCATIONS

The GPUs were located at Gate 10, 11 and 12, as being representative of the most exposed locations.

The noise level from five GPU's was measured:

Houchin 8302 (under load)
Hobart 8656 (under load)
Trilectron 3002 (no load)
Old 28volt diesel 8961 (no load)
Old 28volt diesel 8945 (no load)

3.0 NOISE SURVEY LOCATIONS

Two residential locations were chosen as being representative of residences most exposed to noise from GPU operation. These were:

- the west side of Nuku Street, opposite the carpark, approximately 450m east of Gate 11
- the west edge of the park at the end of Kekerenga Street, approximately 650m south of Gate 11.

Both of these locations directly overlook Gates 11 and 12. Gate 10 is slightly screened from Nuku Street by the South Pier.

4.0 WEATHER CONDITIONS

Wind direction affects the propagation of sound. In general, measurements should be made under either dead calm conditions, or alternatively slight downwind conditions in order that the noise levels are at their typical maximum. Noise levels measured upwind of a source are always lower than under calm or downwind conditions, because of an acoustical "shadow zone" created by the upwards refraction of sound, and thus may under-represent the noise levels.

Measurements were made on two occasions, under different wind conditions:

10 December 1998 (11pm-12pm), under light southerly wind.

Measurements were made at Nuku Street only, as Kekerenga Street on this occasion would have been upwind of the GPUs and hence the noise levels would have been much lower.

The temperature was cool, with cloud and some occasional light rain.

14 December 1998 (10pm-1am), under light northerly wind.

Measurements were made at both Nuku Street (to compare with the measurements made on the previous occasion), and Kekerenga Street. In this case Nuku Street was upwind of the GPUs, and Kekerenga Street was downwind of the GPUs.

Temperature was mild, with clear sky.

5.0 MEASUREMENT METHOD

A sound level meter meeting the requirements of IEC 651 for Type 1 instruments was used to measure the L10 noise level. L10 is the noise descriptor required in the Proposed District Plan. L10 is the noise level exceeded for 10% of the measurement period, and is very approximately a measure of the "average maximum" noise level.

At both measurement locations, the ambient noise (in the absence of GPU noise) was measured as soon as practicable to the actual measurement of the GPU noise. As the ambient noise level at these locations is only a few decibels lower than the (in the order of 40-45dBA), it will affect the noise measurements of the GPU's. In order to establish the actual noise level of each of the GPU's in turn, the ambient noise level must be logarithmically subtracted off the overall measurement to yield the noise level of the GPU in the absence of corrupting influences.

6.0 RESULTS

The ambient noise level was 44dBA, due to a combination of noise from the waste water treatment plant below Kekerenga Street, and distant activity. Nearby traffic noise was excluded from the measurements.

The ambient noise level at Nuku Street was around 40dBA on 14 December, and 44dBA on 10 December, due partly to wind noise in adjacent trees.

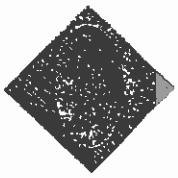
GPU	Load	Measurement location and date of test	Wind direction	Noise level including ambient	Noise level of GPU alone
Houchin 8302	Yes	Kekerenga Street (14 Dec)	Northerly	48dBA	46dBA
Hobart 8656	Yes	Kekerenga Street (14 Dec)	Northerly	47dBA	44dBA
Trilectron 3002	No	Kekerenga Street (14 Dec)	Northerly	46dBA	42dBA
28v diesel 8961	No	Kekerenga Street (14 Dec)	Northerly	46dBA	42dBA
Houchin 8302	Yes	Nuku Street (14 Dec)	Northerly	41	<41
28v diesel 8961	No	Nuku Street (14 Dec)	Northerly	41	<41
28v diesel 8961	No	Nuku Street (10 Dec)	Southerly	48dBA	46dBA
28v diesel 8945	No	Nuku Street (10 Dec)	Southerly	46dBA	42dBA

From measurements made at the closer distance of 10m from the *Houchin 8302*, the dependence of the noise level upon load could be determined. The noise level under no load conditions was 84.5dBA, whereas under load it increased to 85.0dBA. It seems reasonable to assume that the noise level of the other GPU's measured under no load conditions would also increase by a similar amount under load. This means that the levels in the table above could increase by up to 1dBA under load conditions.

7.0 DISCUSSION

The noise levels are dependent upon wind direction. Under typical wind conditions (northerly and north-easterly), all GPU's except the Houchin 8302 individually comply with the noise rule night time limit of 45dBA L10. The Houchin 8302 is only marginally in exceedance of this limit.

Under southerly conditions, the noise level from the 28 volt diesel 8961 is also marginally in exceedance of the allowable limit, because of the closer proximity of Nuku Street to Gates 10,11, and 12.



It is possible that some of the other GPU's may also exceed the allowable limit of 45dBA at Nuku Street under southerly wind conditions, although the opportunity to measure these was not available at the time, as these GPU's were in use in more sheltered locations where the noise was not audible.

Of all of the GPU's measured, the Houchin 8302 is the one with the highest noise emission levels. The bulk of the noise appeared to radiate mostly from the cooling air discharge. It may be possible to reduce the noise level by a few decibels with some additional sound attenuating treatment.

We trust this report contains sufficient information for your present requirements. If you require further assistance please do not hesitate to contact us.

Yours sincerely
MARSHALL DAY ASSOCIATES

Con Wassilieff
Associate

3. Construction noise

Construction noise monitoring

Effective: October 2016

Further to consultation with ANMC on managing construction noise effects, a construction noise monitor was installed in October 2016. The logger is located on the golf course, nearest the closest residential boundary. The logger measures sound level statistics and frequency spectra in 15-minute intervals, and short term (1-second) LAeq sound level profile. The data is available in real time, and as an archived data package.

WIAL Construction Noise Management Plan

Effective: August 2017

Further to consultation with ANMC on managing construction noise effects and review of WIAL procedures for construction and maintenance projects, an airport-wide construction noise management plan was developed.

The CNMP forms part of the WIAL Noise Management Procedures to assist in complying with the objectives and rules of the Wellington City District Plan.

The purpose of the CNMP is to develop and implement procedures and strategies with the aim to minimise the disturbance to residents and other noise sensitive receivers caused by airport construction and maintenance works. The CNMP establishes the approach to considering and managing the effects of construction noise for WIAL construction and maintenance projects.

AECOM

Wellington International Airport
Construction Noise
Wellington International Airport Limited
17-Aug-2017

WIAL Construction Noise Management Plan

WIAL Construction Noise Management Plan

Client: Wellington International Airport Limited

Co No.: 396240

Prepared by

AECOM New Zealand Limited
Level 2, 2 Hazeldean Road, Addington, Christchurch 8024, P O Box 710, Christchurch MC, Christchurch 8140, New Zealand
T +64 3 966 6000 F +64 3 966 6001 www.aecom.com

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Quality Information

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Reviewed by	Michael Smith

Revision History

Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
R0	17/8/17	As issued		

Table of Contents

Abbreviations and Glossary

Abbreviation	Description
ASNS	Activity Specific Noise Schedule
BPO	Best Practicable Option
CNMP	Construction Noise Management Plan
NZS	New Zealand Standard
WIAL	Wellington International Airport Limited

Term	Definition
dB	A unit of measurement on a logarithmic scale, often used to describe the magnitude of sound pressure with respect to a reference value (20 µPa)
$L_{Aeq(t)}$	The A-weighted time-average sound level over a period of time (t), measured in units of decibels (dB)
L_{AFmax}	The maximum A-weighted noise level with a 1/8 second or 'Fast' time constant (indicated by a 'F'), measured in units of decibels (dB)
ppv	Peak Particle Velocity mm/s

1.0 Introduction

This Construction Noise Management Plan (CNMP) has been prepared by AECOM New Zealand Limited on behalf of Wellington International Airport Limited (WIAL).

The CNMP forms part of the WIAL Noise Management Procedures to assist in complying with the objectives and rules of the Wellington City District Plan.

The purpose of the CNMP is to develop and implement procedures and strategies with the aim to minimise the disturbance to residents and other noise sensitive receivers caused by airport construction and maintenance works. The CNMP establishes the approach to considering and managing the effects of construction noise for WIAL construction and maintenance projects.

The objectives of this CNMP are:

- Establish an airport-wide approach to construction noise management
- Develop and implement procedures and strategies to reduce noise impacts on the local community
- Identify appropriate noise and vibration limits and performance standards which balance residential noise amenity and the need to undertake works efficiently
- Provide a framework for project-specific noise management plans for WIAL maintenance works and major infrastructure projects
- Monitor and report on the effectiveness of the mitigation measures implemented in the CNMP

Construction vibration is not anticipated to be an issue due to the setbacks between constructions activities and offsite receivers. Nevertheless, appropriate vibration limits and controls are included in this CNMP for completeness.

This CNMP is an evolving document and will be updated as applicable.

2.0 Airport-wide CNMP

WIAL regularly undertakes construction and maintenance works within the airport precinct shown in Figure 1, including:

- Capital work projects such as new/replacement buildings
- Pavement construction and resurfacing
- General maintenance works to the runway/taxiway infrastructure, which includes vertical structures and ground level (and below) works
- Airfield Ground Lighting installation and maintenance
- Work on Marine Defence Systems including seawalls and structures

Further to consultation with the Wellington Air Noise Management Committee (ANMC) on managing construction noise effects and review of WIAL procedures for construction and maintenance projects, an airport-wide approach to construction noise management is recommended.

WIAL has extensive experience of undertaking construction works and is mindful of the close proximity of residents and other noise sensitive receivers to the airport boundary. Figure 1 shows the residential areas near the airport - Miramar to the north east, Strathmore Park to the South East, and Rongotai to the west.

While it is acknowledged that operational constraints at the airport may require works to be carried out during the flight curfew (1am to 6am), this CNMP requires management and physical strategies to be implemented to avoid or mitigate adverse effects where practicable.

The scope of this CNMP includes:

- Assessment of construction noise and vibration impacts from works within the airport boundary
- WIAL project coordination to ensure cumulative effect of noise generation is addressed
- Mitigation measures and control of noise and vibration during works, including physical and management techniques
- Engagement and notification with affected parties (external).

The requirements of this CNMP do not restrict the delivery of emergency construction and maintenance works at WIAL. The delivery of emergency works must consider methods to manage noise effects. Any emergency works carried out that involve noisy works shall be notified to the Airport Planner within 24 hours.

WIAL has developed this CNMP in accordance with best practice as detailed in New Zealand Standard NZS 6803:1999 ‘Acoustics – Construction Noise’.

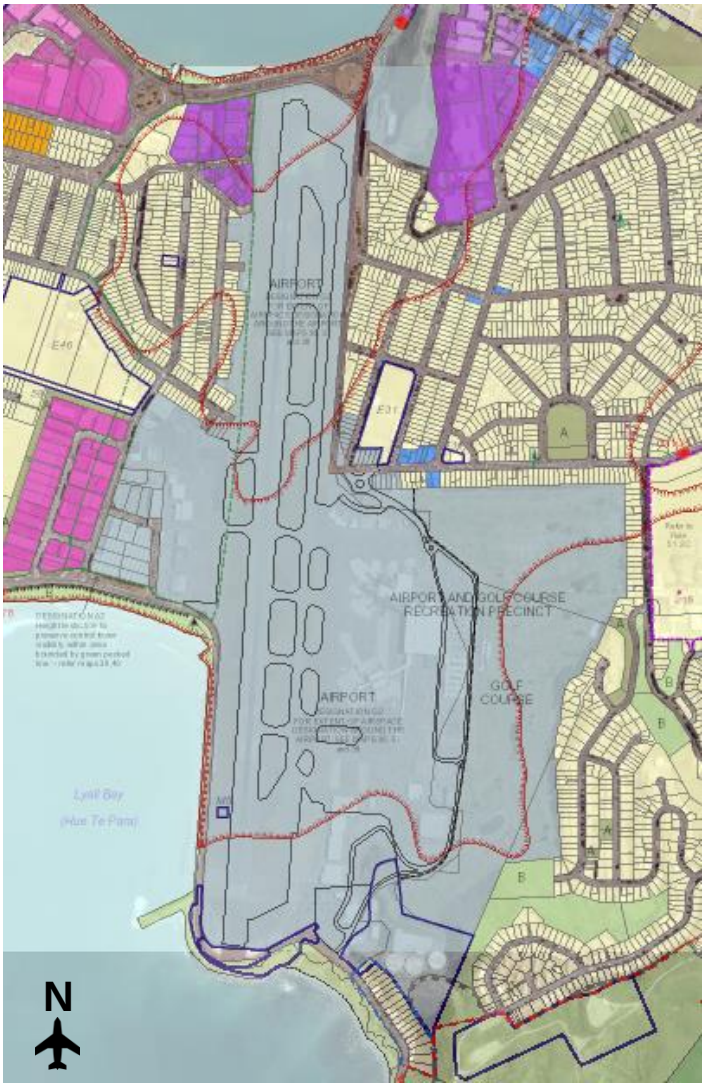


Figure 1 Airport (and Golf Course Recreation) Precinct shown in Grey; suburban zone (residential) in yellow

3.0 WIAL Construction Noise and Vibration Management Procedure

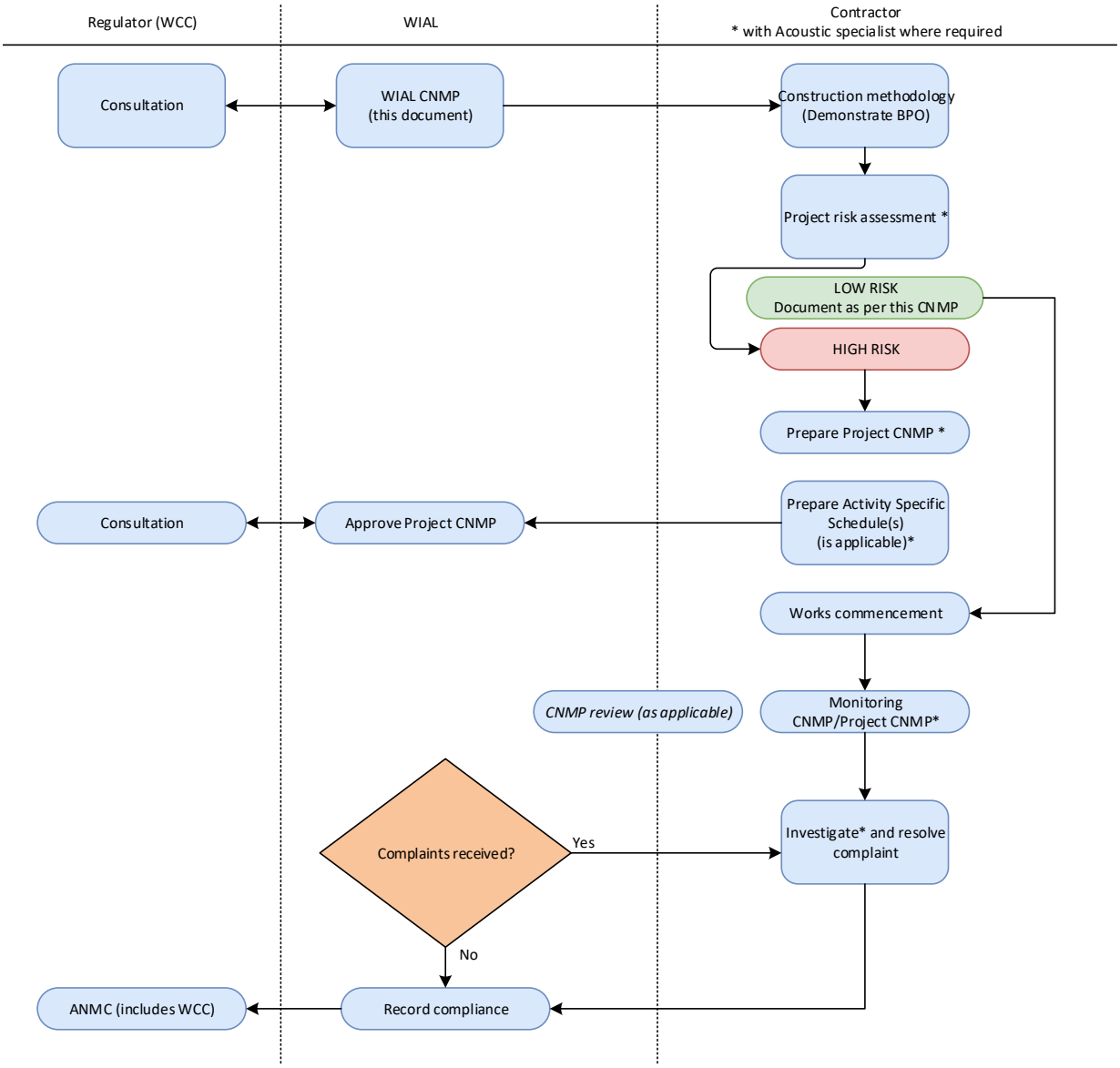


Figure 2 WIAL Construction Noise and Vibration Management Procedure

3.1 Construction methodology: Duty to avoid unreasonable noise

There is a duty on all persons carrying out construction activity to adopt the Best Practicable Option (BPO) to ensure noise does not exceed a reasonable level. This underpins WIAL's approach to all construction projects.

The effects of construction noise can be mitigated using both management and engineering controls. Mitigation measures should be planned and implemented for all projects in a structured hierarchy depending on the extent of predicted effects.

The hierarchy should be in the order of the following:

1. Is there anything preventing the works being done during normal work hours (7.30am to 6pm Monday – Saturday)?
2. Is it imperative that night-time works are undertaken, or can works be rescheduled to daytime?
3. Can the works be sequenced to avoid sensitive times for neighbouring residents/businesses?
4. Have equipment and methodologies been chosen that reduce the overall noise from the activity? Can quieter alternative equipment or methodologies be practicably implemented?
5. All moving plant within the construction site must have broad band reversing alarms installed.
6. Use of quietest equipment and methodology available to minimise noise. This may include a balance between the overall level of noise and the duration of the noise. In some situations it may be preferable to undertake short term noisy works rather than having lower noise levels which may occur for a significant period of time.
7. Scheduling noisy works outside, for example performing concrete cutting during the day and then breaking and resurfacing at night, and providing respite periods from noisy works.
8. Can temporary construction noise barriers or screens be erected that provide effective acoustic shielding of the equipment/activity?
9. Use of multiple items of plant to shorten the construction period, e.g. two items of plant may halve the duration of the activity but at most only lead to a 3 dB increase in noise level.
10. Use of equipment and construction techniques in accordance with manufacturer's instructions / site protocols (method statements).

The project construction methodology shall document application of the above principles and the reasoning behind the approach adopted to demonstrate adoption of BPO to managing construction noise effects.

3.2 Project Noise Risk Assessment

All construction and maintenance activities at Wellington Airport have the potential to generate noise and potentially result in a disturbance to residents and other noise sensitive receivers. A noise risk assessment is required to ensure there is a comprehensive assessment of potential adverse effects. Each project will need to be ranked according to the noise risk as follows:

- Low – predicted noise levels are not considered to be significant and are at least 3 dB lower than the relevant performance noise standard
- High – predicted noise levels without enhanced mitigation are likely to meet or exceed the performance noise standard and/or significant night time works are planned.

To make this assessment, each project will need to be screened against the performance standards using the WIAL Construction Noise Management Tool (see below and Appendix B).

Note that the noise risk for the project should be determined based on the highest risk type of construction activity and take account of concurrent construction works if applicable, i.e. the cumulative effects of multiple projects.

The risk rating should also take into account the duration of the works; a single night will be less of a disturbance compared to works spanning consecutive nights.

Screening assessment	Risk
Detailed noise assessment predicts noise level at least 3 dB below performance standard.	LOW
Detailed noise assessment predicts noise level is within 3 dB of the performance standard, or is higher than the performance standard.	HIGH
Night works are required within 100 m of residential (or other sensitive land use) neighbours of the Airport.	HIGH
Works involving impact piling, percussive concrete breaking or vibratory compaction within 50m of vibration sensitive receptor	HIGH

The project noise risk assessment will determine whether a Project-specific CNMP is required.

3.3 Contractor Management plan

Where required, the appointed contractor shall prepare and implement a project specific CNMP throughout the entire construction period of the Project. The CNMP must describe the measures adopted to seek to meet the NZS 6803 noise limits, where practicable. Where it is not practicable to achieve those performance standards, alternative strategies should be described to address the effects of noise.

The CNMP shall be provided to WIAL for approval prior to commencement of the construction project.

The CNMP shall, as a minimum, address the following:

- Description of the works, anticipated equipment/processes and their scheduled durations.
- Hours of operation, including times and days when construction activities causing noise and/or vibration would occur.
- The applicable construction noise performance standards for the project.
- Identification of affected dwellings and other sensitive locations where noise limits apply.
- Mitigation options, including alternative strategies where full compliance with the relevant noise limits cannot be achieved.
- Management schedules containing site specific information where applicable.
- Construction equipment operator training procedures and expected construction site behaviours.
- Methods and frequency for monitoring and reporting on construction noise.
- Procedures for maintaining contact with stakeholders, notifying of proposed construction activities and handling noise complaints.

Where vibration risk is identified, the Project CNMP shall also include the following:

- The construction vibration limits for the project.
- Identification of affected dwellings and other sensitive locations where vibration limits apply.
- Methods required to mitigate adverse construction vibration.

An example project CNMP is included at Appendix C.

3.4 Activity Specific Noise Schedules

For significant activities a schedule to the CNMP should be prepared once details of construction equipment and locations have been confirmed. These Activity Specific Noise Schedules (ASS) will set out specific conditions relating to a defined activity in a pre-determined location. Generally, ASNSs are developed for activities that have been identified as likely to exceed the Project's noise or vibration performance standards.

Site personnel will be briefed on the requirements of the ASNS, prior to the activity commencing. This would normally be undertaken at either induction or during a tool box talk.

3.5 Engagement

Effective stakeholder engagement is a critical part of managing construction and maintenance noise and vibration. Stakeholder engagement can have a greater bearing on acceptance of the works and complaints than the actual noise and vibration levels. Neighbours who understand what, when and why the works are happening are often able to adjust their activities accordingly and are generally more tolerant of construction noise and vibration.

Stakeholder engagement for construction and maintenance noise and vibration should be integrated with the wider project requirements.

In general, neighbours should be informed at least one week before work starts and any local issues should be identified.

For larger projects, stakeholder engagement should commence during the planning and mobilisation phases. Residents can be informed about work using a variety of means, including letter drops, visits or meetings, advertising, site signboards, posters and notices on websites. When work continues for long periods, regular updates are important.

Information provided should include the:

- Reason for the works
- Reason for the construction methodology proposed
- Overall timeframe and timing of specific noisy or vibration producing activities
- Reason for any night or weekend works
- Expected noise and/or vibration effects
- Point of contact including name and phone number

The extent of notification will be determined by the Construction Noise Management Tool.

3.6 Monitoring

Noise / vibration monitoring should be performed as follows:

- When works start and any new major items of construction plant or a new technique is used. Measurements should be undertaken at a set distance of 10 m from the activity and frequency data in octave or 1/3rd octave bands should also be recorded.
- At monthly intervals throughout construction. Attended monitoring during construction hours at identified dwellings on a rotation basis for a period of at least one hour at identified dwellings.
- As required by any ASNS.
- In response to reasonable complaints being received.

For any major project lasting more than a six months, which includes significant periods of night working, consideration should be given to the use of remote, permanent noise monitoring. The advantage of this method over attended measurements is that real time noise level data can be captured and used to either investigate complaints or to proactively manage construction where noise levels are high.

3.7 Project CNMP review

The CNMP and individual management plans are live documents and should a change occur then the plans must be updated to reflect amended method statements, programme, etc. It is essential that regular reviews and audits are undertaken by the appointed environmental project manager for each project to track performance and to benchmark best practice in all aspects of the project.

3.8 Responsibilities

WIAL, in conjunction with its consultants and contractors, will be responsible for ensuring that the relevant management plan(s) are correctly implemented. They will review all documentation relating to construction noise and vibration before it is issued.

If required, specific training will be provided for site personnel.

The CNMP Procedure (Figure 2) show the responsibilities throughout a construction project for construction noise management.

3.8.1 Contractor

The contractor for each project shall:

- Prepare and implement, when required, a project specific CNMP in accordance with the management plan (an example project CNMP is included at Appendix A).
- Engage an acoustic specialist if complex noise calculations are required or the project has a high risk rating.
- If the project has a high noise risk rating, notify the WIAL project manager as soon as possible.
- Monitor at the beginning of the project and when methodology or plant changes.
- Liaison with the WIAL project manager on any complaints received and undertake investigation and reporting on complaints as required by the WIAL Project Manager.
- Ensure all staff including subcontractors participate in an induction training session on the CNMP, including:
    - team roles and responsibilities for management of noise matters
    - noise mitigation and management procedures
    - sensitivity of receivers to noise and any operational requirements or constraints identified through communication and consultation
    - complaints management procedure

Awareness of current noise matters on, or near active worksites, will be addressed during site meetings and/or toolbox training sessions

3.8.2 Acoustic Specialist

If engaged by the contractor:

- Undertake complex noise calculations
- Undertake, or provide advice on noise monitoring.
- Providing advice on additional mitigation measures appropriate for high risk projects.

3.8.3 WIAL Project Manager

- Identify and communicate across project teams actual/potential concurrent projects
- Undertake consultation with the community, particularly potentially affected residents and businesses prior to works being undertaken.
- Direct the contractor to undertake investigations, monitoring and methodology changes if required in light of monitoring results of complaints.

Appendix A

Construction Limits

Introduction

Wellington City Council requires construction noise emission levels to comply with the Wellington City District Plan's noise standards which refer to the construction noise standard NZS 6803, acknowledging that NZS 6803 does not fully address the issue of construction work that cannot be done during the day and therefore provides exemptions for construction work as follows:

> *Noise from construction, maintenance and demolition activities, including those associated with the urgent repair of utilities to maintain continuity of service, on any site or on any road shall comply with, and be measured and assessed using, the recommendations of NZS6803:1999 Construction Noise except:*
>
> - *work on public highways, railways and the Airport; ….*

This 'exemption' does not remove the duty placed on WIAL to adopt the 'Best Practicable Option' (BPO) to ensure that the emission of noise does not exceed a reasonable level. This is consistent with the requirements of Section 16 of the Resource Management Act 1991. Accordingly, WIAL will endeavour to comply with the requirements of the construction noise standard in ensuring that resulting noise levels are "reasonable".

Performance Standards

The recommended limits for construction noise as established in NZS 6803:1999 will guide WIALs approach to managing the effects of construction noise. The construction noise limits in NZS 6803 are deemed the upper limits for the reasonable protection of health and amenity to the receiving community, varying depending on land use, time of day and duration of the construction work.

NZS 6803 includes two table of recommended upper noise limits for construction noise, which depend on the time of day and the duration of construction noise. These noise limits vary throughout the day, with morning and evening shoulder periods, as well as restrictive night-time noise limits. Limits are specified in terms of a time average level ($L_{Aeq(t)}$) and a maximum level (L_{AFmax}) which addresses individual events. Works at WIAL must consider the duration of works across the WIAL site when referencing the applicable noise limits of NZS 6803 Table 1 and Table 2. This consideration must also consider the cumulative impacts of individual projects which are occurring concurrently.

NZS 6803 limits apply at the building facades and are recommended on the basis that resulting effects are reasonable.

Table 1 Recommended upper limits for construction noise received in residential zones (NZS6803 Table 2)

Time of Week	Time Period	Duration of work					
		Typical duration (dBA)		Short-term duration (dBA)		Long-term duration (dBA)	
		Leq	Lmax	Leq	Lmax	Leq	Lmax
Weekdays	0630-0730	60	75	65	75	55	75
	0730-1800	75	90	80	95	70	85
	1800-2000	70	85	75	90	65	80
	2000-0630	45	75	45	75	45	75
Saturdays	0630-0730	45	75	45	75	45	75
	0730-1800	75	90	80	95	70	85
	1800-2000	45	75	45	75	45	75
	2000-0630	45	75	45	75	45	75
Sundays and public holidays	0630-0730	45	75	45	75	45	75
	0730-1800	55	85	55	85	55	85
	1800-2000	45	75	45	75	45	75
	2000-0630	45	75	45	75	45	75

Table 2 Recommended upper limits for construction noise received in industrial and commercial areas for all days of the year (NZS 6803 Table 3)

Time period	Duration of work		
	Typical duration	Short-term duration	Long-term duration
	Leq (dBA)	Leq (dBA)	Leq (dBA)
0730-1800	75	80	70
1800-0730	80	85	75

Irrespective of the noise limits and ability to comply, construction noise effects should be minimised where possible.

Where the above noise limits cannot be achieved, enhanced management will be required to mitigate noise effects. Where practicable, engineering controls should be used to reduce noise levels. However, for some tasks (e.g. piling) this will not be possible and effects will need to be managed by limiting operating hours, providing respite periods, and ongoing consultation and communication with affected parties.

Impacts from vibration may result in perception of vibration and structural/cosmetic damage of a building. An initial screening exercise has been undertaken and only piling works, percussive concrete breaking and vibratory compaction within 50 m of a vibration sensitive receptor are likely to result in an adverse impact. The following vibration limits apply.

Table 3 Vibration limits

Receiver	Location	Details	Category A	Category B
Occupied dwellings	Inside the building	Night time (2000-0630h)	0.3 mm/s ppv	1 mm/s ppv
		Day time (2000-0630h)	1 mm/s ppv	5 mm/s ppv
Other occupied buildings	Inside the building	Day time (2000-0630h)	2 mm/s ppv	5 mm/s ppv
All other buildings	Building foundation	Transient	5 mm/s ppv	Table 4
		Continuous		50% of Table 4

Construction impacts should be managed to comply with the Category A limits. If measured or predicted vibration levels exceed the Category A limits then a suitably qualified expert should be engaged to assess and manage construction vibration to comply with the Category A limits as far as practicable. If the vibration exceeds the Category B limits then the construction activity shall only proceed if there is appropriate monitoring of vibration levels and any associated effects on the building structure.

Table 4 Transient vibration guide values for cosmetic building damage

Building type	Peak component particle velocity in frequency range of predominant pulse, at base of building
Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above
Unreinforced or light framed structures Residential or light commercial buildings	(maximum displacement of 0.6 mm below 4 Hz) 15 mm/s at 4 Hz, 20 mm/s at 15 Hz, 50 mm/s at 40 Hz and above

*Guide values would be reduced for continuous rather than transient vibration

Appendix B

Construction Noise Management Tool

Appendix B Construction Noise Management Tool

Introduction

A construction noise management tool (CNMT) has been developed for use by WIAL and its contractors. The CNMT is a screening calculation tool which allows project details including works location, equipment type, duration and mitigation to be entered and the likely noise levels and hence risks rating of the project to be determined.

The tools takes into account the local topography surrounding the airport but does not take into account the shielding afforded by non-airport buildings (i.e. residential dwellings).

The CNMT should be used to assess the potential noise risk rating of all projects. If complex projects (long term, multiple worksites or extensive night time works) are proposed then an acoustic specialist should be engaged, and a detailed noise assessment undertaken.

The tool allows a notification list of affected properties to be produced.

The CNMT has been developed from a CadnaA noise model which uses the following noise model settings and these should be used for any computer predictions.

WIAL Construction noise model settings

Parameter	Setting/source
Software	Any recognised package
Algorithm	ISO 9613-2
Reflection model	Ray tracing, 1 order of reflections
Temperature	10°
Humidity	70%
Ground absorption	G = 0 (water/pavement), 0.5 elsewhere
Terrain contour resolution	1 m
Receiver height	1.5 m (4.5 m upper floors) - most exposed façade
Receivers	Façade (add 3 dB correction to any free field receivers)

For complex noise calculation, the standardised construction noise levels below should be used, unless actual measured data is available. The data presented overleaf provides an inventory of activities with associated octave band sound pressure levels measured at a distance of 10 m from the source.

Construction noise source levels

Activity	Description	Reference	Octave band sound pressure level (dB at 10 m)								L_{Aeq}, dB at 10 m
			63	125	250	500	1k	2k	4k	8k	
Piling	Impact hammer	contractor	93	93	93	93	93	93	93	93	100
	Tracked mobile crane (55t)	BS 5228-1 C.3.29	81	77	69	67	62	60	61	51	70
	Drop hammer pile rig power pack	BS 5228-1 C.3.7	77	78	73	66	63	57	50	42	69
Demolition	Petrol hand-held circular saw cutting concrete floor slab (3kW)	BS 5228-1 C.4.70	72	89	81	80	80	82	86	85	91
	Backhoe mounted hydraulic breaker (69kW)	BS 5228-1 C.5.6	90	79	75	78	78	83	91	92	88
	Tracked excavator (35t)	BS 5228-1 C.5.18	76	79	75	75	76	73	70	65	80
	Dump truck idling	Estimate	63	63	63	63	63	63	63	63	70
	Angle grinder grinding steel (2.3 kW)	BS 5228-1 C.4.93	57	51	52	60	70	77	73	73	80
	Diesel generator (4 kW)	BS 5228-1 C.4.85	69	69	67	60	59	60	56	53	66
Paving	Vibratory roller (8.9t)	BS 5228-1 C.5.20	90	82	73	72	70	65	59	54	75
	Asphalt paver + tipper lorry (18t)	BS 5228-1 C.5.31	72	77	74	72	71	70	67	60	77
General civil works	Tracked mobile crane (55t)	BS 5228-1 C.3.29	81	77	69	67	62	60	61	51	70
	Hand-held welder (welding piles)	BS 5228-1 C.3.31	67	68	69	68	69	66	61	56	73
	Diesel generator(4 kW)	BS 5228-1 C.4.85	69	69	67	60	59	60	56	53	66

Appendix C

Project CNMP Example

4. Noise enquiries

NOISE COMPLAINT PROCEDURE

Effective Date: 1 July 1999

FOR REVIEW

REVIEW NOTES

- 0508 AIR NOISE (voicemail) and airnoise@wellingtonairport.co.nz
- Contact details included on all notification (eg construction works) and WIAL website
- 3 working day response line to all enquiries
- WIAL 2017 website review includes online noise enquiry form
- Correspondence (details of enquiry, response, action if any) filed
- WebTrak

5. LUMINS – Land Use Management and Insulation for Airport Noise Study

History

The Land Use Management and Insulation for Airport Noise Study (LUMINS) finds its origins in the 1997 Consent Order which inserted into the District Plan a requirement for a Noise Management Plan for the Airport to be prepared. This plan is non statutory but sits alongside and complements the District Plan and its package of mechanisms, and aims to encourage the co-existence of the airport and the surrounding community. The Noise Management Plan requires:

- Consideration of land use measures which may mitigate adverse effects through changes to controls (Stage 1).
- Consideration of any need for insulation of existing houses within the ANB; the extent to which such insulation is appropriate, and the ultimate responsibility for cost (Stage 2).

LUMINS Stage 1

Stage 1 of LUMINS considered:

- The extent to which residential and other noise sensitive activities are likely and able to intensify within the ANB;
- Whether people's health would be affected by airport generated noise and if so what the extent of that effect was; and
- Whether, based on the findings of Stage 1, LUMINS should proceed with Stage 2.

In its conclusion, Stage 1 identified that there was a need to proceed to Stage 2 of LUMINS because:

- Residential and other noise sensitive development could significantly intensify within the ANB under the existing District Plan provisions.
- The extent of the effect of aircraft noise on the future population likely to be residing inside the ANB could be significant.

Consequently, it was recommended to the ANMC in August 2007 to progress to Stage 2 of the LUMINS Study.

Refer *Land Use Management and Insulation for Airport Noise Study (LUMINS) 2006*

LUMINS Stage 2

The purpose of the LUMINS Stage 2 Land Use was to:

- Examine the land uses within the ANB that are incompatible with the prevailing and forecast noise environment
- Determine the effectiveness of existing planning instruments in promoting compatible land uses and minimising incompatible land uses
- Determine the changes required to planning instruments to promote more compatible land uses within the ANB.

The LUMINS study made the following recommendations for land use change and management:

1. The existing land use measures within the Air Noise Boundary (ANB) of the District Plan were inadequate and required amendment
2. That where the sound exposure exceeds L_{dn} 75dB residential properties should be purchased over time and residential (noise-sensitive) use be terminated
3. There is a need to insulate existing noise-sensitive activities (residential and educational facilities) within the ANB.

Refer *Land Use Management and Insulation for Airport Noise Study (LUMINS) Stage 2, 2009*

LUMINS Actions

WCC District Plan land use controls

The majority of the identified planning issues were addressed through Plan Changes 72 and 73 to the District Plan and review of the Airport and Golf Course Precinct provisions.

WIAL are identified as an affected party to any resource consent application for subdivision or residential activity within the ANB. WIAL actively engages with WCC on such applications and enquiries with respect to residential activity (new or intensification) are forwarded to the Airport Planner.

Purchase and removal of residential dwellings located within the L_{dn} 75dB contour

LUMINS Stage 2 identified a total of 44 residential properties on Bridge Street, Cairns Street and Calabar Road within the L_{dn}75 dB contour to be acquired and decommissioned from residential use.

All WIAL-owned dwellings were removed following the LUMINS recommendation, and WIAL's Fair Valuation and Purchase Programme has been offered to home owners since 2009. The Quieter Homes noise mitigation package will not be offered to these properties.

Refer *WANT House Purchase Programme map*
https://drive.google.com/open?id=1u3BhINapBq1kP43Dr00xcU43fa4&usp=sharing

Acoustic mitigation (insulation) project

The Acoustic Mitigation Implementation Report (Impact Project Management 2013) scoped the LUMINS implementation project, identifying a number of principles to guide the implementation, procedural requirements and recommendations for a Trial of the implementation project. These recommendations were adopted by ANMC on 11 November 2013.

The Trial Phase was implemented on six Airport owned houses that best represented building construction types within the ANB. The acoustic mitigation works trialled different products and construction techniques to identify which performed best with respect to noise reduction, aesthetic and cost. The Trial Phase was completed in October 2014.

A comprehensive review of the Trial Phase findings and project costings was undertaken in early 2015. Consideration of the alternative acoustic treatment products installed in the Trial Phase was undertaken and the preferred acoustic treatment options, based on an assessment of quality, performance and cost, identified. This informed a Certified Standard Package of Acoustic Treatment – a priority order of acoustic treatments options, including an initial assessment of risks to consider prior to commencing design and construction (pre-design).

An Audit Phase was proposed to test and refine the acoustic treatment options and installation process under "real life" conditions prior to the programme roll out across the ANB.

The acoustic treatment package was successfully installed in three privately owned homes in early 2016.

Quieter Homes

The phased roll out of the "Quieter Homes" acoustic mitigation project commenced in April 2016. The phased roll out is managed by area, starting with those properties that experience the highest exposure to aircraft noise.

ANMC is regularly updated as to the progress of the Quieter Homes roll out.

Refer *Quieter Homes phased roll out map* and https://www.wellingtonairport.co.nz/corporate/safety-and-environment/quieter-homes/ for detail.

LAND USE MANAGEMENT AND INSULATION FOR AIRPORT NOISE STUDY (LUMINS)

1. Executive Summary

1.1 The Land Use Management and Insulation for Airport Noise Study (LUMINS) finds its origins in the 1997 Consent Order which inserted into the District Plan a requirement for a Noise Management Plan for the Airport to be prepared. This plan is non statutory but sits alongside and complements the District Plan and its package of mechanisms, and aims to encourage the co-existence of the airport and the surrounding community. There are two outstanding issues the Noise Management Plan identifies that have as yet not been addressed:

- **Consideration of land use measures which may mitigate adverse effects through changes to controls.**
- **Consideration of any need for insulation of existing houses within the ANB; the extent to which such insulation is appropriate, and the ultimate responsibility for cost.**

1.2 The Study to confront these two matters has been separated into two parts. This report deals only with Stage 1. Stage 2, a more detailed investigation would only be advanced to if it is considered there is sufficient merit to do so.

1.3 Some of the more salient points to emerge out of the investigations undertaken as part of Stage 1 are:

- **There are now over 700 residential units located inside the Air Noise Boundary (ANB)**
- **Most of the housing stock is of good quality**

- **There appears to be only a weak correlation between housing value and proximity to the airport**

- **The numbers of residential units are predicted to increase significantly inside the ANB within the forecast period (to 2020)**

- **The average ANB dwelling's construction is reasonably effective at retarding aircraft noise when windows are closed**

- **Under any growth scenario where windows are open all residential units inside the ANB will be subjected to 'undesirable' levels of aircraft noise. Where windows are closed the number of dwellings so exposed drops but remains significant.**

- **The Airport is in the optimal location compared to several other potential locations in the Wellington Region**

- **The Airport is a significant contributor in direct and indirect terms to the Wellington Region's economy**

- **Noise generated by the Airport has subsided significantly from the peak at 1988 while overall activity has increased substantially, illustrating the effect of investment in quieter technology.**

- **Noise is permitted to increase to levels substantially greater than experienced presently (about 5 dBA L_{dn} more than present)**

1.4 The results of the investigations provide confirmation that sufficient merit is accumulated to warrant progression through to the second stage of the Study.

1.5 A recommendation is therefore made to advance to Stage 2 of the LUMINS study.

2. Introduction

2.1 This report summarises the results for the investigation of Stage 1 of the Land Use Management and Insulation for airport Noise Study (LUMINS), and assesses whether there is merit in advancing to the second stage of the Study. The report has been prepared within the framework provided by the Terms of Reference for Stage 1. The report proceeds in the following manner:

1. It provides a background to the Study and present planning controls in and around the Airport, inside the 'Air Noise Boundary' (ANB, the capacity quota set for the airport at the 65 dBA L_{dn} noise contour. The Boundary is shown on attached Map 1).

2. It examines in detail the purpose and objectives of the Terms of Reference for Stage 1.

3. It summarises the results of each of the steps that the Stage 1 investigation is broken into.

4. It assesses those results to determine whether there is sufficient merit in advancing to the more detailed investigations of Stage 2.

5. Finally the report makes a recommendation on advancement to Stage 2.

2.2 The final decision on advancement rests with the Air Noise Committee, to which these reports are presented to assist them in their deliberations. As such these reports are presented as draft documents – it is the Air Noise Committee's prerogative to confirm them as final.

2.3 The Air Noise Committee is made up of representatives from the following organisations and groups:

- Residents
- Board of Airline Representatives New Zealand (BARNZ)
- Local non BARNZ operators
- Airways New Zealand
- Wellington International Airport Limited
- Wellington City Council
- Technical adviser to resident representatives
- New Zealand Defence Force

3. Rongotai and the Airport, the Airport and Wellington

3.1 Although the current airport as we know it was primarily created in 1959, the area has been associated with aviation activity since 1910. Following the First World War the wide sweeping beach of Lyall Bay and the adjoining Lyall Bay Recreation Ground were used as a base for pleasure flights. In 1929 an area of 19ha was levelled to form a municipal aerodrome. The aerodrome was used for commercial services and by the time the Second World War broke out in 1939 had expanded to 35ha. During the war it was used by the RNZAF and was further enlarged.

3.2 Construction of a new airport began in 1952 and was completed in 1959. The work involved large scale excavation and reclamation of both Lyall Bay and Evans Bay, massive sea protection and the removal or demolition of around 180 houses. The new airport initially had a runway length of 1750m, but this was extended in 1972 to 1936m.

3.3 The residential and commercial areas currently surrounding the Airport were generally established before the creation of the present Airport, probably between 1910 and the beginning of the Second World War. Residential dwellings had spread across the northern part of the Rongotai isthmus, including the hill that was removed for the northern end of the runway, and over into Miramar. The location of industrial uses in Miramar has generally remained constant up to the present day – behind Wexford Hill and on Ropa Lane, although the former gas works site on the corner of Tahi and Tauhinu Street has now been converted to retail and residential uses.

3.4 The exceptions are the industrial land centred on Cairns and Rongotai Roads which was created when the area was reclaimed for the Airport, and the land to the west of the airport that was formerly occupied by the 1940 Centennial Exhibition Showgrounds. The presence of the Airport mainly determined the development pattern and uses found in these areas now. The suburb of Strathmore is also largely post war and post airport.

3.5 In 1992 WIAL commissioned a report[3] on the viability of alternative locations for an airport within the Wellington region. Seven different sites were evaluated: Ohariu Valley, Horokiwi, Mana Island, Paraparaumu, Te Horo, the Wairarapa and Pencarrow. The report concluded:

> "*The topography of the Wellington Region constrains alterative sites to be high cost, operationally poor or located at a distance which penalises users and business activity. No site offers a better alternative to Wellington International Airport at the present time.* "

3.6 In 1997 a report[4] was prepared on the economic contribution of Wellington Airport to the economy of Wellington. According to the report the airport was responsible for direct and indirect benefits to Wellington in the order of $276 million per year, and for the direct and indirect creation of around 2800 jobs. While the data is somewhat dated it illustrates the considerable contribution and flow-on effect of the airport to Wellington's economy (then, about 1.2% of regional output).

4.0 History of Planning Controls

4.1 Wellington's first district scheme was made operative in 1972. This was reviewed in 1979, the review becoming the operative plan in 1985. This 1985 plan was the forerunner to the present District Plan.

4.2 There was a notable absence of noise-related controls on the airport and on the uses surrounding it in the historical planning documents. (The curfew was first introduced in 1975 and administered by the Civil Aviation Authority's precursor and was independent of Wellington City Council controls.) This possibly betrays a certain coexistence that had evolved, probably a reflection of the relatively low numbers of aircraft using the airport at that time, albeit that these older aircraft were considerably noisier than their modern counterparts.

4.3 The zoning pattern of the 1985 plan for the most part corresponds with that of the present plan. However the Airport did not have its own zoning, this was split between residential in the north and industrial in the south, but with a designation for airport purposes laid over the top of both. The Golf Course had a mixture of zonings – retail, industrial and residential.

4.4 Events overtook the development of these somewhat benign planning instruments with the advent of Ansett New Zealand into the domestic market in the mid 1980's. Not only was there a very substantial increase

[3] "Wellington International Airport Ltd – Alternative Airport Locations Study", Works Consultancy Ltd, November 1992

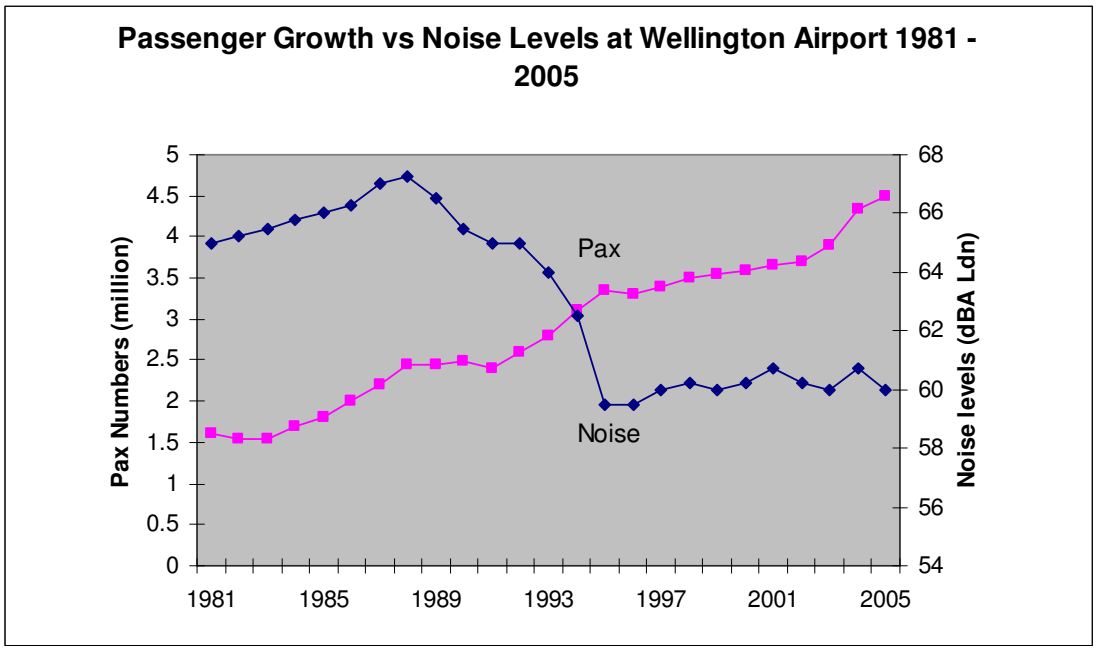
[4] "The Economic Impact of Wellington International Airport", Business & Economic Research Ltd, July 1997.

in the numbers of flights, but Ansett began its operations with old and noisy Boeing 737-100 planes.

4.5 In the late 1980s this exacerbated the pressure on the Council to regulate aircraft noise. It decided that even if it could change the 1985 plan in the face of the existing Airport designation, there was likely to be a very lengthy hearings and appeals process. The Council decided instead to deal with the problem by way of two bylaws. The first controlled engine testing, the second noisy aircraft.

4.7 Interestingly, while noise generated by the airport has subsided significantly since its peak at 1988 (67 dBA[ϒ] L_{dn} at Rongotai College) to around 60 dBA L_{dn} today, overall airport activity has increased extensively. This is illustrated in Figure 1 below with airport activity represented by number of passengers using the airport per year. The number of passengers using the airport in 1988 was approximately 2.5 million with noise reaching 67 dBA L_{dn}, yet in 2005 4.5 million passengers used the airport with noise levels pegged back to 60 dBA L_{dn}. What this shows is the effect of substantial investment in new technology by the airlines and the Airport, such as the replacement of old noisier aircraft with newer quieter planes like the Bombadier Dash 8 Q-300. Figure 1 below and the Noise over the Years figure included in the report on Step 1(c) illustrate the effect of investment by the airlines and airport to drive noise down from its historic peak.

Figure 1: Passenger Growth versus Noise levels generated at Wellington Airport, 1981 - 2005



[ϒ] An illustration putting the noise values stated throughout this report in context is attached as Appendix 1.

4.8 The introduction of the Resource Management Act 1991 and the requirement that a completely new district plan be prepared provided the opportunity to thoroughly re-examine the Airport's status within the context of the planning system. The designation was removed and replaced with the current Airport Precinct, which allowed much greater control to be exerted on the Airport's operations through the District Plan's provisions (a designation essentially 'sits outside' the plan shielding the designated use from its controls).

4.9 The designation's removal, and the full exposure of the Airport to the District Plan was only one part of a two pronged approach – noise management controls on the one hand, land use planning controls on the other. The District Plan introduced for the first time restrictions on the type and intensity of residential development that could establish in areas subject to significant levels of airport noise. This approach represented a 'pact' between the community and the Airport – that it was fair and equitable that both parties should bear part of the burden of lowering noise to an acceptable standard.

4.10 The final details of this arrangement contained in the proposed District Plan could not be agreed upon by all the parties, and three Environment Court appeals against it were lodged by WIAL, BARNZ and RANAG.

5. 1997 Decision & the District Plan

5.1 The current planning provisions relating to the Airport find their origin in the 1997 Environment Court Decision and Consent Order on these appeals.

5.2 The parties agreed on a package of air noise provisions, confirmed through consent order comprising:

- An airnoise boundary
- A ban on non-noise certified and chapter 2 aircraft
- A curfew
- Ground noise controls
- Land use controls

5.3 The one remaining issue that could not be agreed upon was the status of new residential development in the Suburban Centres zone. BARNZ and

WIAL sought non–complying status, WCC unrestricted discretionary – the current status.

5.4 The parties also agreed on a framework within which outstanding issues and concerns can be resolved, given expression through the Noise Management Plan (NMP). The following is taken from the District Plan, which in turn is obtained directly from the 1997 Consent Order:

A noise management plan (NMP) will immediately be implemented by Wellington International Airport Limited (WIAL) to assist all interested parties in complying with the objectives and rules in the District Plan.

The noise management plan will include:

1. *A statement of noise management objectives and policies.*

2. *Details of methods and processes for remedying and mitigating adverse effects of airport noise including but not limited to:*

    - *Improvements to Airport layout to reduce ground noise.*

    - *Improvements to airport equipment (including provision of engine test shielding such as an acoustic enclosure for propeller driver aircraft) to reduce ground noise.*

    - *Aircraft operating procedures in the air and on the ground.*

3. *Procedures for monitoring and ongoing review of the plan.*

4. *Dispute resolution procedures.*

5. *A programme for immediate and ongoing refinement by way of shrinkage of the location of the air noise boundary (ANB), with priority to be given to those areas which through further monitoring are found not to be exposed to forecast Ldn 65 dBA, with the intent that the programme be completed within two years.*

6. ***Consideration of land use measures which may mitigate adverse effects through changes to controls.***

7. ***Consideration of any need for insulation of existing houses within the ANB; the extent to which such insulation is appropriate, and the ultimate responsibility for cost.***

8. *Details of methods and process for monitoring and reporting compliance with the District Plan rules, including but not limited to:*

   - *Airnoise boundary and activity ceilings provided in the rules.*
   - *Engine testing.*
   - *Auxiliary Power units (APUs Ground Power Units (GPUs).*
   - *Curfew.*

9. *Details for certification by WIAL of night curfew exempt aircraft.*

5.5 All of these matters have been completed and included in the NMP, with the exceptions of items 6 and 7. This report addresses aspects of these two outstanding items.

6. Terms of Reference

6.1 In August 2004 Terms of Reference were agreed upon by the Air Noise Management Committee for a study into items 6 and 7, attached as Appendix 2. It was decided to combine the matters together into one study given insulation for air noise and land use management are in many ways closely connected, presenting a strong synergy.

6.2 The Terms of Reference separate the Study into 'Initial' and 'Subsequent' investigations, corresponding with Stage 1 and Stage 2 respectively.

6.3 Stage 1 is focused on what is going on inside the Air Noise Boundary at the present time, and what could happen under the existing District Plan regime. Using this information it then inquires and forms conclusions on the effect of noise exposure on the existing and potential future populations inside the ANB. Stage 1 could be summarised as:

1. To what extent are residential and other noise sensitive activities likely and able to intensify within the ANB.

2. Is people's health being adversely affected by exposure to aircraft noise, and if so what is the extent of the effect and the numbers of people affected?

6.4 The assessment of these matters is divided into 5 items or steps. The items are in many ways interrelated, building on each other, and in combination seek to provide answers to the above two questions.

6.5 Item (a) looks at the nature of residential development, including temporary accommodation and schools that exist inside the ANB at the moment. This is termed 'the baseline'.

6.6 Item (b) requires an assessment of the degree to which residential and other noise sensitive development could intensify or change under existing planning rules. This is termed 'the future' – what could happen inside the ANB over the next 15 years.

6.7 Item (c) provides a context to noise levels currently being experienced by comparing them with those at historic peak (around 1987), the time of the Environment Court Decision in 1997 and the levels permitted by the District Plan.

6.8 Item (d) is an examination of noise levels that can be expected to be experienced inside typical dwellings found within the ANB. This is acquired by the measurement of the noise-reducing characteristics of typical dwellings.

6.9 Item (e) brings together items (b), (c), (d) in forming statements on the noise effects that are and will be experienced by people living in the ANB now and in the future.

6.10 A summary of the results produced for each of those items is set out below.

7. Summation to Steps 1(a) to 1(e)

7.1 Step 1(a)

(a) *'An accurate measure of the changes to ownership, number, condition and type of construction of residential buildings (dwellings, apartment blocks and other uses including short stay accommodation and schools) within the Air Noise Boundary – the baseline.'*

7.2 There are two stand-out features from the investigation carried out for step 1(a).

7.3 The first is the total number of residential units inside the Air Noise Boundary. Partly on the basis of evidence adduced to the Environment Court in the past there was a general consensus there were about 650 residential units inside the ANB. The WCC and Valuation data has however allowed a detailed analysis to be conducted, revealing the higher figure of 728 residential units in total. This includes the 32 units established inside the Suburban Centres zone. It is possible that previous

counts underestimated recent infill and failed to include some blocks of flats dating from the seventies in the western sector of the ANB.

7.4 The second feature is the seeming lack of correlation between the presence of the Airport and the changes to ownership, condition and type of construction of the residential units inside the ANB. There would seem to be no discernible pattern to these factors that would be attributable to the airport's presence. Instead ownership change appears to be fairly uniform across the ANB and does not decrease away from the Airport. The same holds for the quality of housing, expressed through the condition map.

7.5 This finding is reinforced by the capital value map which shows that values are evenly distributed on the flat either side of the airport within the ANB, and are perhaps more influenced by views and elevation such as on Maupuia Ridge and at Moa Point where values can be seen to increase markedly (However it may be that the somewhat coarse gradations of the capital value map may obscure more subtle differences in value, as values are grouped in increments of $150 000).

7.6 What is clear is that proximity to the airport and its noise is not perceived by the market place to be a key constraining factor to the residential development of the area. Residential development is taking place inside the ANB, despite and perhaps with little regard to the airport's presence.

7.7 There could be several explanations for this – the property boom of the eastern suburbs, quieter aircraft etc – this study does not attempt to explain why. It is also possible that the airport is having an effect but it cannot be made out over such a relatively small area like the ANB. Nevertheless it is difficult to contrast the ANB area with another as a comparison becomes flooded with variables, inevitably resulting in a likening of apples with oranges.

7.8 The findings of the examination carried out into step 1(a) can be summarised as follows:

- There is an average turnover of 45% within the ANB between 1999-2005, although any correlation between proximity to the airport and turnover is weak.
- There is a total of 728 residential units inside the ANB.
- The condition of residential buildings is generally 'above average'.
- The most common type of house construction is wooden walls and iron roof

- The two short stay accommodation sites and the two educational facilities inside the ANB are in good condition. There are two childcare centres within the ANB, a Samoan preschool within Mirimar South School and on the corner of Salek Street and Rongotai Road.

7.9 Step 1(b)

(b). '*An assessment, as best as practicable, of the extent to which residential and other noise-sensitive development could intensify or change within the ANB area under existing district plan provisions. – the future, possibly develop some alternative scenarios.'*

7.10 The report for step 1(b) was divided into 3 broad areas of investigation:

1. An assessment of the total numbers of residential units that *theoretically could* be established inside the ANB

2. Tempering the above with a 'real-world' assessment of the numbers of residential units that are *likely* to be established inside the ANB

3. Because both of the above assessments are intimately informed by the provisions of the District Plan, an examination of the operation of the Plan provisions in those zones receptive to noise sensitive development was also carried out. This provides a holistic understanding of the functioning of the Plan and how it relates to growth inside the Air Noise Boundary.

Outer Residential Zone

7.11 The report concluded that in the Outer Residential Zone inside the ANB, an extra 276 residential units could theoretically be established, in conservative circumstances. In more favourable conditions, under a moderate growth scenario it is assumed an extra 474 residential units could be built. These figures represent increases of 40% and 68% respectively over the current 696 houses inside the Outer Residential zone in the ANB.

7.12 Remembering that an extra 276 - 474 units is hypothetical only but provides the background against which the magnitude of the likely scenarios can be evaluated.

7.13 Three likely growth scenarios were developed using a synthesis of two sets of growth projections– low, medium, and high which attained increases of 57, 91 and 184 respectively.

7.14 It is difficult to predict which of the likely growth scenarios will occur in the next 15 years. The District Plan objectives and policies emphasise urban containment, and infill housing is a steady trend across all residential areas of the city. The ANB has been no exception to this trend, as evidenced by the increase in dwelling numbers to the current 728. A factor may be the ability to undertake small housing developments, of one or two additional units, without difficulty under the present District Plan rules. Growth may also be sustained by the flat land, a relative scarcity in Wellington, proximity to desirable Seatoun, good public transport access and the views that parts of the ANB enjoys such as on Maupuia Ridge.

7.15 Balanced against this is the requirement for multi-unit housing developments (3 or more units) within the ANB to first acquire resource consent for a discretionary unrestricted activity, and the economy. While 15 years is a reasonable amount of time within which a lot of development can occur, recent growth is on the back of a long economic and property boom which is unlikely to continue indefinitely. Growth could ease back but not to historical levels. For these reasons it is considered that likely growth will fall somewhere between 57-184 additional residential units, probably around the middle of the range.

Suburban Centres Zone

7.16 The selection of a particular capacity figure for the Suburban Centres zone almost becomes irrelevant - all the capacity figures developed illustrate the huge potential of land zoned Suburban Centre to accommodate more residential units, even under 'constrained' conditions. The figures also demonstrate that potentially the Airport could be significantly more enclosed by uses very different, and very (much) more sensitive to noise than today.

7.17 Balanced with that is that land in the Suburban Centre zone is generally fully utilised by commercial activities. Any decision to develop these properties for residential will be dependent on business decisions to relocate, downsize (for example to ground level only) or close existing businesses and the attractiveness of those sites to other commercial activities. That will be more compelling in some areas of the zone where the value of land for residential would outweigh that of other competing uses, and less compelling in other parts. In any event it is acknowledged that the commercial sector, the primary driver of demand for land in the Suburban Centres zone, can be volatile. Presently demand is solid.

7.18 Four likely growth figures in residential units arose out of the four growth scenarios: low – 82 in total, medium – 157, high – 232, and 432 coming out of the 'Step shift' scenario.

7.19 It is not considered that the low scenario is reliable, there are already 32 residential units in the zone, 15 years is a reasonable amount of time and the recent Corrigan Decision effectively lessens the barriers to the construction of considerably more units on the western side of Maupuia Ridge at least.

7.20 It is also considered the 'high' and 'step shift' scenarios can be put aside. It is not anticipated that commercial and industrial uses sectors presently occupying most of the zone will collapse releasing substantial areas for residential development. Instead there is a good chance that the film industry, proximity to the Airport and CBD, and flat land will ensure the continuance of non-residential uses for the most part.

7.21 That notwithstanding there are some areas of the zone that are very likely to be developed for residential units – Maupuia Ridge in particular because the topography does not lend itself to commercial uses and in light of the recent Corrigan decision. The recent trend for sea side living will also probably mean that some parts of the zone close to Lyall Bay will be converted to residential units. Commercial uses there seem at present marginal, and the nearby Airport Retail Park has encouraged some uplift in the general area. It is considered that residential development on some part of Burnham Wharf is also a distinct possibility over the next 15 years. CentrePort has indicated its desire to promote substantial residential development around its port facilities in the Central City. It is likely that this development philosophy will be extended to Burnham Wharf, especially given its high amenity and proximity to the pleasant Shelly Bay coastline.

7.22 The upshot of all this is that a figure somewhere between 50 and 200 additional units is considered the most appropriate forecast for the Suburban Centres zone, between 82 and 232 in total (32 existing/already constructed) but probably tending towards marginally above the mid range.

Other Noise Sensitive Development

7.23 Determining capacities within the ANB for travellers' accommodation and childcare centres, other components of noise sensitive uses, is a bit difficult given the variables. However it is considered likely that a hotel will be constructed inside the Airport Precinct (it is anticipated in that zone's provisions). It is also likely a hotel could be established near the Burnham Wharf area, and an additional childcare centre in the Outer Residential zone, as this form of child care becomes more popular.

7.24 Step 1(c)

1(c): *'An assessment of current noise levels against those applied at historic peak, at the time of the Environment Court decision in 1997 and against the permitted noise levels of the District Plan.'*

7.25 This assessment was relatively straightforward, and is graphed on page 2 of the report for Step 1 (c). it shows that capacity levels are represented by the Air Noise Boundary which largely follows the L_{dn} 65 dBA noise contour.

7.26 Historic peak is confirmed as 2-3 dBA L_{dn} decibels louder than Capacity.

7.27 Current noise levels are 5 decibels less than Capacity.

7.28 1997 (Environment Court Decision) levels are also approximately 5 decibels less than Capacity.

7.29 In itself this Step provides a comparison and a setting for all the relevant noise levels. It should be noted that increasing noise levels from those received currently to Capacity equates to an approximate tripling of current annual aircraft movements (based on the assumption that the current mix of aircraft remains and flight numbers are increased evenly throughout the day. Capacity may be more quickly reached if more flights are concentrated at night time, due to the 10 dBA penalty accorded to all night flights.)

7.30 The information derived through the step 1(c) exercise also feeds into the other steps, particularly step 1(e).

7.31 Step 1(d)

1(d): `*Using available local and international information, provide estimates of expected indoor aircraft noise levels within ANB – buildings, based on the acoustic performance of existing buildings within the area and the level of aircraft noise anticipated by the ANB.'*

7.32 A detailed investigation into the sound reducing characteristics of houses inside the ANB was carried out over the winter of 2005. Noise meters were set up inside and outside 4 representative houses to record simultaneous noise levels received from jet aircraft movements (Noise levels were based on jet aircraft as these generate the majority of noise at the airport and form the basis on which the ANB is calculated).

7.33 The investigations determined that overall the noise received inside an existing average house inside the ANB is 26 decibels less than the noise experienced outside when windows and doors are closed. This reduces down to 17 decibels when windows are open. That is, the typical ANB dwelling possesses such noise reducing characteristics that reduce aircraft noise by 26 and 17 decibels when windows are closed and open respectively. Opening windows effectively diminishes much of the sound insulating characteristics of a dwelling, as it creates an unobstructed pathway for noise into the dwelling.

7.34 These results mirror those for a study conducted in the United States (also 26 and 17 decibels, p. 4 Step 1(d) report LUMINS) and closely approximate those for a similar study carried out in Auckland – 24-31 and 18 when windows are closed and open respectively.

7.35 The results from 1(d) investigations were a little surprising in that such a significant reduction with closed windows was slightly better than expected. The houses tested, like the majority of existing houses inside the ANB, date from the 1920's and '30's and contain very little insulation. Often there is nothing between the exterior cladding and interior walls. As predicted when windows are opened noise insulation reduces sharply.

7.36 The primary purpose of step 1(d) was to inform the analysis carried out for 1(e).

7.37 Step 1(e)

1(e): *'Using available local and international information on effects of aircraft noise, provide statements as to likely effects/impacts on the calculated noise exposed population and houses (baseline and future) at these predicted indoor exposure levels and determine the baseline and future population impacted.'*

7.38 As a starting point three main effects of environmental noise exposure are identified:

- Amenity, represented by the criterion L_{dn}
- Communication, represented by the criterion SEL
- Sleep disturbance, represented by the criterion L_{max}

7.39 Assessment was expanded beyond the use of the L_{dn} criterion alone since, as discussed under step 1(b) it is considered to not fully capture the full impact of aircraft noise. For example, because the L_{dn} is a time averaged measure one or two large noisy events at night causing significant disturbance can be masked by generally benign conditions predominating the rest of the time. The SEL and L_{max} measures take account of some of

these effects not picked up by L_{dn}, ie. communication interference and sleep disturbance.

7.40 Thresholds for the three criteria were then determined beyond which aircraft noise is considered 'undesirable'. An undesirable level is such that more than a small percentage of people are adversely affected (p. 12, Step 1(e) report LUMINS). The following thresholds for internal noise levels were identified and demarcated in that report:

Figure 2: Thresholds for internal noise levels

Amenity	L_{dn} > 45 dBA
Communication interference	SEL > 70 dBA
Sleep disturbance*	L_{max} > 54 dBA

* As defined by Griefahn, who does not take into account the benefit of curfewed operations such as exist at Wellington.

7.41 The thresholds were then combined with the general noise insulation qualities of existing houses inside the ANB, produced by the Step 1(d) investigations, to show the numbers of houses and people adversely affected by aircraft noise, now and in the future. The 'future' was based on the population growth scenarios identified in step 1(b) – 'low', 'medium', 'high', for both the Outer Residential and Suburban Centres zones.

7.42 This exercise results in the following tables, illustrating the number of people that will be exposed to undesirable internal noise levels where windows are opened and with windows closed. Population numbers are based on Department of Statistics' average occupancy per dwelling in the Rongotai and Miramar areas (2.6 persons/dwelling). Where windows are opened much of the effectiveness of any noise insulation is lost.

7.43 *Figure 3: Number of people exposed to undesirable internal noise levels, with windows open:*

Thresholds	Current noise and population	Future noise levels Population growth scenarios			
		None	Low	Medium	High
No. people > 45 L_{dn}	1214	1892*	2171*	2454*	2891*
No. people > SEL 70	1892*	1892*	2171*	2454*	2891*
No. people > L_{max} 54	1892*	1892*	2171*	2454*	2891*

An * denotes all people inside the ANB affected.

7.44 *Figure 4: Number of people exposed to undesirable internal noise levels, with windows closed*

Thresholds	Current noise and population	Future noise levels Population growth scenarios			
		None	Low	Medium	High
No. people > 45 Ldn	46	613	613	613	613
No. people > SEL 70	613	613	613	613	613
No. people > Lmax 54	1053	1053	1185	1307	1518

7.45 Translated into percentages, where windows are open and when the airport is operating at capacity, 100% of people and houses inside the

ANB will be adversely affected by undesirable noise levels. This is under all scenarios. When windows are closed this falls to between 20-32% (depending on the level of growth) for the annoyance and communication interference thresholds and 53-56% for sleep disturbance.

7.46 The results of the step 1(e) examination demonstrate the potential for significant numbers of people inside the ANB both currently and in the future when the airport is operating at capacity to be adversely affected by undesirable levels of aircraft noise. This is most pronounced when windows are open which effectively neutralises much of a dwelling's noise insulation properties, and remains substantial when windows are closed. There do not appear to be data or studies available that examine the amount of time windows would be open, not only for the Wellington context but in general. It is assumed for the purposes of this study that windows would be open for a reasonable amount of time, especially over the summer period.

7.47 It is observed from the results that where windows are closed the numbers of people subject to adverse levels of amenity and communication interference (represented by L_{dn} and SEL) remains constant over the various growth scenarios. That is because new dwellings, under current Plan provisions must be built in accordance with the Plan's 45L_{dn} internal noise environment, leaving only existing housing adversely affected.

7.48 However the number of people exposed to undesirable levels of noise in terms of the L_{max} measure does rise in parallel with the growth of dwellings. While new houses in the ANB will be required to be insulated to the Plan's 45 L_{dn} requirement, such insulation will not prevent the type of disturbance as represented by the L_{max} (this is because the L_{dn} measure averages all the sound energy over a certain period to provide an indication of accumulated annoyance, but will mask occasional significantly disruptive events).

7.49 Sleep disturbance is a particularly sensitive component of undesirable exposure to aircraft noise. At Wellington Airport the curfew works to minimise this type of disturbance, as there are virtually no aircraft movements between 1am and 6am. Nonetheless night time officially extends from 10pm to 7am, when ideally people can generally expect the minimum of interruptions to sleep. It is noted in the report that noise exposure in the latter stages of sleep is more likely to result in awakening than if the noise exposure occurs during the first 2-3 hours of sleep (p. 7, Step 1(e) report LUMINS). Operation of the Airport at capacity will result in an increase in flights in the period between 6-7am when people are more easily awoken. To lessen sleep disturbance effects Griefahn recommends progressively reducing the frequency of flights or concentrating flights at the beginning and end of the night to keep the

hours in between free. The curfew at Wellington ensures that a 5 hour period at least is preserved as uninterrupted each night.

7.50 The impact of airport noise on other travellers' accommodation has not been examined in the same depth as for residential units. It is considered the absence of a sustained domiciliary component to this activity significantly reduces occupants' exposure to aircraft noise. There is also much less inertia to people occupying traveller's accommodation – if the accommodation is unsuitable in terms of noise they can move.

7.51 Investigations into the internal noise levels received at Miramar South School revealed that aircraft noise is having some adverse effect on teaching in certain classrooms at the school. This noise sensitive activity (at least as it comprises parts of Miramar South School) therefore currently and in the future will suffer from adverse levels of aircraft noise exposure. The aviation sector is supportive of the inclusion of schools in the Study so associated problems can be addressed.

8. Tests for Merit

8.1 Where Stage 1 is a 'snapshot' of what is going on inside the ANB, Stage 2 will be focused on resolving any issues posed by the first stage. It looks at whether changes to the land use management regime inside the ANB are necessary and if noise insulation should be added to existing houses to protect occupants, and what the cost of this would be.

8.2 Stage 2 is not a natural corollary of Stage 1. At the end of Stage 1 it must be determined whether there is merit in proceeding to Stage 2. This is stated in the August 2004 Terms of Reference for this Study. A possible conclusion to Stage 1 investigations is that the Plan is working and will continue to work effectively in managing noise-sensitive uses inside the ANB, and the exposure of existing and future populations inside the ANB to aircraft noise is not adverse to their health. If that is the case the Study finishes there.

8.3 Advancement to Stage 2 is a major step – re-examining the District plan's approach and insulating houses for aircraft noise are potentially very expensive, challenging and time consuming, and are movers that cannot be undertaken lightly.

8.4 In the context of this study it is considered that the 'merit' of proceeding to Stage 2 should be determined by the responses to three sequential sets of enquiries:

1. Whether the extent to which residential and other noise sensitive uses inside the ANB could intensify under existing District Plan provisions will be significant, and

2. Whether the effects of aircraft noise on existing and future residents indoors will be significant

3. As a consequence, is there a need to advance to Stage 2, and is that advancement appropriate?.

8.5 These enquiries have been designed to provide rigour and transparency in the justification on whether or not to proceed to Stage 2. They find their origin in:

- The fundamental questions posed by the Noise Management Plan's two outstanding points **(Enquiries 1 and 2).**

- The Study's Terms of Reference which state the initial (Stage 1) focus will be on 'need' and 'appropriateness' **(Enquiry 3)**.

8.6 Evaluation through these three 'tests' will determine whether there is merit in advancing to Stage 2. The final decision on advancement is of course a matter reserved for the Committee.

First Enquiry

8.7 Whether the extent to which residential and other noise sensitive uses inside the ANB could intensify under existing District Plan provisions will be significant.

8.8 The presence of the airport is not a significant impediment to the ongoing intensifying urban development surrounding it. Development appears to be proceeding at a rate comparable to areas outside the ANB and there is a weak correlation between the proximity to the airport and value.

8.9 The number of dwellings has increased from 650 in 1997 to 728 in 2006 – representing a steady rate of growth in the ANB over this period.

8.10 Analysis of the technical reports indicate that there is considerable capacity for residential growth inside the ANB and that by 2020 there is likely to be:

- between 753 and 880 dwellings in the Outer Residential Area
- between 82 and 232 dwellings in the Suburban Centres zone.

8.12 While the technical analysis identifies growth for both zones, it is acknowledged that all future housing must be insulated against airport noise to the requirements of the District Plan. This will temper the effect

of the increase in residents somewhat. However as highlighted the L_{dn} 45 dBA standard does not completely capture the full effect of aircraft noise, as it does not accurately account for all aspects of disturbance, such as sleep interruption.

8.13 In summary - based on past development trends and likely future development scenarios under the existing District Plan, it is likely that residential and other noise sensitive development could significantly intensify within the ANB.

Second Enquiry

The extent of the effect of exposure to aircraft noise on people

8.14 The effects on people of exposure to aircraft noise is primarily dependant on:

- Levels of aircraft noise
- Effectiveness of the dwelling to insulate against aircraft noise

8.15 While current noise levels are below the permitted standard in the District Plan, it is anticipated that growth in air traffic to 2020 will increase the accumulative noise to a level close to the allowable maximum standard. Should this occur, noise levels within the ANB will increase by approximately 5dBA L_{dn}.

8.16 Technical analysis on the effectiveness of dwellings to insulate against aircraft noise indicates that a significant number of residents could be exposed to undesirable levels of aircraft noise – depending on whether windows are open or closed.

8.17 Where windows are closed around 613 people (236 dwellings) will be exposed to undesirable levels of amenity and communication interference. According to the research by Griefahn as referenced in the Step 1(e) report between 1185 and 1518 people would possibly be exposed to an undesirable level of sleep disturbance. This must be qualified though by noting of course that this research upon which the sleep disturbance levels are based does not take into account the effect of a curfew such as exists at Wellington.

8.18 Where windows are opened the evidence becomes quite cogent. No one living inside the ANB in 15 years time (between 1892 and 2891 people) with their windows open would not be exposed to undesirable levels of airport related noise.

8.19 It is therefore concluded that the extent of the effect of aircraft noise on the future population likely to be residing inside the ANB could be significant.

Third Enquiry

Need and appropriateness

8.20 This enquiry provides the final rigour to determining if the Study results present sufficient merit warranting advancement to Stage 2. The Terms of Reference state Stage 2 consideration can occur '…following stage 1 if having regard to "need and appropriateness" it is decided to proceed.'

8.21 This raises the following questions.

8.22 Is there a need to advance to Stage 2?

8.23 The Study results indicate that noise sensitive uses inside the ANB could significantly intensify within the planning period, and that significant numbers of people could be exposed to the adverse effects of aircraft noise. It is clear that further investigation is required if these consequences are to be avoided. Not entering into further investigation could strongly aggravate the possibility that large numbers of people will be exposed to undesirable levels of aircraft noise. This has the secondary effect of increasing the chances that the Airport would become the focus for further restriction. As such, there is a demonstrable need to advance to Stage 2.

8.24 Secondly, is it appropriate to undertake further investigation?

8.25 It could be while further investigation is needed it may not be appropriate to carry out that investigation. Further analysis through Stage 2 potentially exposes the District Plan to change and the Airport, Airlines or other parties to considerable cost for an insulation programme.

8.26 It is considered in the circumstances that it is appropriate to undertake additional work, in full recognition of that exposure. The potential adverse effects demonstrated by the Stage 1 analysis demand it. Ignoring those results and ceasing the Study now could leave issues to intensify and go unresolved, intensifying the risk of adverse effects on the local community, the airport and indirectly the entire region.

8.27 Therefore it is appropriate to proceed to Stage 2.

9. Conclusion

9.1 This report has inquired into whether there is merit in proceeding to Stage 2 of the LUMINS Study.

9.2 It established the background to the current provisions of the District Plan and the Study. It then summarised the results for the separate steps into which Stage 1 of the Study was broken into. This allowed the results to undergo scrutiny by each of the three 'tests'.

9.3 At this point we are now able to ascertain 'merit'.

9.4 The following was concluded for each of the tests:

1. Residential and other noise sensitive development could significantly intensify within the ANB under existing District Plan provisions.

2. The extent of the effect of aircraft noise on the future population likely to be residing inside the ANB could be significant

3. There is a need to carry out further investigation on the issues highlighted, and this investigation is appropriate.

9.5 Consequently there is merit in progressing to Stage 2 of the LUMINS Study.

10. Recommendation

10.1 It is recommended to the Wellington Air Noise Management Committee that Stage 2 be progressed to.

5.2 LUMINS Stage 2 2009

L U M I N S

Land Use Management and
Insulation for Airport
Noise Study

STAGE 2

SEPTEMBER 2009

Prepared for Air Noise Management Committee
by Boffa Miskell Ltd