Auckland Airport

MARSHALL DAY Acoustics

AUCKLAND AIRPORT
2022 FINANCIAL YEAR ANNUAL NOISE MANAGEMENT REPORT

12 September 2022

Cover Photo: Robert de Bock

EXECUTIVE SUMMARY

Designation 1100 requires Auckland International Airport Limited (AIAL) to report on its aircraft noise monitoring programme. The programme involves continuous 'on the ground' monitoring of aircraft noise levels at three sites, noise contour calculations for actual and projected aircraft activity, engine testing noise monitoring and noise complaint monitoring. This report has been prepared by Marshall Day Acoustics and provides an overview of the noise monitoring programme for FY22 (Jul 2021 – Jun 2022).

The COVID-19 pandemic continued to have a significant impact on aircraft operations during FY22, and its effects will persist into FY23 and potentially beyond. Compared with FY21, operations decreased by 12%, with night-time movements (10pm – 7am) up 8% and daytime movements down 14%. This decrease from FY21 is because FY22 had more stringent and longer lasting lockdowns e.g. from August 2021 to December 2021.

Night-time movements made up 8% of the total movements in FY22 with the remaining movements (92%) occurring in the daytime. The runway usage during FY22 was 61% Runway 23L and 39% Runway 05R. This is within 9% of the historical average runway split of 70%/30% in favour of Runway 23L.

The three permanent noise monitors are located on the outer boundary of the High Aircraft Noise Area (HANA). The measurement results from all noise monitors demonstrate compliance with the 65 dB L_{dn} noise limit at the outer boundary of the HANA. Compared with FY21, the measured noise levels for FY22 have decreased by 0.4 dB at Puhinui School, and increased by 1.2 dB at the Velodrome, and by 0.1 dB at Prices Rd.

All noise monitors had calibration issues through FY22 which were resolved by firmware and hardware upgrades. The Prices Road monitor also had a monitor malfunction for 6 days in December due to corrupted firmware. This outage was resolved by retrieving the monitor and reinstalling the firmware

The calculated noise contours based on actual FY22 aircraft operations also show compliance with the 60 and 65 dB L_{dn} limits at all locations along the Moderate Aircraft Noise Area (MANA) and HANA boundaries respectively.

The projected Annual Aircraft Noise Contours for FY23 (2023 AANC), which represents activity occurring in the coming year, shows an imperceptible decrease (0.6 - 1.8 dB) in noise compared with the 2022 AANC. While the airport is predicting an increase in passengers for FY23, this is predominately through international flights which carry more passengers on larger aircraft. This means while there is a projected increase in passenger count, the overall movement count is predicted to be lower than was projected for FY22.

The Noise Mitigation Programme utilises the AANC to identify properties eligible for sound insulation offers. This year no new properties are eligible for offers as the 2023 AANC is smaller than previous years. Despite this, Auckland Airport has continued to make annual offers to eligible properties located within the Future HANA noise contour.

Noise from engine testing activities has been compliant with the relevant noise limits throughout FY22. The highest recorded L_{dn} at each of the three compliance locations was 37 dB, which is 18 dB below the permissible noise limit.

There were 89 complaints received in FY22 made by 26 complainants. We note that 49 (55%) of the complaints were from one person. The total number of complaints received has increased by 7% when compared to FY21. The total number of people complaining has decreased by 47% when compared to FY21.

The complaints for FY22 were predominantly from the Central Suburbs, with the remainder coming mostly from South Auckland and East Auckland. Most people made less than 5 complaints with only one person making more.

There was a loose correlation between the number of complaints and usage of Runway 05 (departures to the east).

The noise reduction initiatives in FY22 have been summarised in Section 9.0. The primary initiative was the development of a new night track for flights from North America and the Pacific Islands arriving from the east to approach Runway 05 without flying over the main urban isthmus. This was developed, published and available for use by December 2021.

It was also agreed that possible northern and southern alternatives for the existing route flown by Sydney night flights over western and central Auckland would be investigated and a Discussion Paper prepared for the ANCCG's consideration. This occurred at the March and June 2022 meetings. The majority of ANCCG members agreed that the Sydney night flights should continue on the existing route, due to factors such as risk minimisation, carbon reduction, and equitably sharing noise from night flights across Auckland. However, all ANCCG members agreed that the height of this flight path over western and central Auckland should be reviewed and increased if possible. Auckland Airport is undertaking this work with Airways in the first half of FY23.

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1.0 INTRODUCTION

Designation 1100 requires AIAL to report on its statutory aircraft noise monitoring programme. The programme involves continuous 'in-field' monitoring of aircraft noise levels at three sites, noise contour calculations for actual and projected aircraft activity, engine testing noise monitoring and monitoring of public noise complaints.

The Notice of Requirement lodged in August 2017 to alter conditions in the Designation was approved by Auckland Council in late 2019. This was required in preparation for the Northern Runway future development. The updated Conditions have been used for this report along with the updated Aircraft Noise Areas in the Designation.

Designation 1100 is the framework within which the Airport operates. The designation sets out noise performance criteria and noise management obligations for the Airport to comply with. Condition 5(d) of Designation 1100 requires AIAL to undertake the following:

- Monitor noise from aircraft operations near the boundary of the High Aircraft Noise Area (HANA) to demonstrate that the Day/Night level of 65 dB L_{dn} is not exceeded outside the HANA
- Use recognised noise modelling software and noise monitoring data to calculate whether the noise from aircraft operations exceeds 60 dB L_{dn} anywhere outside the Moderate Aircraft Noise Area (MANA)
- Calculate noise levels to ensure compliance with Condition 10 of the Designation relating to the Noise Mitigation Programme

Condition 13(b) of Designation 1100 requires the airport to calculate and report on the noise level from engine testing activities and Condition 9(c) requires the airport to report on the noise complaints it receives.

AIAL is required to prepare an Annual Noise Management Report each year under Condition 9(b) which summarises the measurements and modelling required by Condition 5(d) and identifies past and future initiatives for noise reduction.

This report has been prepared by Marshall Day Acoustics and provides an overview of the noise monitoring programme for the 2022 financial year (Jul 21 – Jun 22) including:

- A review of the noise monitoring system, calibration, and results
- Calculation of noise contours for actual aircraft activity – the Actual Noise Contour (ANC) – to determine compliance
- Calculation of the Annual Aircraft Noise Contours (AANC) for projected aircraft activity to determine offers for the sound insulation programme
- Summary of past and future initiatives to reduce noise in the community

A summary of the air traffic records for the 2022 financial year has also been included in this report along with flight path diagrams, calculation of noise from engine testing activities and a summary of noise complaints received. A glossary of terminology is given in Appendix A.

2.0 AIR TRAFFIC RECORDS

Table 1 shows a summary of aircraft movement numbers at Auckland Airport during FY22 (Jul-21 to Jun-22) with FY21 data (Jul-20 to Jun-21) included for reference.

Table 1: Aircraft movements numbers

	FY21	FY22	Difference	% Change
Total Movements	94,268	82,543	-11,725	-12%
Daytime Movements (7am to 10pm)	86,301	73,937	-12,364	-14%
Night-time Movements (10pm to 7am)	7,967	8,606	639	+8%

To give broader context: FY22 movements represent a 55% decrease from FY19 movements (181,356), which was the last financial year period to not be affected by the COVID-19 pandemic. These movement records are from the Airport's noise monitoring system which uses air-traffic data provided by Airways Corporation NZ.

We note that aircraft movement numbers from the monitoring system are lower than those reported on the Airport's website. There was a discrepancy of 3,520 movements for FY22 which is a -4.1% difference. The cause of this discrepancy is being investigated by Casper, but we consider it would have a negligible impact on noise levels reported from the monitoring system.

Overall, aircraft activity during FY22 decreased by 12% when compared to the previous year. Night-time movements increased by 8% and movements in the daytime decreased by 14%. Night-time movements made up 10% of the total movements in FY22 with the remaining 90% of movements occurring in the daytime.

FY22 is the second complete financial year following the start of the pandemic, with continued border closures and lockdowns. Airport activity began recovering at the end of FY22 with less stringent movement restrictions and more open borders. However, there were fewer movements in FY22 than FY21 as this 'opening up' came late in the financial year.

Figure 1 shows the aircraft movements broken down by broad aircraft type for the previous two financial year periods and FY19 (the last financial year pre-pandemic). For FY22, 52% of total flights were jet aircraft and 47% were turboprops.

Figure 1: Proportion of aircraft movements by aircraft type

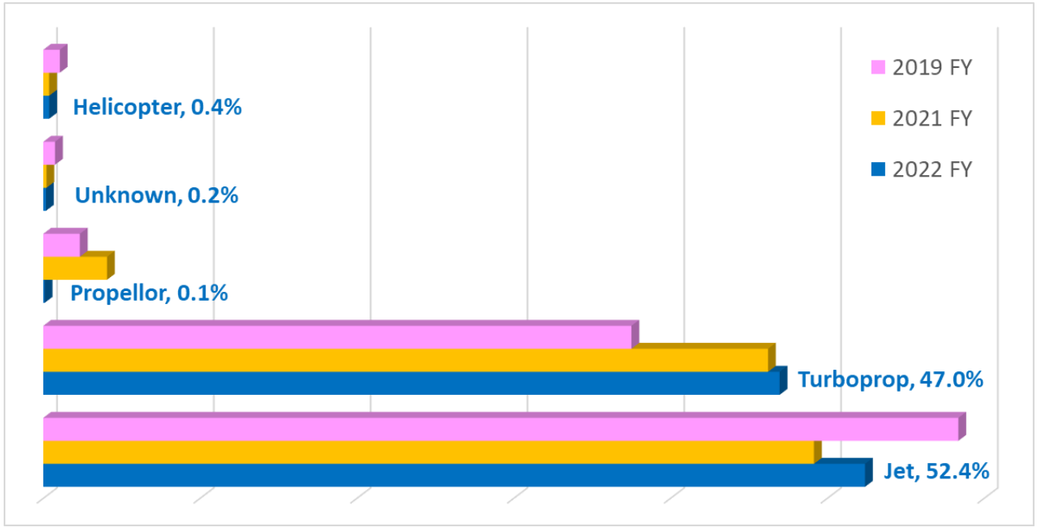


Table 2 below shows the runway usage for FY22. The typical average runway split is 70% Runway 23 (arrivals from the east, departures to the west) and 30% Runway 05 (arrivals from the west, departures to the east). The runway usage for FY22 was slightly different to the typical split with 61% Runway 23 usage and 39% Runway 05 usage. A small number of movements were helicopters and thus were not associated with a runway.

Table 2: Runway usage

	Typical Runway Split	FY22 Runway Split	Deviation
Runway Mode 23	70%	61%	9%
Runway Mode 05	30%	39%	

3.0 FLIGHT PATHS

The flight paths that aircraft utilise are variable and depend on the aircraft type, aircraft weight, destination/origin, the weather at the time, other air traffic in the area, and other factors. One major factor that influences flight paths is the wind direction. In Auckland, the prevailing wind is from the southwest and under these conditions aircraft use Runway Mode 23 where departing aircraft take off towards the west over the Manukau Harbour and arriving aircraft land on the eastern end of the runway, overflying Papatoetoe.

Figure 2 shows the actual flight paths for the busiest day (7am – 10pm) in FY22 when westerly winds were prevailing (17-Dec-21) and Figure 3 shows the actual flight paths for the busiest night (10pm – 7am) in FY22 when westerly winds were prevailing (17-Dec-21). Each flight path is coloured by altitude. Larger versions of these figures are shown in Appendix B along with figures for the busiest easterly wind day/night (16-Jul-21).

Figure 2: Individual flight paths for the busiest RW23L day (7am - 10pm) in FY22

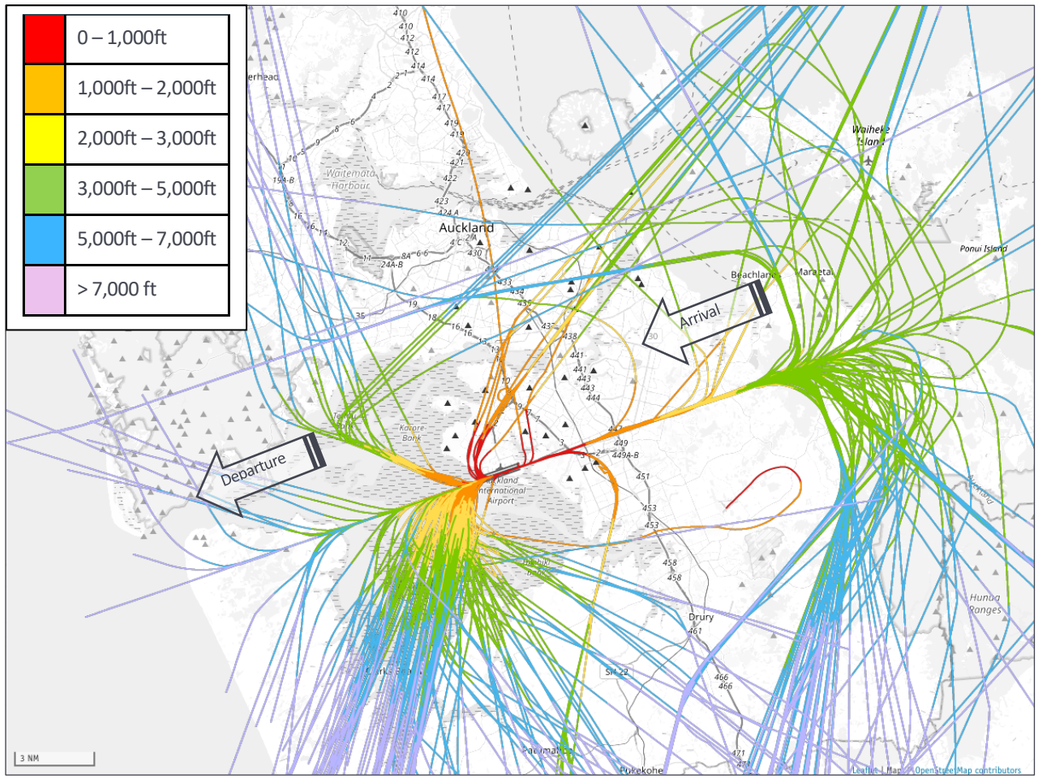
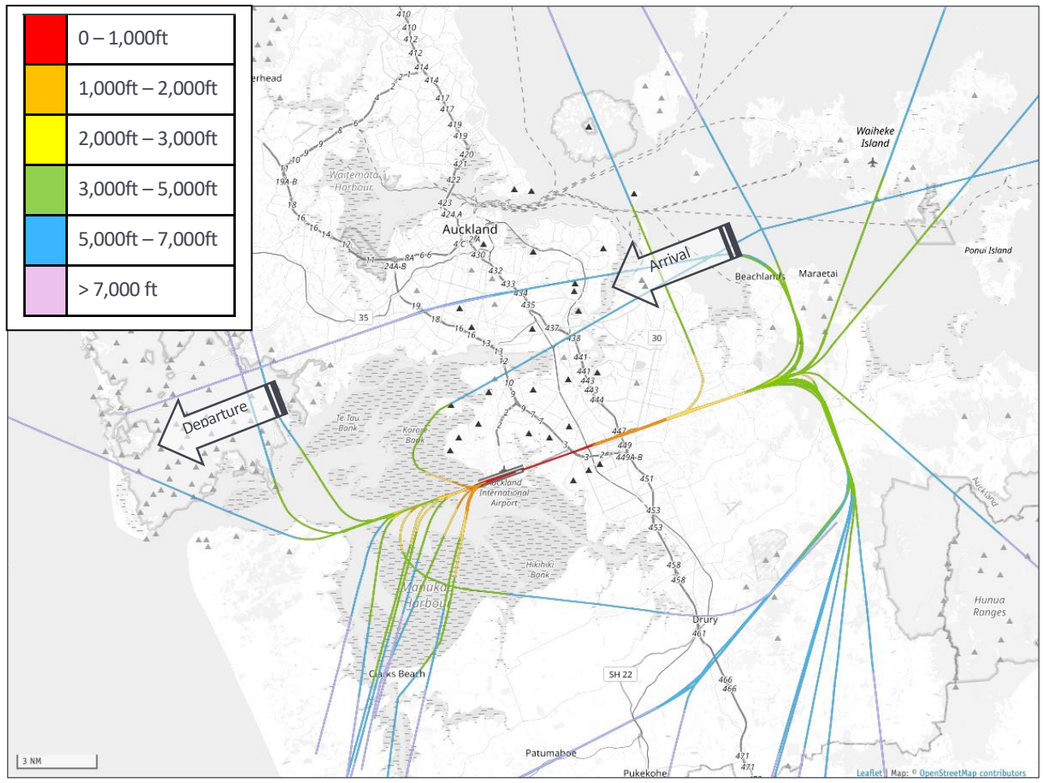


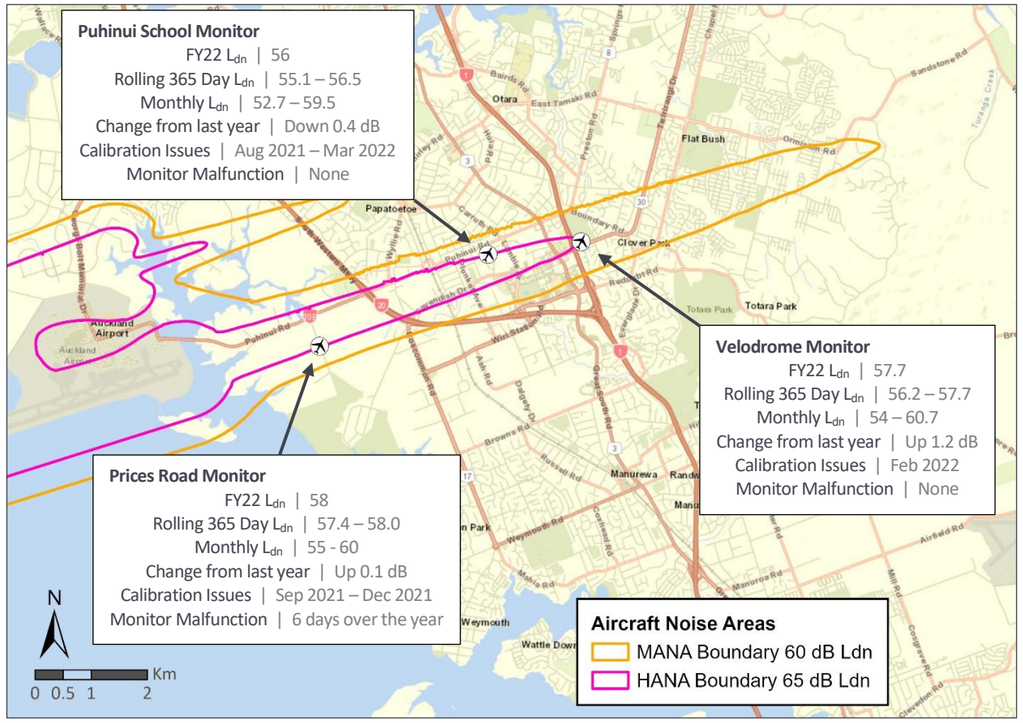
Figure 3: Individual flight paths for the busiest RW23L night (10pm - 7am) in FY22



4.0 MONITORED NOISE LEVELS

AIAL has three permanent noise monitors located on the boundary of the HANA at Puhinui School, the Velodrome, and Prices Road. The location of the monitors is shown in Figure 4 along with a summary of the monitoring results for FY22. The noise limit at the boundary of the HANA is 65 dB L_{dn} (365-day average). Appendix C provides information on how the captured noise data is processed and analysed.

Figure 4: Noise monitor summary



All noise monitors had calibration issues in FY22, and the Prices Rd monitor also had a malfunction, as summarised below:

- The Puhinui Monitor had issues calibrating from August 2021 to March 2022. These issues were resolved in April 2022 when the firmware was upgraded and the microphone replaced
- The Velodrome Monitor had issues calibrating in February 2022 which was resolved with a firmware and hardware upgrade. We note that this monitor also had noise event correlation issues throughout the year which is discussed further in Section 5.0
- The Prices Road Monitor had issues calibrating from September 2021 to December 2021. It was also inoperative between 9 December 2021 and 16 December 2021, due to corrupted firmware. This outage was resolved by retrieving the monitor and reinstalling the firmware

Shipping and supply delays due to COVID-19 increased lead times on the replacement hardware components required to correct monitor issues.

Table 3 shows the FY22 measured noise levels decreased by 0 - 1 dB from FY21. A change in noise level of 1 to 2 dB is generally imperceptible to the human ear, 3 to 4 dB is just perceptible to discernible, and 5 to 8 dB is noticeable to appreciable. Note that the levels from FY22 were 3.9 - 5.2 dB lower than in FY19.

Table 3: Measured noise levels

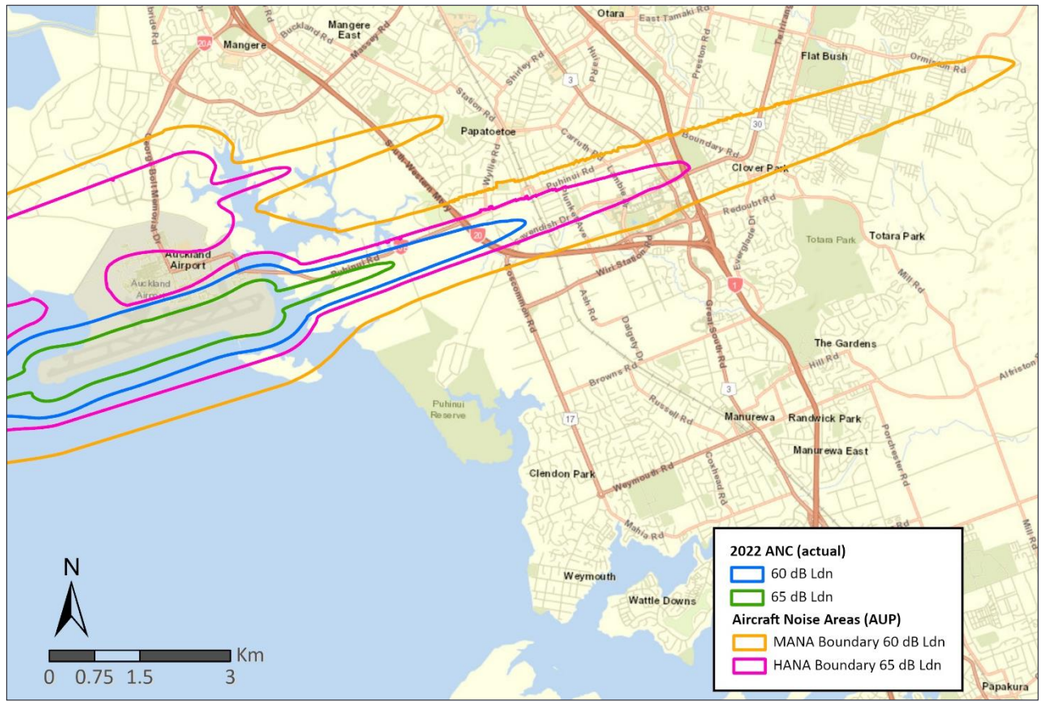
Monitor Location	FY21 (dB L_{dn})	FY22 (dB L_{dn})	Difference (dB)
Puhinui School	56.4	56.0	-0.4
Velodrome	56.5	57.7	1.2
Prices Road	57.9	58.0	0.1

5.0 2022 ACTUAL NOISE CONTOUR (ANC) – ACTUAL ACTIVITY

The ANC noise contours represent the actual aircraft activity occurring in FY22. The purpose of these noise contours is to assess compliance with the MANA and HANA each year. The noise contours have been calculated using the latest version of the FAA Integrated Noise Model (INM version 7.0d) and the aircraft movement data obtained from the noise monitoring system. Appendix C provides information on how the data is processed for calculation.

Figure 5 shows the calculated 60 and 65 dB L_{dn} contours for FY22. The HANA and MANA boundaries are also shown in Figure 5. Noise from aircraft operations must not exceed 65 and 60 dB L_{dn} at the HANA and MANA Boundaries respectively.

Figure 5: 2022 Actual Noise Contour (ANC)



To give broader context, Appendix D shows the 2022 ANC compared with the 2019 ANC (pre-pandemic).

The calculated noise contours show that noise from aircraft operations in FY22 readily complied with the limits at the HANA and MANA boundaries. It is important to verify the noise model against the measured levels to ensure an acceptable tolerance. Table 4 lists the calculated noise level at each monitoring site compared with the actual measured noise level for FY22. In this case the model is within 2 dB of the measured levels at the three monitoring locations. This is considered a reasonable tolerance for a compliance assessment.

Table 4: Calculated and measured noise levels (actual activity FY21)

Monitor Location	Measured Noise Level L_{dn} (dB)	Calculated Noise Level L_{dn} (dB)	Difference (dB)
Puhinui School	56.0	55.9	-0.1
Velodrome	57.7	56.1	-1.6
Prices Road	58.0	58.7	+0.7

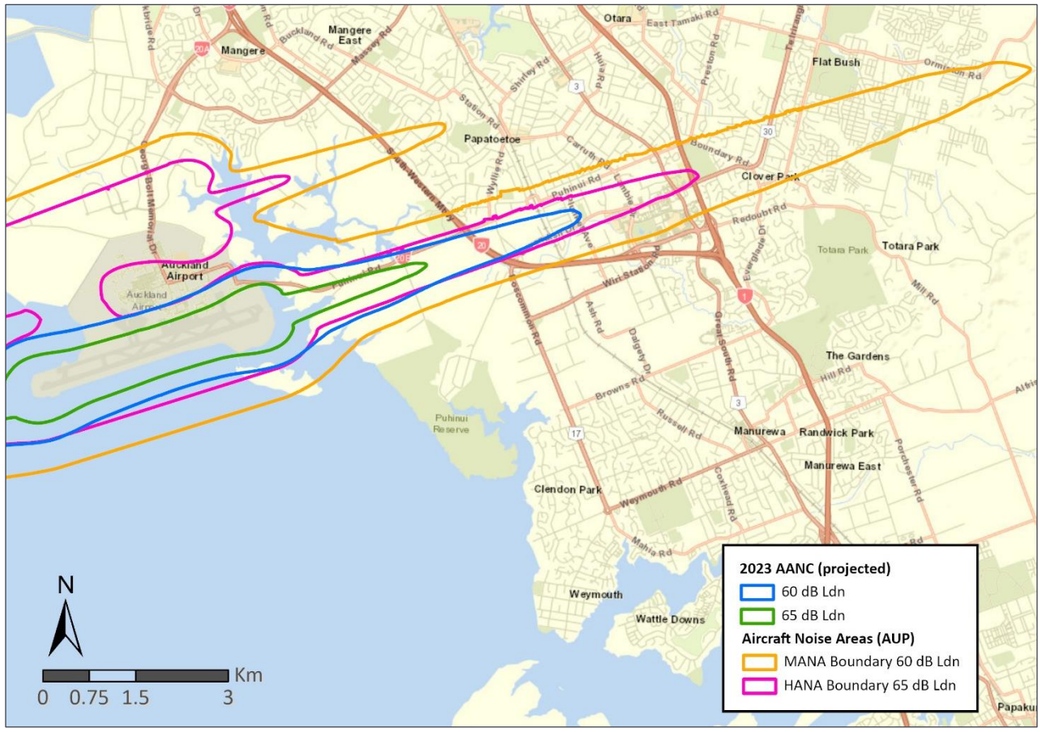
We note that the Velodrome monitor had a reduction in noise event correlation throughout the year. The noise event correlation is the proportion of all aircraft movements that overflew the monitor that were captured by the monitor as noise events. Casper[1] has investigated this issue and believe the correlation decrease was due to the increased proportion of turboprop overflights versus jet overflights at the monitor, which was caused by the drop in international travel because of the pandemic. Turboprop aircraft are quieter than jets, and so are less likely to be captured by the monitor which resulted in an overall decrease in correlation.

The correlation is expected to improve as international travel increases and there are more jet aircraft operations at the Airport. Until then, Casper has provided some recommendations in a report to Auckland Airport than can be implemented to improve the correlation rate.

6.0 2023 ANNUAL AIRCRAFT NOISE CONTOUR (AANC) – PROJECTED ACTIVITY

The Annual Aircraft Noise Contours (2023 AANC) will be published in August 2022 and represent noise from aircraft activity predicted to occur in the coming year. The purpose of these noise contours is to identify which properties are eligible to receive an offer for noise mitigation treatment in accordance with Condition 10 of Designation 1100. Figure 6 shows the 2023 AANC contours compared to the HANA and MANA.

Figure 6: 2023 Annual Aircraft Noise Contour (AANC)



The AANC are also calculated using INM. The projected aircraft activity has been based on actual aircraft movements for the 12 months ending 30 June 2022. A predicted growth factor provided by Auckland Airport has been applied to this data to represent movement numbers for the forthcoming year.

Condition 10 of Designation 1100 sets out that qualifying[2] properties in the MANA become eligible for the mitigation offer if the property falls inside the 60 dB L_{dn} contour of the AANC. Qualifying properties inside the HANA become eligible for the offer if the property falls inside the 65 dB L_{dn} contour of the AANC. There are no qualifying HANA properties inside the 2023 AANC 65 dB L_{dn} contour and no qualifying MANA properties inside the 60 dB L_{dn} contour. Therefore, no mitigation offers are required based on the 2023 AANC. This was also the case in FY21 and FY22. Nonetheless, AIAL voluntarily made offers to all properties within the HANA despite there being no requirement under the Designation. The Airport has advised that it intends to continue to apply the same approach in FY23 and will again make noise mitigation offers to all properties within the HANA. Further details are provided in Section 9.0.

Appendix E shows the 2022 AANC compared to the 2023 AANC. The 2023 AANC are slightly smaller than the 2022 AANC. This is due to an overall reduction in the projected aircraft movements down from approximately 133,000 in FY22 to 120,000 in FY23.

We note that while the Airport is predicting growth in passenger numbers for FY23, this growth will be predominately international travel using larger planes. Further, the Airport was predicting a large increase in domestic flights for FY22 which meant high numbers of smaller aircraft (though ultimately this domestic growth was not realised). Due to these factors, the overall movements projected for FY23 are lower than were projected for FY22.

Table 5 lists the predicted noise levels at the monitoring sites for the 2022 AANC and 2023 AANC. The noise levels in the 2023 AANC are considered to be imperceptibly lower than the 2022 AANC, due to the reduction in movements.

Table 5: 2022 and 2023 AANC calculated noise levels (projected activity)

Monitor Location	2022 AANC (dB L_{dn})	2023 AANC (dB L_{dn})	Difference
Puhinui School	59.3	57.5	-1.8
Velodrome	59.4	57.6	-1.8
Prices Road	61.3	60.7	-0.6

7.0 ENGINE TESTING

Engine testing noise emissions are limited to 55 dB L_{dn} (7 day rolling average) and 75 dB L_{Amax} (10pm – 7am) received in the "Identified Area" shown in Figure 1 of Designation 1100. Noise emissions from engine testing activities are calculated and assessed monthly for compliance at three key locations in the Identified Area (Res1, Res2, Res3). The calculations are based on records of engine testing activity provided by the airport users and established noise levels relating to each type of test.

Figure 7 shows the lowest, highest, and average 7 day rolling L_{dn} noise level at each of the three compliance locations for FY22. The highest L_{dn} calculated for the three compliance locations was 37 dB, which is 18 decibels below the noise limit.

[1] The independent provider of the monitoring system, detailed in Appendix C

[2] Meets the Existing Building definition in Designation 1100

Figure 7: FY22 Engine testing monitoring summary

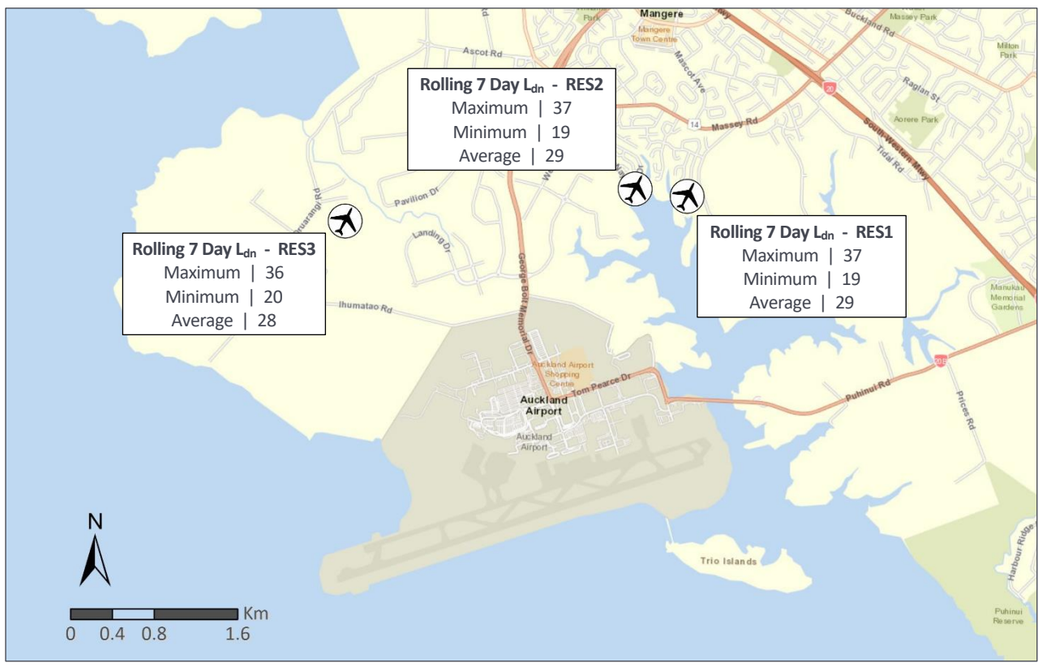


Figure 8: Engine testing noise emissions (Rolling 7 Day L_{dn})

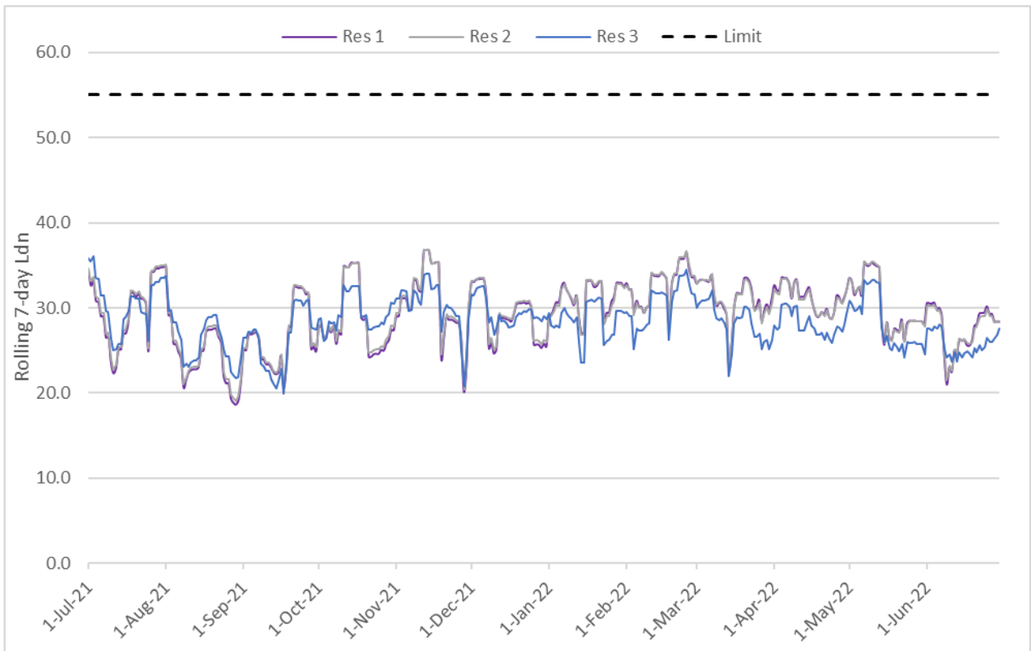


Figure 8 shows a graph of the 7-day rolling L_{dn} noise level at the three compliance locations for each day. Generally, the noise levels were below 30 dB L_{dn}.

The purpose of the L_{Amax} limit is to control the maximum noise level during engine testing at night to protect against sleep disturbance. The L_{Amax} level during a test depends on the aircraft type, power setting and propagation conditions but is not affected by the duration of testing. It has been previously ascertained that aircraft undergoing engine testing at Auckland Airport comply with the 75 dB L_{Amax} limit at the three compliance locations for all power settings.

8.0 NOISE COMPLAINTS

People may make multiple complaints during the year and each complaint could relate to either a specific aircraft overflight or a more general issue such as increased overflights at night. Therefore, the terminology used in this report when summarising the statistics is as follows:

- The number of 'complainants' (no. of people who complain)
- The number of 'generic' noise complaints (e.g. "there was more aircraft noise last night")
- The number of 'specific' event complaints (e.g. "the flight at 6:25pm last night was particularly noisy")
- The number of 'question' noise enquiries (e.g. "can you tell me more about how noise is managed at the airport")

During FY22 the airport received 89 noise complaints from 26 people, 62 (70%) of these were specific complaints, 17 (19%) were generic complaints, and 10 (11%) were question enquiries (of which 7 were regarding the Noise Mitigation Package).

The complaints for FY22 came predominantly from the Central Suburbs, with the remainder coming mostly from South Auckland and East Auckland

Table 6 shows the noise complaints and number of people complaining over the past 5 years.

Table 6: Summary of complaints since 2018

	FY18	FY19[3]	FY20	FY21	FY22
No. Complaints	467	905	261	83	89
No. People Complaining	155	132	65	49	26

[3] An unusual spike in noise complaints arose in 2019 as one person made 318 complaints in one three month period

We note that 49 (55%) of the complaints received in FY22 were from one person. The total number of complaints received in FY22 increased by 6 (7%) when compared to FY21. The total number of people complaining in FY22 decreased by 23 (47%) when compared to FY21.

Figure 9 shows the number of complaints made in each month of FY21 and FY22. The number of complaints received per month ranged between 3 and 13 in FY22. The complaints received each month in FY22 was higher than in FY21 six months, less for five months, and the same for October.

Figure 9: Aircraft noise complaints in FY21 and FY22

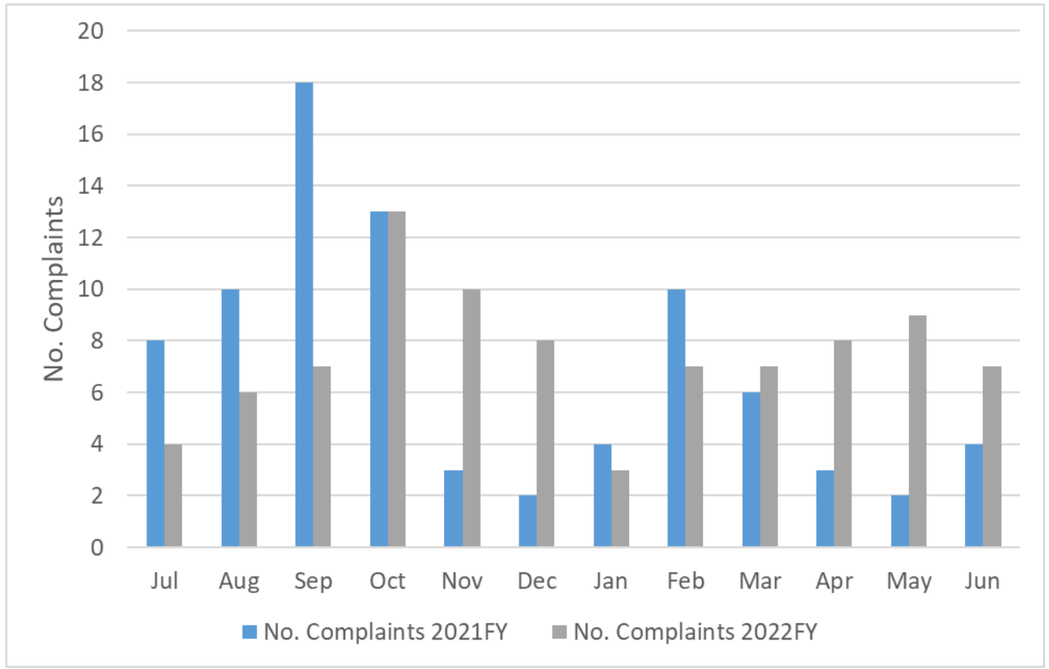


Figure 10 shows the number of people that complained in each month of FY21 and FY22. Each month the number of people making the complaints ranged between 3 and 7 during FY22. Figure 11 shows the specific complaints at night-time (10pm-7am) compared with daytime for each month in FY22.

Figure 10: Number of people complaining about aircraft noise in FY21 and FY22

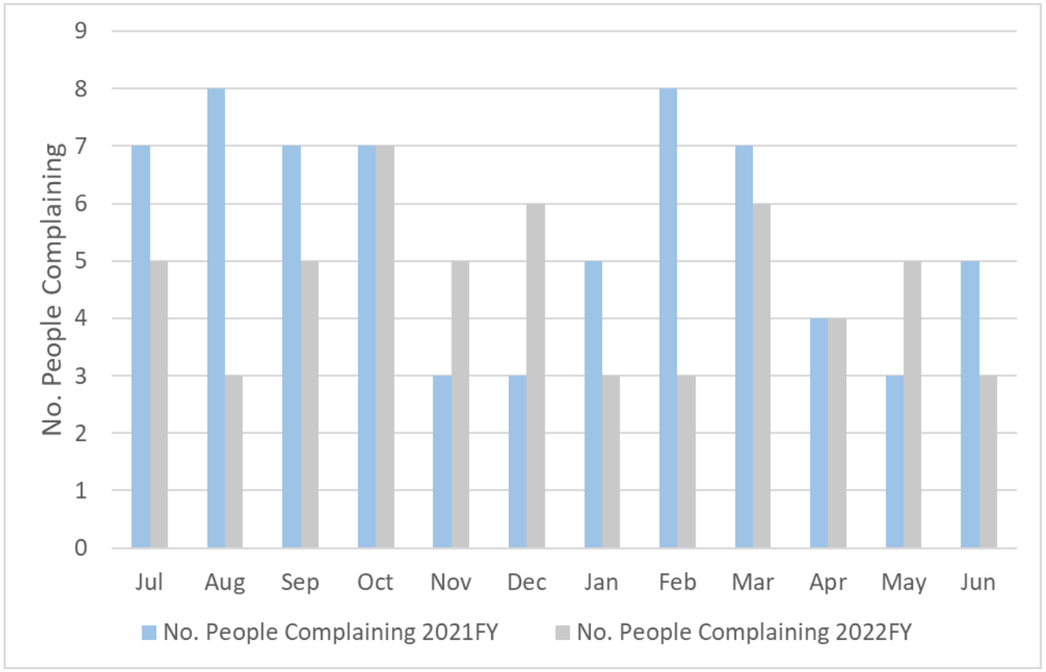
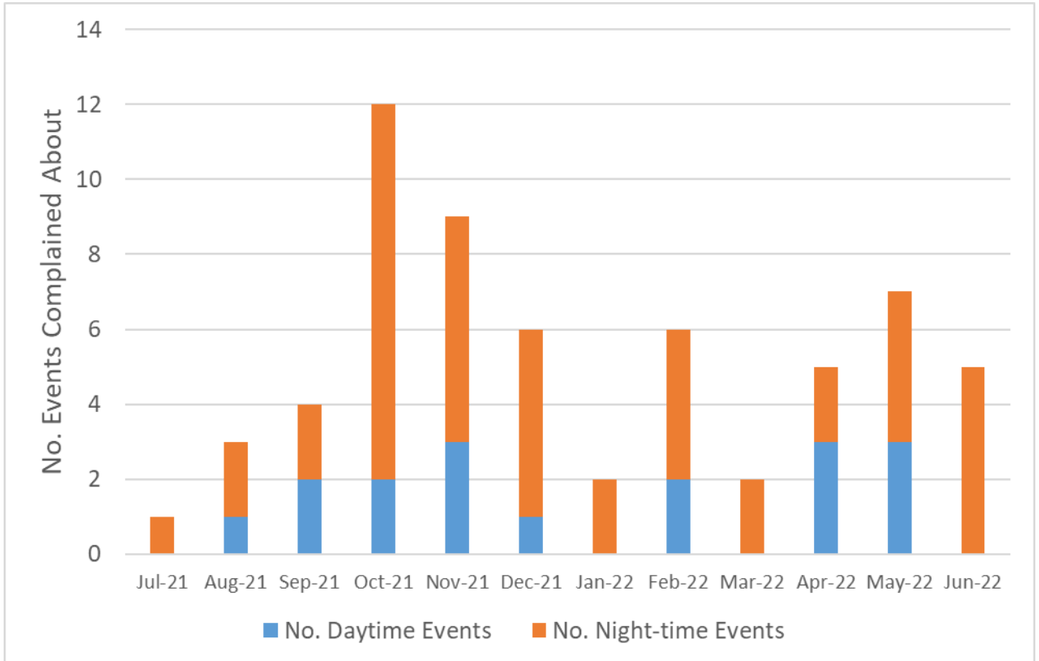


Figure 11: Number of specific complaints (by time of day)



Daytime flights made up 38% of the aircraft overflights complained about in FY22 with the remaining 62% relating to aircraft events at night-time. There is little correlation between complaints and frequency of aircraft movements. This is shown in Figure 12 which graphs the number of specific aircraft noise complaints and the number of aircraft operations per hour. The orange bars show the number of complaints that related to an aircraft operation in each hour of the day in FY22, and the grey line shows the average daily aircraft operations that occurred in each hour of the day.

Figure 12: Specific complaints by hour vs aircraft operations by hour

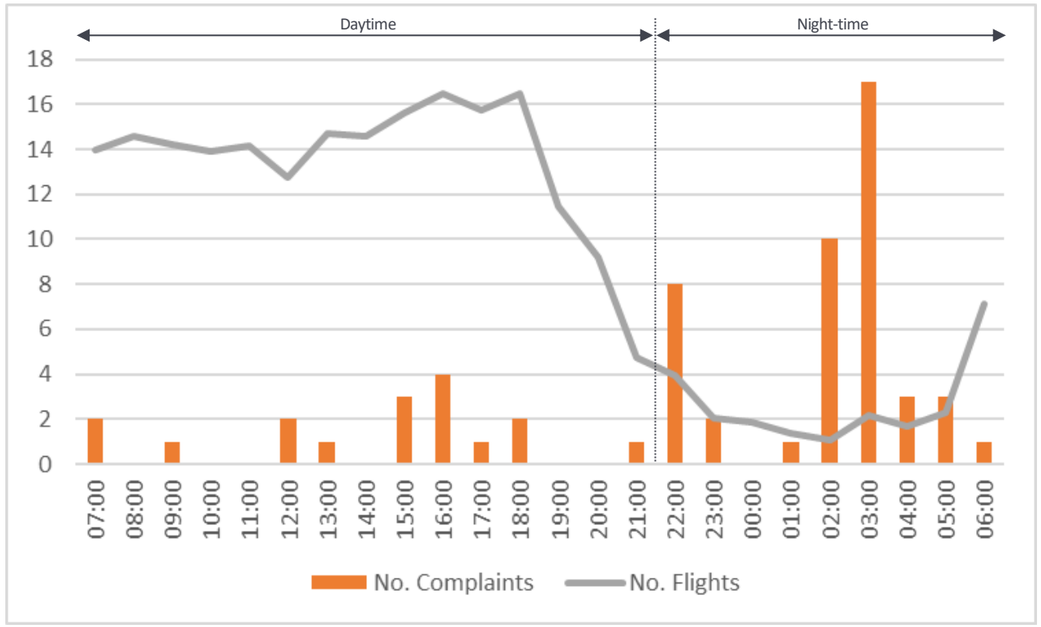


Figure 13 shows the percentage usage of Runway 05 compared to the number of specific complaints. There is a loose correlation between runway use and the number of complaints received.

Historically it has been found that the airport receives a higher number of complaints when Runway 05 is used (departures over East Auckland). The increased disturbance caused when Runway 05 is in use is most likely because flights more frequently overfly the Central and Eastern suburbs under these conditions. Departure flight tracks are more dispersed and therefore overfly a larger area of the central and eastern suburbs than arrivals. This is demonstrated by comparing the flight tracks in Appendix B. Departures also have a different noise character and can be louder than arrivals as the aircraft are climbing under power.

Figure 13: Number of aircraft noise complaints vs. usage of RW05

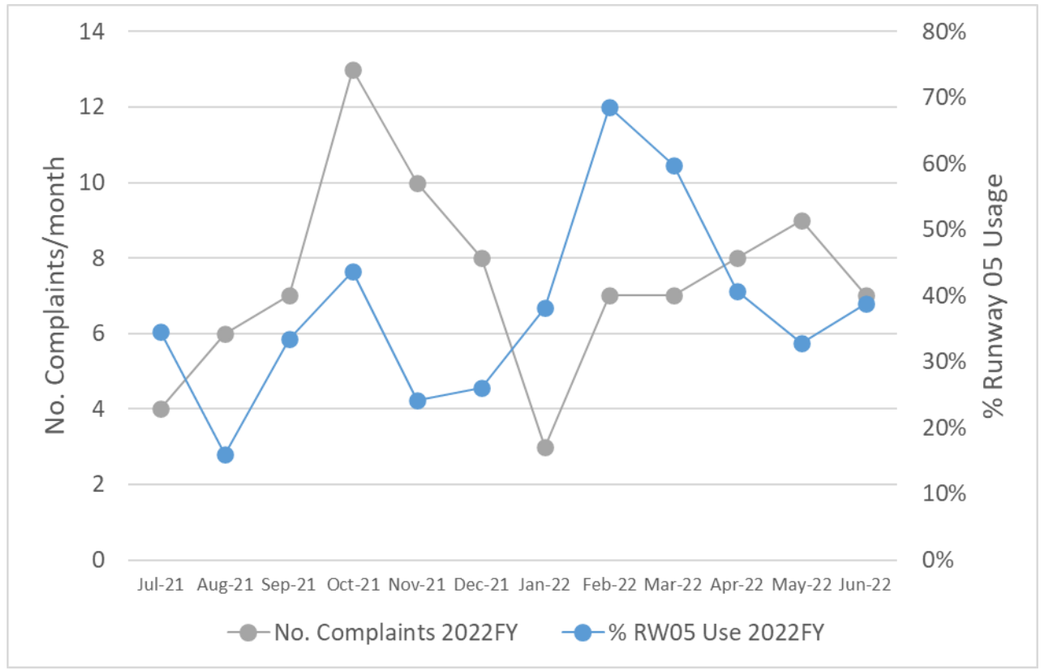


Figure 14 shows the number of complaints received by area. Appendix F gives more detail on the number of complaints received from each suburb. Remuera residents made the largest number of complaints (56%) with the remaining complainants spread over 16 other suburbs. All but one complaint in Remuera was made by one complainant.

Figure 14: Complaints by area

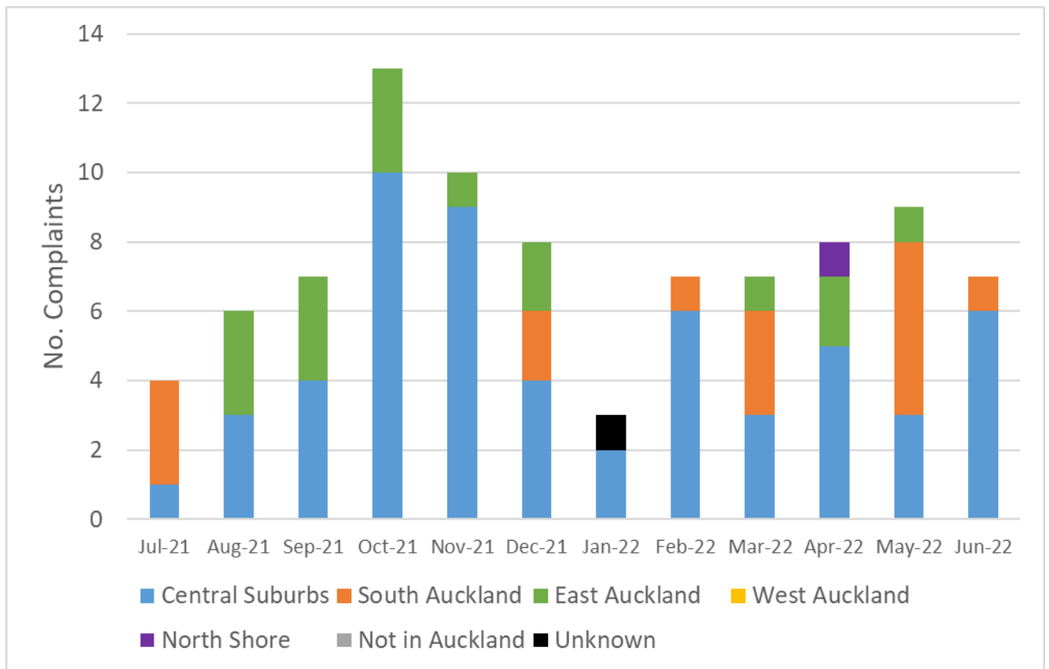
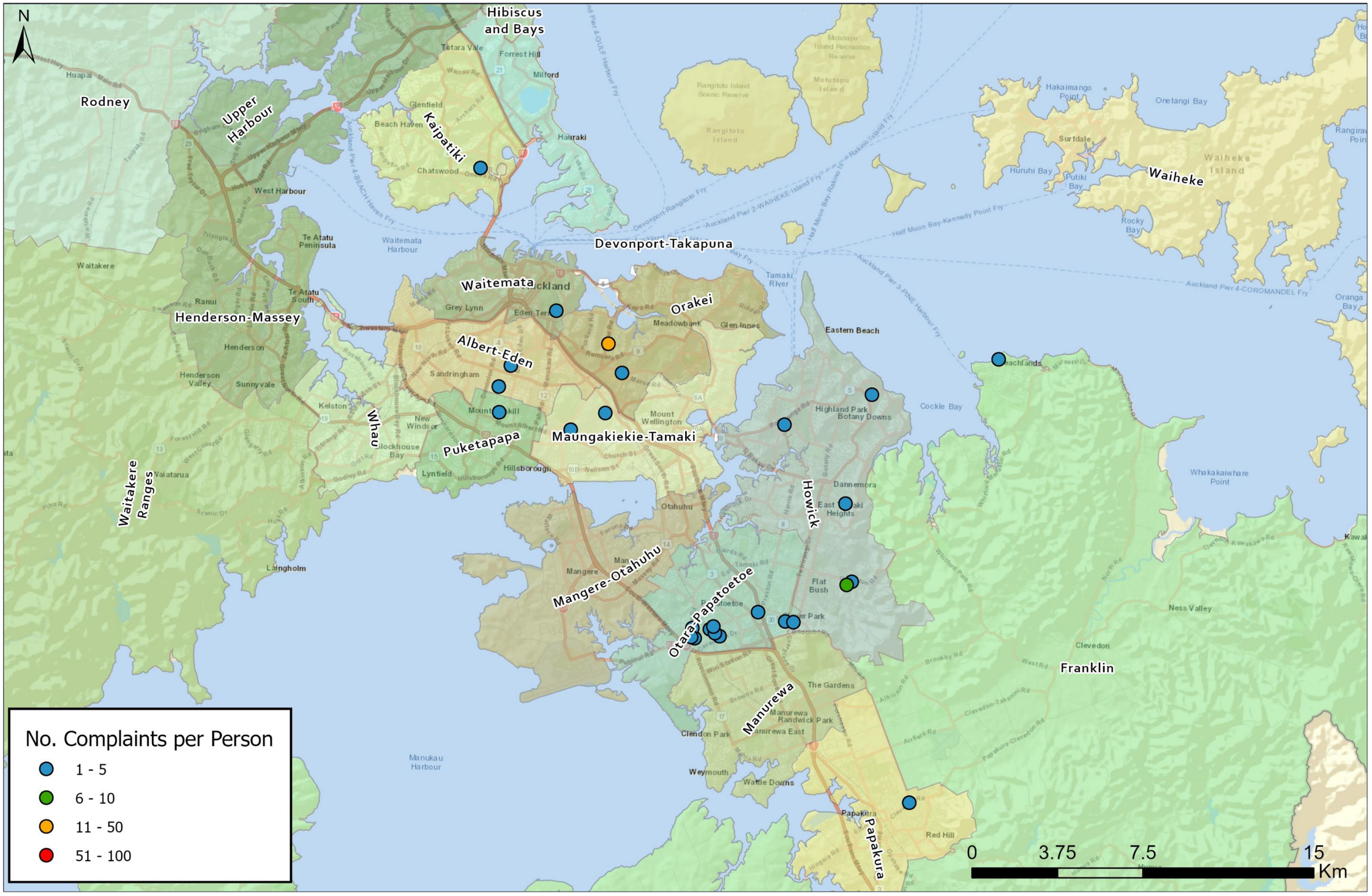


Figure 15 shows the locations of people complaining in FY22 coloured to represent the number of complaints made by that person, the local board outlines are shown behind.

The map shows that the location of complainants is mostly spread over Central Auckland, with some in East and South Auckland, and one in the North Shore. Most people made 5 or less complaints (blue dots), with just one person making more than 6 complaints (orange dot) during FY22.

Figure 15: Number of complaints per person in FY22



9.0 NOISE REDUCTION INITIATIVES

Condition 9(b) requires AIAL to report on any initiatives to reduce aircraft noise in the community for both the financial year being reported on and the forthcoming financial year. AIAL is required to detail the outcomes of initiatives investigated in the financial year being reported on. This section gives details of these initiatives.

COVID-19 Impact

Notwithstanding the significant reduction in aircraft traffic experienced as a result of COVID-19 when traffic volumes were at the lowest since 1972, and the corresponding financial impact which led Auckland Airport to deliver its first and second ever annual losses, the Airport has continued to both meet, and exceed, its noise monitoring and community engagement obligations.

There continued to be an additional five noise monitors deployed (above the three noise monitors required by the Designation), the on-line flight tracking tool available to the public (Casper) continued to be provided, the supplementary free 0800 number to make noise complaints in person continued to be offered. The Aircraft Noise Community Consultative Group still met quarterly as required – through a hybrid of attendance on-line and in person representation.

Current Initiatives

Northern STAR Development

In May 2021 the Mt Wellington monitor was removed, with the intention to decommission it for a period of around 15 months. The monitor was under the Green SMART track, predominantly servicing international arrivals from the west. Given the large reduction in international arrivals, the decision was made to retrieve the monitor and save on the operation costs.

These cost savings were put towards the development of a new Northern STAR serving 05R for flights from North America and the Pacific Islands, which was published and in use December 2021. It is expected this Northern STAR will meaningfully reduce night-time noise exposure and complaints when Runway 05R is in use. The relocation of this noise monitor will be considered by the ANCCG in line with decisions made on the Sydney night-STAR and review of the height of the existing track.

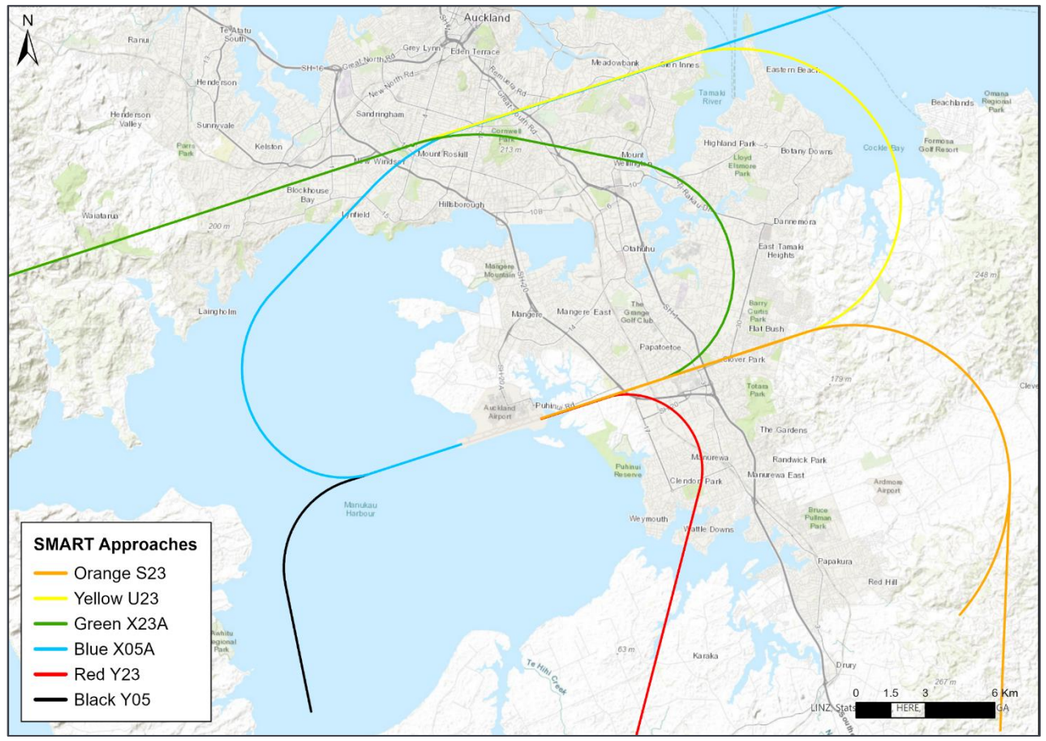
Orange SMART Track

A new SMART track called 'Orange' was implemented in September 2019 on a trial basis, shown in Figure 16. This track was implemented to provide an additional option to the 'Red' SMART track which has been in operation since 2012 and overflies the populated areas of Wattle Downs and Manurewa. The trial concluded after a full 12-month period ending in September 2021.

A report of the trial was produced including information about noise measurements and complaints throughout the trial. There were no noise complaints received from residents under the Orange Track flight path. Analysis of the noise impact of the flight paths indicated that the noise impact in the Clevedon area from the use of the Orange track at the levels during the trial is minimal or relatively modest and significantly lower than the ambient noise level in the area. The 36 dB dB L_{dn} recorded from use of the Orange Track during the trial, and the forecast up to 39 dB L_{dn} if usage increased are both well within the 55 dB dB L_{dn} identified as suitable for residential use by New Zealand Standard NZS 6805: 1992 Airport Noise Management and Land Use Planning.

This report was provided to the ANCCG and considered at its December 2021 meeting with ANCCG members supporting the confirmation of this new SMART Track by the Airport. This has occurred with the Orange Track now being permanently available for use by domestic traffic arriving from the South between 7am and 10pm, which provides an alternative to the Red Track over the Wattle Downs area.

Figure 16: SMART approaches



Noise Mitigation Programme

Condition 10 of Auckland Airport Designation 1100 sets out the requirements for how Auckland Airport should mitigate the effects of aircraft noise within specified noise contours through the implementation of a Noise Mitigation Programme.

An opportunity was explored in 2021/2022 to readjust the timeframes of the Noise Mitigation Programme - specifically when the annual offer would be made to better align with the financial year (being July to June) – and Auckland Airport proposed to undertake an offer round in September 2021. However, as Auckland entered into Level 4 lockdown (and then Red Alert Level) between August and December 2021, Auckland Airport did not make the offers at this time and instead decided that the 2021/2022 offer in March 2021 would remain valid until the 2022/2023 offer was made. This did not disadvantage any home owner due to the offers having actually exceeded the ANC and AANC. Despite the lockdowns and alert level restrictions, Auckland Airport completed 20 installations (8 HANA and 12 MANA) in the first half of 2022 under the 2021/2022 offer.

As COVID-19 continues to have an unprecedented impact on the aviation industry with far fewer aircraft movements compared to previous years, the FY23 AANC is again significantly reduced in size. Similar to the previous FY22 AANC, there are no eligible properties within the FY23 AANC as none have been forecast to be exposed to sufficiently high enough noise levels to trigger the requirement of an offer from Auckland Airport. Nevertheless, Auckland Airport has decided – despite not being obliged to under its Designation – to again make the 2022/2023 offers to all properties that qualify[4] for the programme located within the Future HANA as part of its ongoing commitment to being a good neighbour. The 2022/2023 noise mitigation offer will be made in August 2022 to 147 properties.

[4] Meet the Existing Building definition in Designation 1100

The initiatives and improvements made to the Noise Mitigation Programme in previous years will continue to be implemented as part of the 2022/2023 offer and will include:

- Continued efforts to reach homeowners and tenants when making annual offers by sending offers to both the homeowners address as well as the physical address of the property. This will likely improve tenant awareness of the programme.
- Letters sent to eligible properties will be Airport branded and include text advising that the letter relates to the Noise Mitigation Programme and that they are eligible. This will likely better entice the recipient to open the letter.
- The placement of community notices in areas within the AANC as well as the development of social media content which can be shared by all interested community groups on various social media platforms.
- Holding more public and accessible "Community Information Sessions". In previous years, Community Information Sessions were by invite only i.e. to those that had received an offer letter from Auckland Airport. However, as part of increasing awareness of the programme, Auckland Airport propose to provide these sessions in a public space such as a library located within the eligible area. Auckland Airport also propose to allow interested homeowners to book a time to call the Noise Mitigation Programme manager (either via phone or video call) which will accommodate those who are unable to physically attend the Community Information Sessions.
- An improved "close-out" process following the installation of a noise mitigation package, which will include post-installation audits, homeowner sign-off that the works are satisfactory and the issue of an Auckland Airport branded folder containing key contacts, warranty and maintenance information and operation manuals.

Sydney Night Flights

At the March and June 2022 ANCCG meetings, Auckland Airport presented two Discussion Papers on the Sydney Night Flight Arrivals Track on Runway 23. These documents were prepared in response to requests from the Ōrākei Local Board Representative on the ANCCG for a Sydney Night STAR to be developed which removes these flights from over-flying central Auckland. These papers outlined and explored two untested and untrialled, concept flight paths that could be used to move some or all of Sydney night flights onto either:

- the Melbourne/South Australia Night STAR (adding an extra 8 track miles per arriving flight and increasing flights over an area earmarked for intensive future urban development); or
- the Brisbane/North Australia Night STAR crossing Auckland at Stillwater/Silverdale (adding an extra 15 track miles per arriving flight, and increasing the risk of flight paths crossing as they move between arrival or departure 'air-space gates').

Assessment was undertaken within these Discission Papers of

- the flight volumes on each path and impact of moving flights
- historical levels of noise complaints
- the safety risks identified by Airways regarding potential crossing of flight paths
- an assessment of the volumes of people or households affected by the concept flight paths
- the methodology and calculation of the incremental carbon impact of the concept routes

After a full review of these papers, and canvassing of members' views, the consensus of most members was that the Sydney night flights should continue to be routed over western and central Auckland, and should not be moved to either a Northern or Southern route. One Local Board and one community representative disagreed, holding the view that these flights should be moved to a Northern route as it was inappropriate for night-time flights to be operating across the densest residential areas of Auckland. Airways identified the possibility of investigating raising the minimum height of aircraft through the LOSGA way-point at Mt Eden, which could create a small reduction in aircraft noise. All members supported this work being undertaken and it will feature in the FY23 workplan.

Future Initiatives

The discussion paper and analysis on options in relation to reducing or mitigating night-time flights from Sydney, identified the possibility of increasing the height at LOSGA (a way point in the vicinity of Mt Eden) flown over by aircraft crossing the west and central city for night time flights, which may act to reduce the aircraft noise experienced by residents. This is being explored by the airport and Aeropath, in conjunction with airline testing of the altered flight profile. Any change would likely be in time for the February 2023 AIP publication date.

Airways has identified a possible pathway for flights at night departing to South Australia on Runway 05 which could be developed which would avoid flying over South Auckland. Investigations will occur with reflection in the AIP in 2023 if this pathway proves achievable.

At the annual review of noise monitor locations in June 2022, Auckland Airport proposed relocating two noise monitors which had been used to measure noise associated with the Yellow and Orange SMART Track trials (both of which had concluded). It was proposed to relocate the noise monitor at Trig Road in Whitford (used for the Yellow Trial) to the outer edge of the MANA to measure noise levels at the boundary of the MANA under the centre-line approach path. This would continue to capture noise from aircraft using the Yellow SMART Track, but would have the added benefit of measuring noise from all flights on the centre approach path at the outer edge of the MANA. It was also proposed to relocate the noise monitor located at Clevedon (used for the Orange Trial) to Beachlands, to measure the noise experienced at Beachlands from aircraft turning to join the centre approach. There has not previously been a noise monitor in either of these locations, therefore these proposals were supported by Marshall Day Acoustics from a noise monitoring perspective, and also by the Local Board representatives for these areas as well as the full ANCCG. These monitor relocations are expected to be in place during September 2022.

ANCCG members have requested that promotional awareness raising material be developed for pilots which raises their understanding of the noise abatement procedures operating at Auckland Airport, as well as awareness around decisions that could be made to reduce aircraft noise such as ensuring the plane is flown at a speed making air braking less likely.

Auckland Airport has identified that there is an opportunity to restructure the flight management and aircraft noise information on its website, so that the transactional needs of residents visiting the website are more easily able to be accessed – for instance, how to apply for a noise mitigation package, how to make a noise complaint, and how to apply for a grant from the Airport Community Trust.

The local board election cycle is a three yearly one, with elections being held October 2022. This will mean a change in a number of the local board representatives on the ANCCG from December 2022. At the recommendation of local board representatives who themselves were new in 2019, the Airport will arrange for a training and induction day for all new ANCCG members in February 2023. This will enable those new members to gain an understanding of aircraft noise issues faster than otherwise might be the case, and thus increase the quality of their contribution and oversight of community aircraft noise issues from early in their role as an ANCCG member. Community representative appointments are also on a three yearly cycle, so if changes occur, they can also benefit from the training and induction day.

Combined with the work already underway, this means that the focus of noise initiatives in FY23 will primarily be:

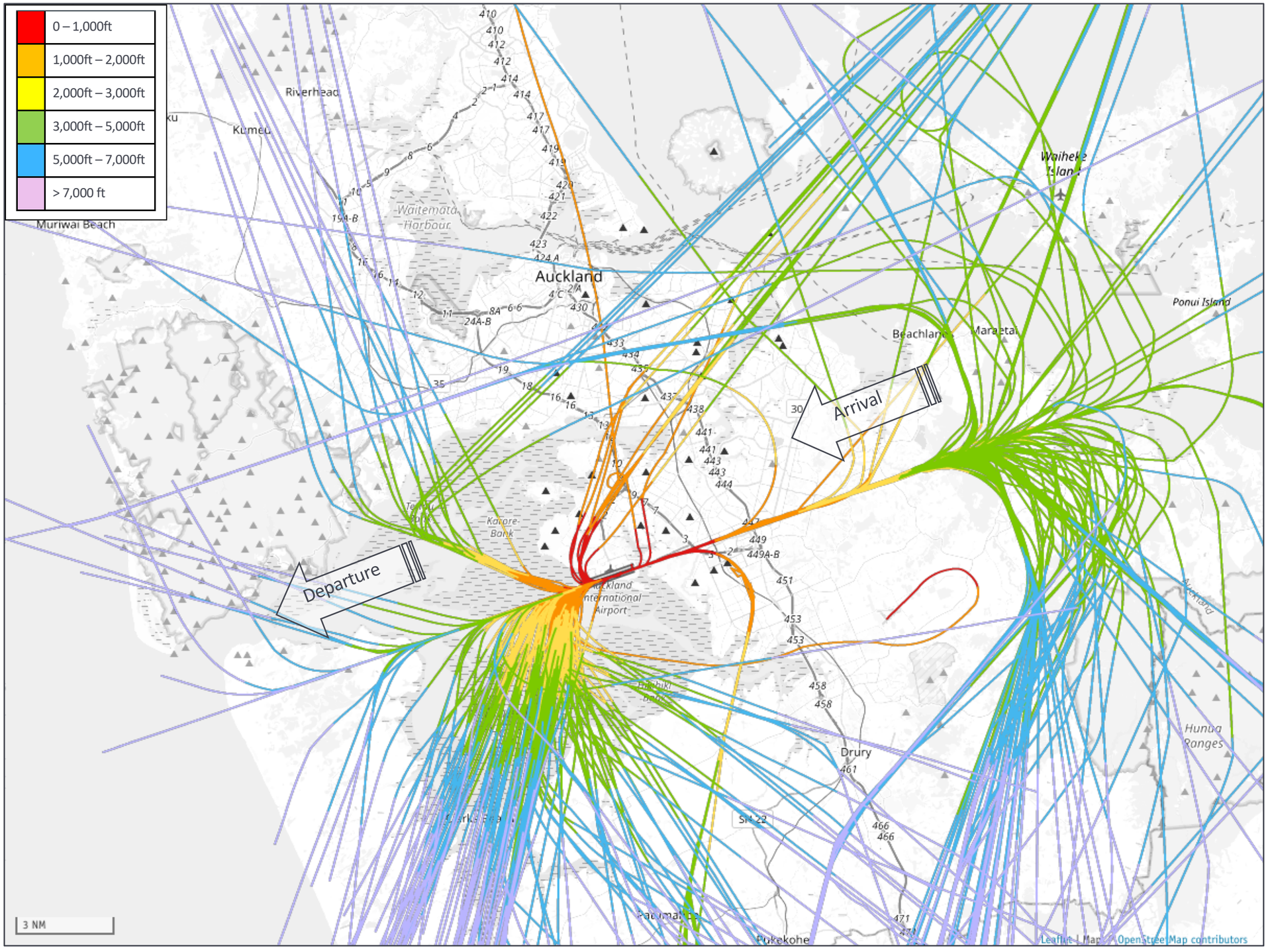
- Reviewing whether aircraft height at LOSGA can be increased for night-time flights from Sydney, and if so developing and implementing this new Night STAR
- Undertake work into whether a night path for flights departing to South Australia on Runway 05 can be developed
- Work towards developing an aircraft noise awareness brochure for pilots
- Increasing visibility and accessibility to key aircraft noise related transactional queries on the Auckland Airport website
- Undertaking an induction and training day for new ANCCG members
- Undertaking noise monitoring in two new areas not previously monitored for aircraft noise, namely the outer boundary of the MANA under the centre approach path and Beachlands where aircraft flying over the western and central city turn to join the centre approach path.

APPENDIX A GLOSSARY OF TERMINOLOGY

dBA	A measurement of sound level which has its frequency characteristics modified by a filter (A-weighted) so as to more closely approximate the frequency bias of the human ear.
L_{eq}	The time averaged sound level (on a logarithmic/energy basis) over the measurement period (normally A-weighted).
L_{dn}	The day-night sound level which is calculated from the 24-hour L_{eq} with a 10 dBA penalty applied to the night-time (2200-0700 hours) L_{eq} (normally A-weighted).
L_{max}	The maximum sound level recorded during the measurement period (normally A-weighted).
Noise	A sound that is unwanted by, or distracting to, the receiver.
Ambient Noise	Ambient Noise is the all-encompassing noise associated with any given environment and is usually a composite of sounds from many sources near and far.
NZS 6805:1992	New Zealand Standard NZS 6805:1992 "Airport Noise Management and Land Use Planning"
ANC	The Actual Noise Contour represents the actual activity that occurred in the relevant financial year. Detailed further in Section 5.0
AANC	The Annual Aircraft Noise Contour represents the activity projected to occur in the relevant financial year. Detailed further in Section 6.0

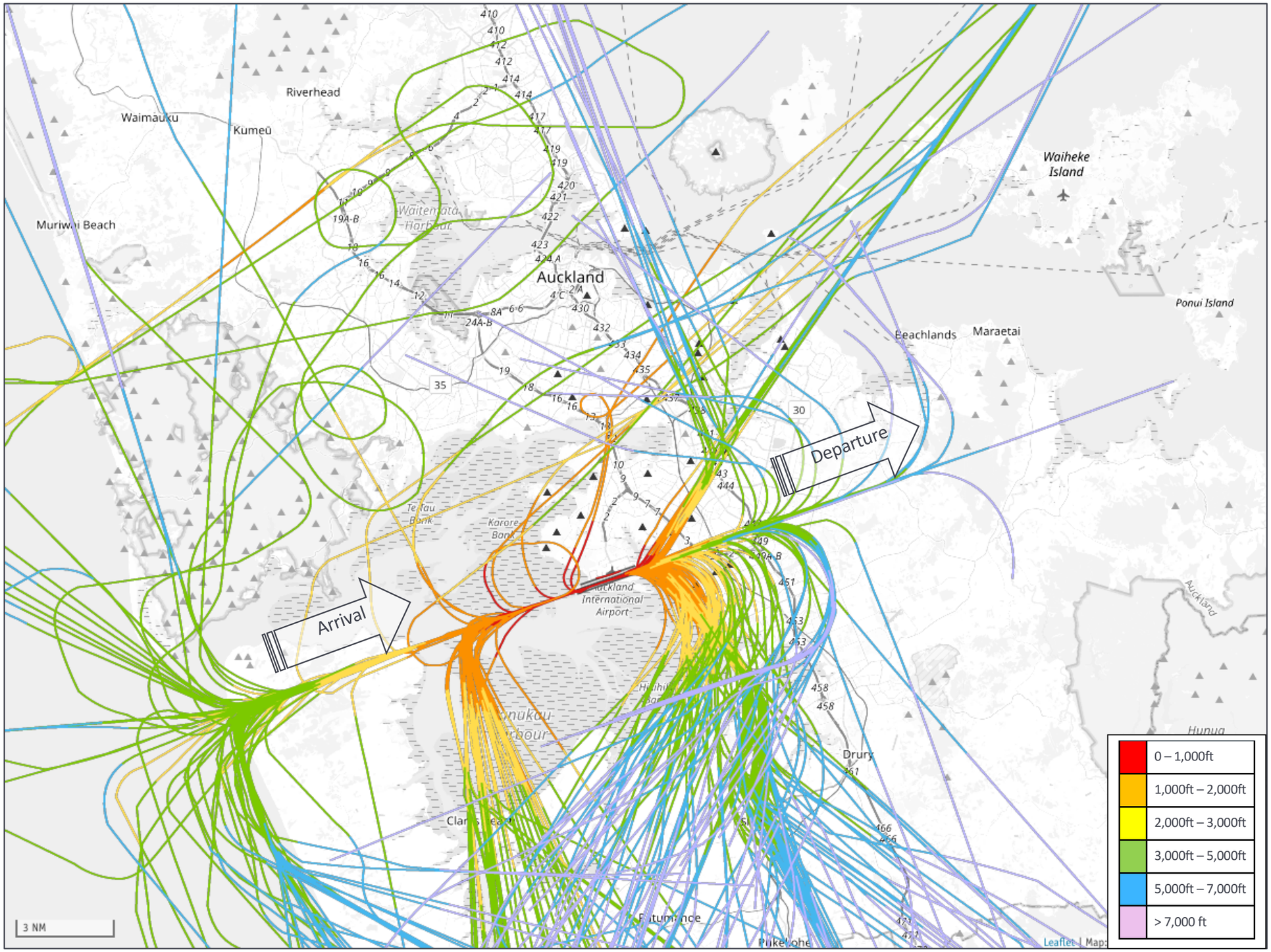
APPENDIX B FLIGHT TRACK DIAGRAMS

B1 Individual Flight Paths for the Busiest RW23L Day (7am - 10pm) in FY22



B2 Individual Flight Paths for the Busiest RW23L Night (10pm - 7am) in FY22

B3 Individual Flight Paths for the Busiest RW05R Day (7am - 10pm) in FY22



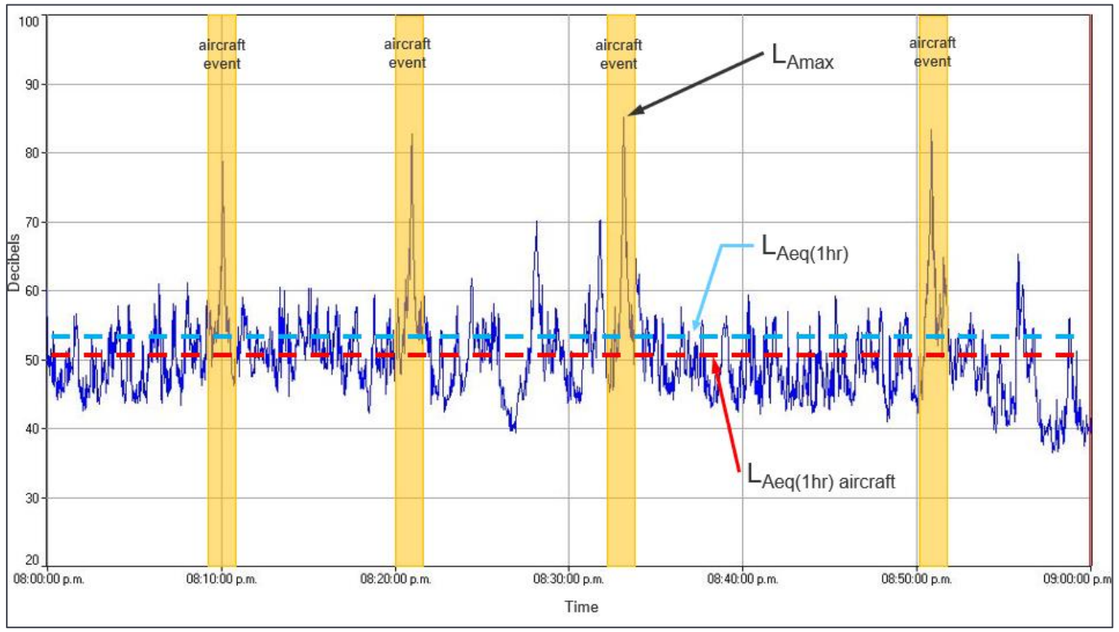
B4 Individual Flight Paths for the Busiest RW05R Night (10pm - 7am) in FY22

APPENDIX C SCIENCE OF NOISE MONITORING AND NOISE CONTOUR CALCULATIONS

How We Monitor Aircraft Noise

Most outdoor noise sources such as roads, quarries, and airports fluctuate throughout the day. Figure C1 shows a sample of an hour long environmental noise measurement with the noise level on the y axis and time on the x axis. The blue trace in Figure C1 shows the L_{Aeq} measured every second.

Figure C1: Hypothetical example of hourly average noise level ($L_{Aeq(1hr)}$) from aircraft flyovers



The noise level fluctuates throughout the hour between 40 and 85 decibels and therefore a statistical measure is needed to quantify the noise source. A range of metrics are used to quantify environmental noise. Each of these metrics tells us something about the noise source in question.

L_{Aeq} is the time averaged sound level over the measurement period and is the most common descriptor for environmental noise. Most general environmental noise limits use the L_{Aeq} descriptor.

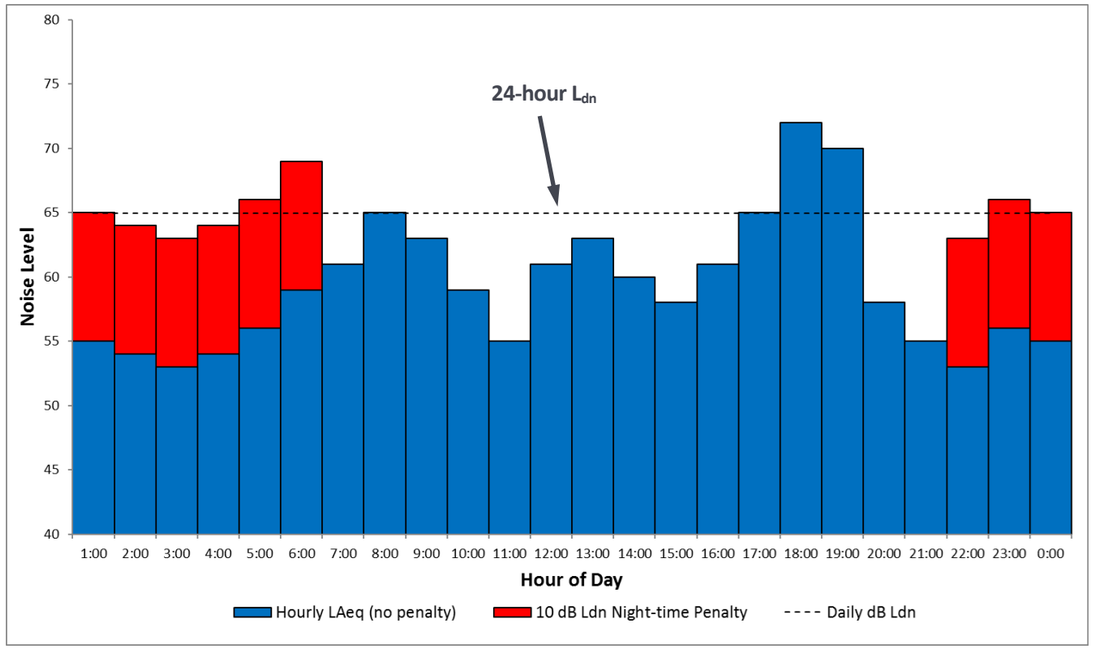
L_{Amax} is the maximum sound level during the measurement period. Most general environmental noise limits include an L_{Amax} noise limit at night. However, transportation noise sources generally are not controlled by L_{Amax} limits.

Aircraft noise is a series of discrete events with periods in between where there is no aircraft noise. The data in the graph includes four aircraft flyovers indicated in yellow. The dashed light blue line is the average sound level (L_{Aeq}) from all sources over the hour. The dashed red line is the average sound level (L_{Aeq}) from aircraft events only over the hour.

Auckland Airport's noise limits are based on a metric called L_{dn} (the day/night weighted average noise exposure). This is the average (L_{Aeq}) noise level from aircraft events over a 24-hour period with a 10 dB weighting during the night (10pm – 7am). Figure C2 shows how the night weighting is applied to calculate L_{dn}.

Like almost all New Zealand's international and regional airports, Auckland Airport's noise management framework is based on New Zealand Standard *NZS 6805:1992 Airport Noise Management and Land Use Planning*. NZS 6805 recommends noise boundaries based on the L_{dn} metric. International research has found that the L_{dn} metric correlates well with community annoyance to aircraft and other transportation noise. L_{dn} is the metric used for airports in the USA.

Figure C2: Hypothetical example of L_{dn} calculation

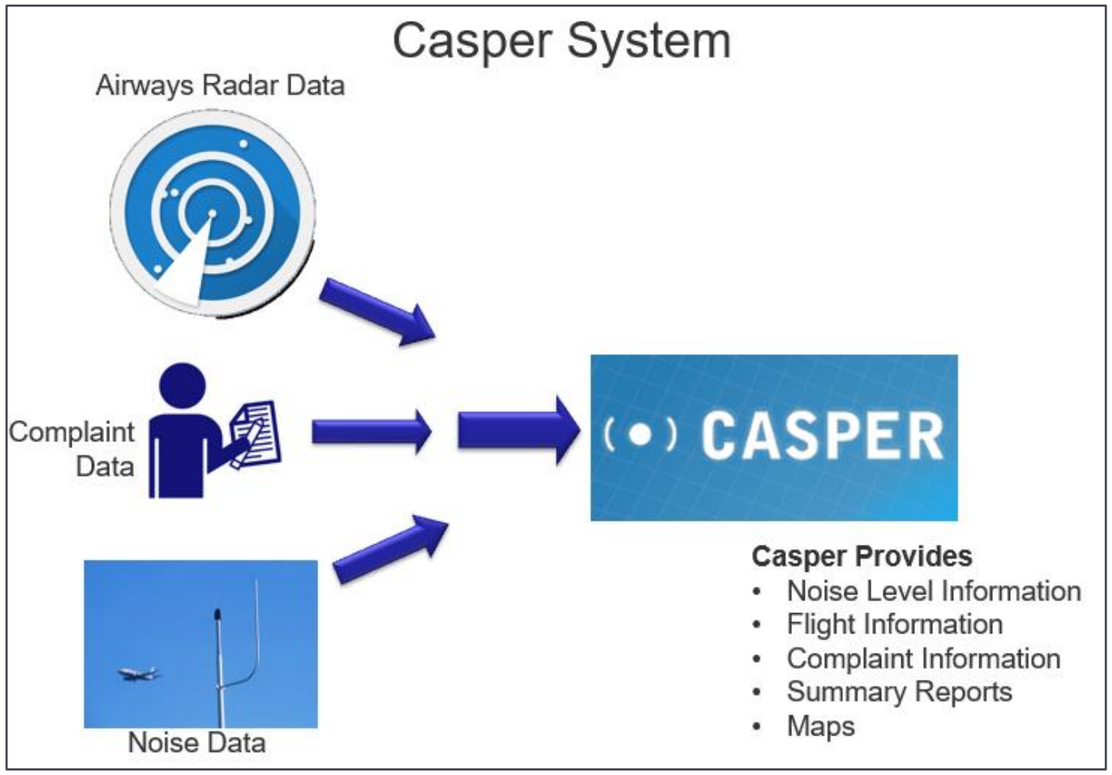


At Auckland Airport, noise levels from aircraft operations are monitored continuously in the community at three locations. These are the three permanent monitoring locations on the HANA boundary required under Designation 1100. The monitoring software identifies possible aircraft events based on defined noise level and duration criteria designed to exclude lower level ambient noise sources. The noise events are then correlated to aircraft flyovers using radar data from Airways to identify whether an aircraft was present at the time a noise event was registered. The correlated aircraft noise events are then used to calculate the L_{dn} noise level for each noise monitor.

Auckland Airport's noise monitoring system is supplied and operated by an independent provider Casper. Casper also provides the three permanent noise monitors and two of the five additional temporary noise monitors analysed in this report. We provide the remaining three temporary monitors. Temporary noise monitors have been used by Auckland Airport at various locations over time as a part of SMART track trials and in response to ANCCG recommendations.

All eight noise monitors connect to the Casper noise monitoring system which combines and correlates data from the noise monitoring terminals, Airways aircraft flight data, and noise complaints from the public. Marshall Day Acoustics has access to Casper's web platform which provides much of the information used to prepare the annual and quarterly noise reports. Figure C3 graphically lays out the Casper inputs and details some outputs.

Figure C3: Casper system details



How We Model Aircraft Noise

Several computer based models have been developed internationally to predict the level of aircraft noise on areas surrounding an airport. The model used for Auckland Airport is the Integrated Noise Model (INM). The INM applies calculation algorithms specifically for aircraft noise prediction set out in ECAC Doc 29[5] and SAE AIR 1845[6] and includes a database of noise levels and operating procedures for most commercial, general aviation, military, and rotary aircraft.

The INM program calculates L_{dn} noise contours for an average day. For Auckland Airport the average day is determined by averaging 12 months of aircraft movements. This data is extracted from the Casper monitoring software which has details of every aircraft movement including:

- Aircraft type
- Time of Day (daytime 0700-2200 or night-time 2200-0700)
- Departure, arrival
- Runway
- Flight track
- Destination (affects aircraft weight)

Marshall Day Acoustics has built a base model in INM of Auckland Airport runways and typical flight tracks. To calculate the average day of aircraft operations for the noise model, all the aircraft movements over 12 months that share the same parameters above are summed and then divided by 365.

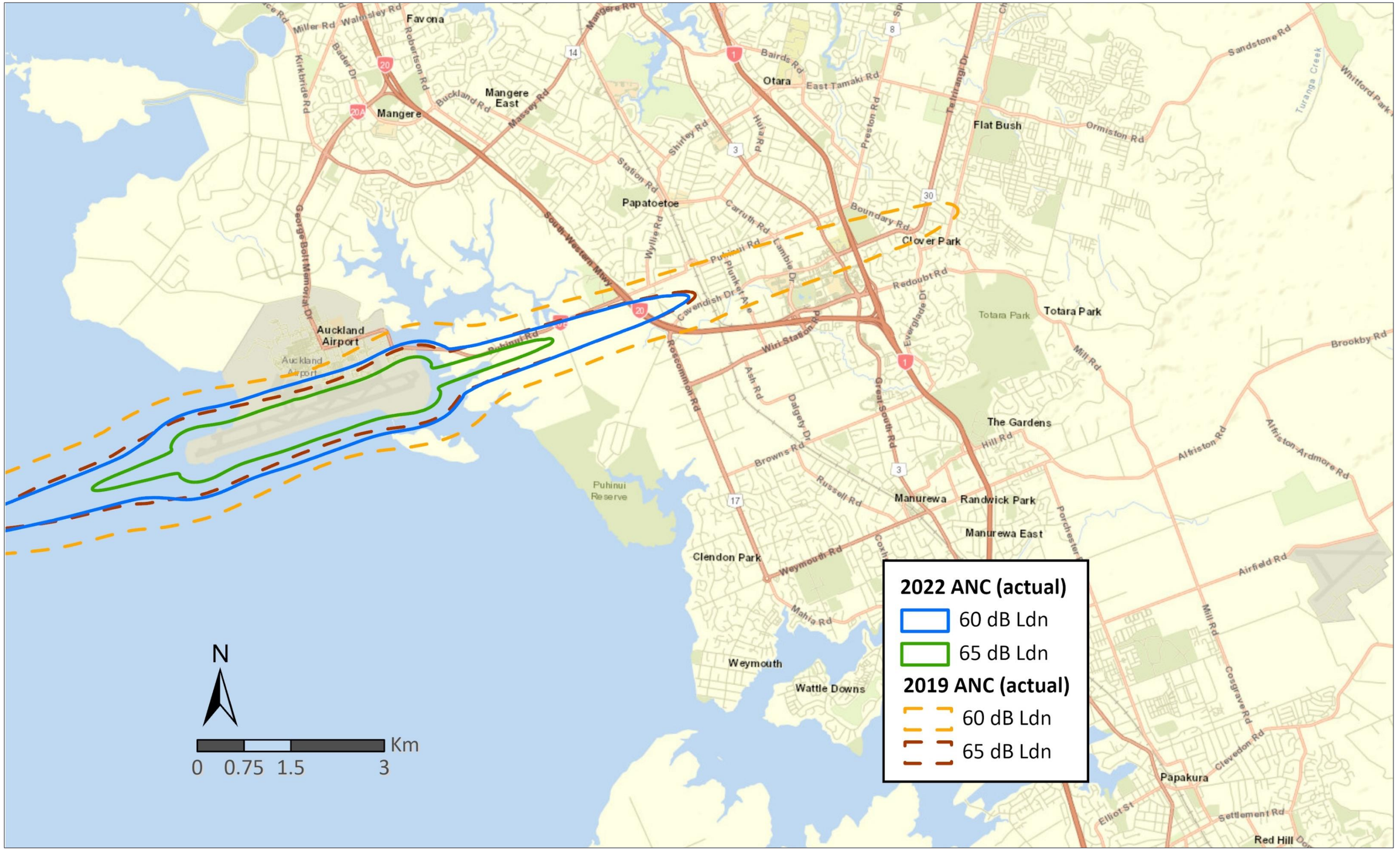
The INM uses its database of noise and operating procedures to calculate the noise level at a large number of grid points (which represent the geographical points around the airport where noise is calculated) by summing the 'noise energy' from each aircraft movement during the average day's operation. The 'noise energy' is calculated using the hourly L_{eq} value, night-weighted by +10 dBA and then averaged over 24 hours to give the daily L_{dn} value at each grid point. The grid points with equal noise level are then joined graphically to give a plot of L_{dn} noise contours (e.g. all grid points with a level of 60 dB L_{dn} are joined with a line which becomes the 60 dB L_{dn} contour). This is how the ANNA, MANA, and HANA contours were calculated for the AUP (using projected aircraft movements in the far future), and how the ANC (Section 5.0) and AANC (Section 6.0) contours are calculated annually for this report.

Over 20 years Marshall Day Acoustics has undertaken calibration studies to compare the modelled noise levels with measured levels from the monitoring system for individual aircraft types and operations. Adjustments have been made to the model inputs with respect to take-off procedures and weights to calibrate the model to better represent measured levels.

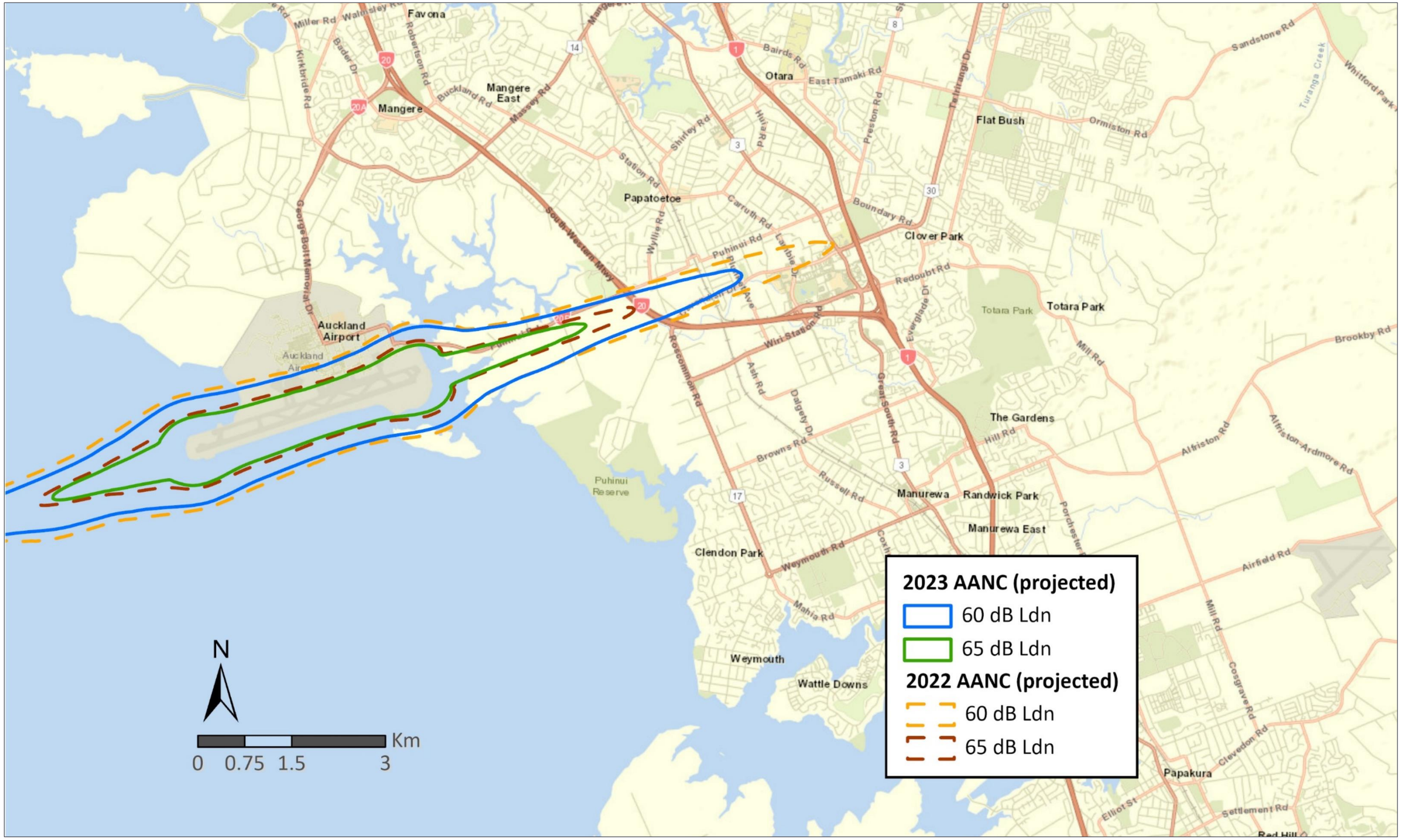
[5] European Civil Aviation Conference Doc 29 Report on Standard Method of Computing Noise Contours Around Civil Airports. https://www.ecac-ceac.org/about-ecac

[6] SAE International - Procedure for the Calculation of Airplane Noise in the Vicinity of Airports. SAE International, formerly named the Society of Automotive Engineers, is a United States-based, globally active professional association and standards developing organization. https://www.sae.org/about

APPENDIX D 2019 & 2022 ANC COMPARISON



APPENDIX E 2022 & 2023 AANC COMPARISON



APPENDIX F NOISE COMPLAINTS BY SUBURB

Suburb	No. Complaints
Auckland	1
Beachlands	3
Clover Park	5
Cockle Bay	2
East tamaki	1
Ellerslie	1
Flat Bush	7
Manukau City Centre	1
Mount Eden	3

Suburb	No. Complaints
Mount Roskill	1
Northcote	1
Onehunga	1
Pakuranga Heights	3
Papakura	1
Papatoetoe	7
Remuera	50
Wiri	1