BRISBANE AIRPORT

THE GAP SHORT-TERM NOISE MONITORING

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PREPARED FOR

BRISBANE AIRPORT CORPORATION PTY LTD
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TABLE OF CONTENTS

GLOSSARY OF TERMS

L_{Amax}	The maximum noise level over a sample period is the maximum level measured during the sample period. For aircraft noise, the maximum noise level is measured using slow response.
N-above	'Number-above', or 'N-above', describe the number of aircraft noise events that exceed a particular noise threshold. The most common 'N-above' are N70 and N60, describing the number of events above 70 dB(A) and 60 dB(A) respectively.
RNP-AR	Required Navigation Performance Authorisation Required (RNP-AR) is a precision arrival or departure procedure which uses satellite navigation. RNP-AR is typically developed to provide a shortened arrival procedure (as is the case at Brisbane Airport).
ILS	Instrument Landing System is a radio navigation system. ILS is typically available in most weather conditions, including poor conditions that may prohibit some other navigation methods. ILS require a long, straight arrival path.
CNE	Correlated Noise Events (CNE) are events recorded in the noise monitoring data that are correlated with a simultaneous aircraft operation nearby, for which valid air traffic surveillance data has also been collected.
AHD	The Australian Height Datum (AHD) is the official national vertical datum for Australia.

AIRCRAFT TYPES AND ABBREVIATIONS

717-200	Boeing 712-200 (narrow body jet)
737-300	Boeing 737-300 (narrow body jet)
737-400	Boeing 737-400 (narrow body jet)
737-700	Boeing 737-700 (narrow body jet)
737-800	Boeing 737–800 (narrow body jet)
737-MAX8	Boeing 737-MAX 8 (narrow body jet)
777-300ER	Boeing 777-300ER (wide body jet)
787-8	Boeing 787-8 (wide body jet)
787-10	Boeing 787-10 (wide body jet)
A320-200	Airbus A320-200 (narrow body jet)
A321-200	Airbus A321-200 (narrow body jet)
A330-200	Airbus A330-200 (wide body jet)
A350-900	Airbus A350-900 (wide body jet)
A350-1000	Airbus A350-1000 (wide body jet)
A380-800	Airbus A380-800 (wide body jet)
B463	British Aerospace BAe-146-300 (narrow body jet)
E190	Embraer E190-100 (narrow body jet)
F100	Focker 100 (narrow body jet)
F70	Focker 70 (narrow body jet)
DH8D	DeHavilland Dash 8 (turbo propeller)
SF34	Saab 340 (turbo propeller)
BE20	Beech 200 Super King Air (turbo propeller)

1 INTRODUCTION

Brisbane Airport operates a north-south oriented parallel runway system. The system comprises the legacy runway, Runways 01R/19L, and the new runway, Runways 01L/19R.

Brisbane Airport Corporation (BAC) engaged Envirosuite to undertake short-term noise monitoring in The Gap in response to community enquiries regarding aircraft noise. SoundIN Pty Ltd (SoundIN) has been engaged by BAC to review and analyse the results of that noise monitoring. This report details the results of that analysis.

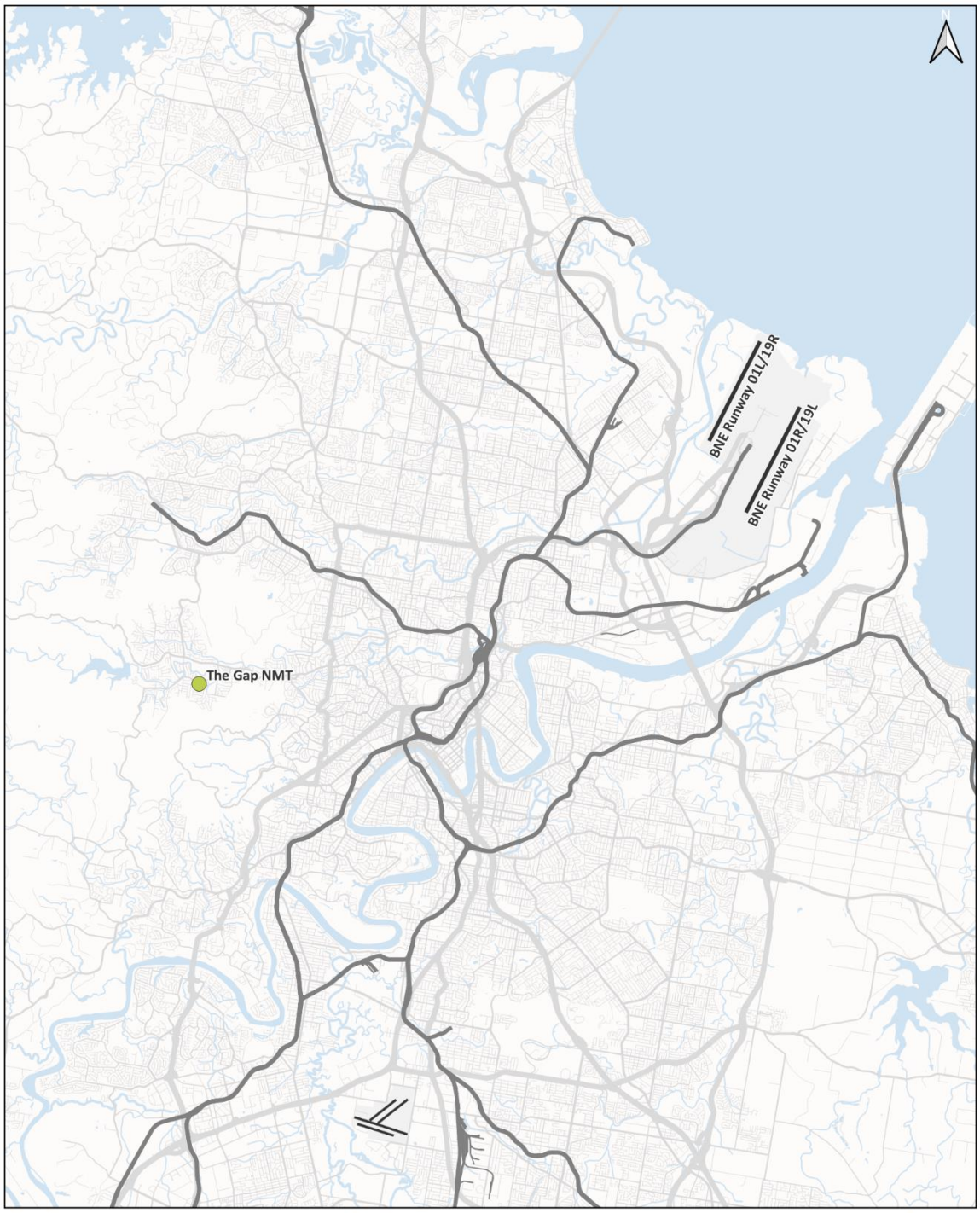
Short-term noise monitoring is periodically undertaken by BAC at locations surrounding the airport based on community feedback. This short-term noise monitoring augments the permanent Noise and Flight Path Monitoring System (NFPMS) operated by Airservices.

The short-term monitoring detailed in this report was undertaken for the purposes of:

- Recording the aircraft noise levels at The Gap from aircraft arriving and departing from Brisbane Airport; and
- Recording the relative altitude of aircraft overflying those areas; and
- Facilitating an investigation into noise and flight path data affecting the area.

Brisbane Airport and the noise monitoring site are indicated in **Figure 1-1**.

Figure 1-1 Site Locality



THE GAP SHORT-TERM NOISE MONITORING

SITE LOCALITY

LEGEND

Noise monitor

0 2 4 6 8 km

Note: Locations of features are indicative only and are shown solely to demonstrate features pertinent to the noise assessment.

2 NOISE MONITORING DESCRIPTION

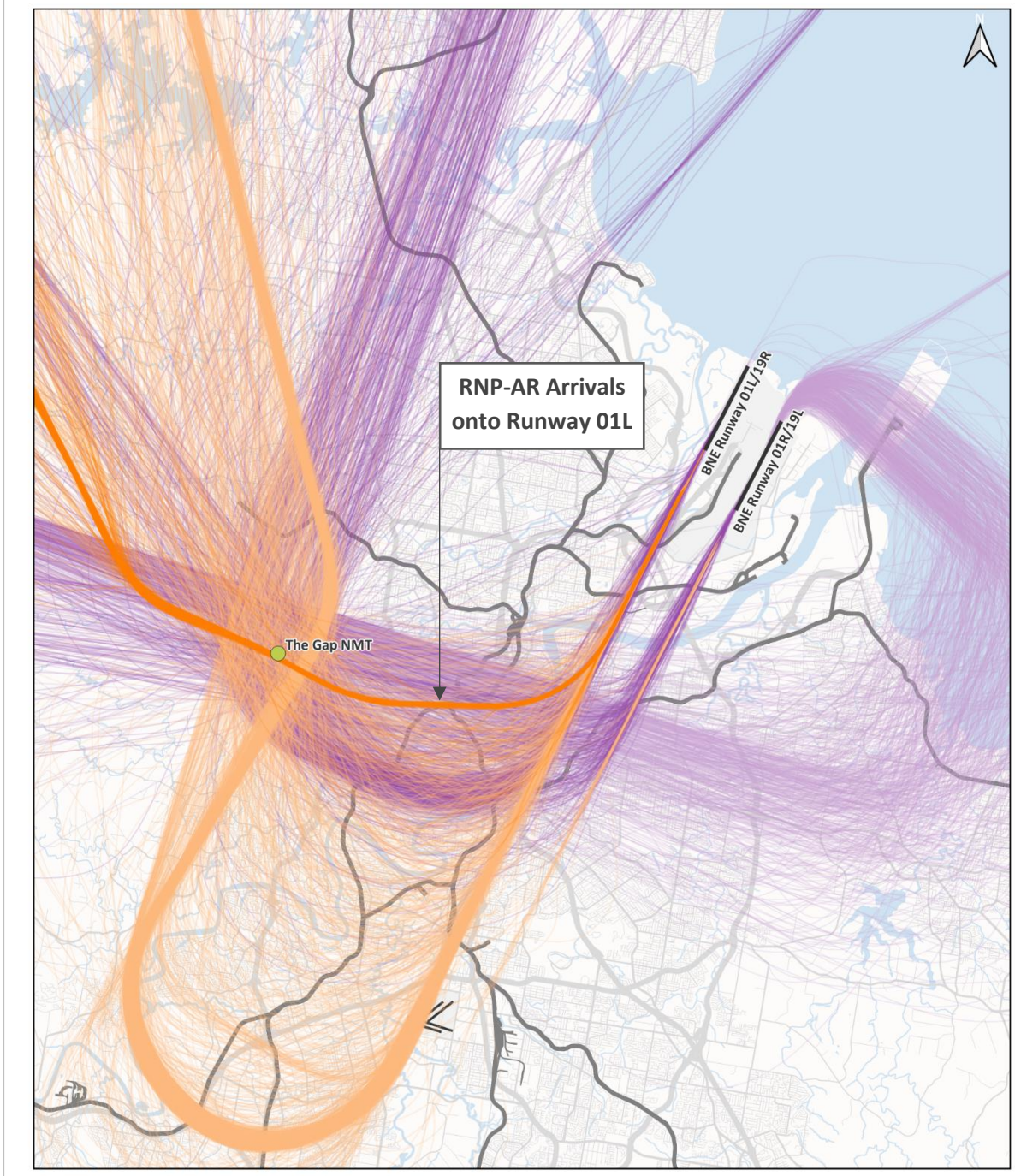
2.1 Details of the Short-Term Noise Monitor Deployment

The following details of the noise monitor deployments are pertinent.

- Monitoring was undertaken at The Gap site between 1 November 2023 and 2 April 2024.
- During the monitoring period, two substantial outages occurred due to equipment failures. Excluding these periods, more than 16 weeks of data was collected during the monitoring.
- The duration of this monitoring (approx. 16 weeks) is considered sufficient to collect a representative sample of operations from Brisbane Airport, including variations in operating modes, aircraft flown, and weather conditions.
- The Gap noise monitor was installed at an elevation of approximately 62 m AHD.
- The monitor parameters were tailored to primarily capture arrival operations onto the new runway (Runway 01L) via the RNP-AR flight path. These flight paths are available during the day and evening.
- In addition to RNP-AR arrivals, other operations in the area include arrivals to new runway (Runway 01L) via the ILS, and some departures from both new and legacy runways. In comparison to the RNP-AR arrivals onto the new runway, other operations in the area are generally at a higher altitude.
- The short-term noise monitoring consisted of a noise monitor terminal equipped with an outdoor microphone. The microphone was verified in conformance with IEC 61672-1 before the deployment.
- Self-calibration checks on the noise monitor terminal occurred daily on time, and the monitor remained within the calibration range throughout the deployment period.

Figure 2-1 demonstrates the location of the noise monitoring site with respect to the various flight paths.

Figure 2-1 Noise Monitoring Site and Flight Paths



2.2 Aircraft Noise Event Detection

Noise events exceeding a defined threshold were automatically identified by the noise monitoring terminals and noise level data saved. Events which were correlated with a simultaneous aircraft operation nearby were automatically identified as aircraft noise events. These events are described as correlated noise events (CNE). The noise level data and aircraft operation data for these events were subsequently associated and saved for post-processing and analysis.

To permit the correlation of aircraft events with measured noise events, a three-dimensional cylinder-like capture zone at each deployment site was established in the processing software. The capture zone was defined by a circular radius 2,000 m, projected 2,000 m (6,561 ft) up from the monitor site. The capture zone is shown in **Figure 2-2**.

The capture zone targets the RNP-AR arrival operations onto the new runway, which were the focus of the monitoring. Increasing the capture zone ceiling was investigated during post-processing by Envirosuite, to investigate operations other than the RNP-AR arrivals described above. However, Envirosuite confirmed that no additional clean aircraft noise events above the stated thresholds were recorded during the deployment, for aircraft operating above the 6,561 ft ceiling.

The automated noise monitoring system requires several criteria to be met in order to classify an aircraft noise event. These criteria relate to the validity of recorded noise level and air traffic control (ATC) surveillance data, the proximity of aircraft (i.e., within the relevant capture zone) and that the noise level, duration and rise and fall accords with that of an aircraft noise event.

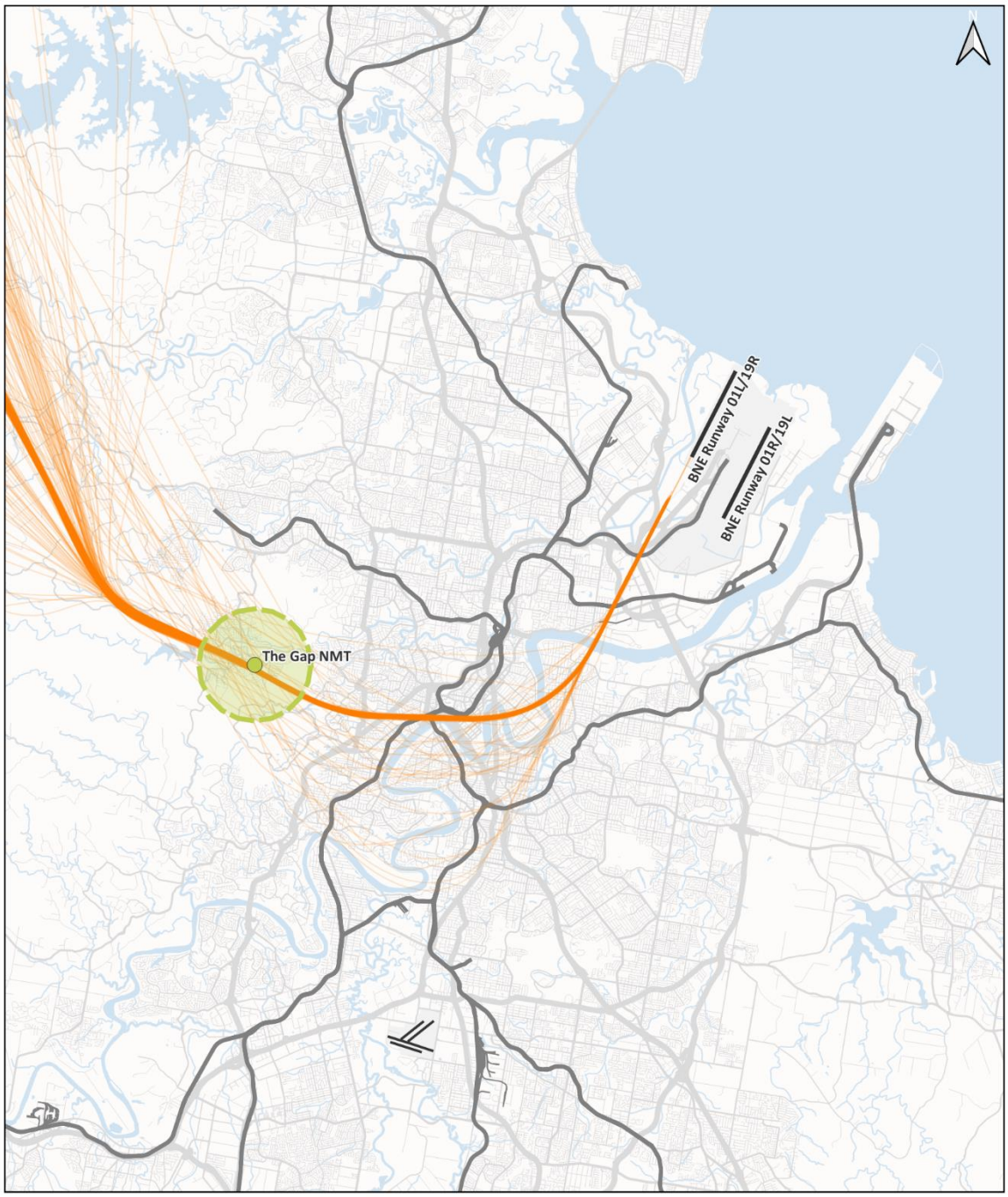
In this way, the system is able to automatically eliminate most extraneous noise events. However, it is possible that some aircraft noise events are not recorded. Most often these are due to the absence of valid ATC surveillance data, or due to the aircraft noise levels being insufficient to satisfy the defined thresholds for noise level and duration.

The noise detection thresholds applied for the monitoring described are described in **Table 2-1**. Noise detection thresholds were established based on the measured background noise levels.

Table 2-1 Noise Detection Thresholds

Time Period	Threshold
12 midnight to 5 am	45 dBA
5 am to 7 pm	55 dBA
7 pm to 12 midnight	52 dBA

Figure 2-2 Capture Zone



3 NOISE MONITORING RESULTS

This section of the report presents the noise monitoring results for the The Gap site.

3.1 Correlated Aircraft Arrival Operations

Table 3-1 presents a summary of the correlated aircraft departure noise events at The Gap site.

Table 3-1 Summary of Correlated Aircraft Arrival Noise Events at The Gap

Aircraft [1]	Number of CNE	Average L_{Amax} - dB(A)	90th Percentile L_{Amax} [2] - dB(A)	Standard Deviation of L_{Amax}	Average Slant Distance [3] - feet	10th Percentile Slant Distance [3,4] - feet
737-800	341	62.2	65	2.3	3307	3182
A320-200	122	65.6	68	2.3	3065	2986
737-700	27	61.5	63.3	1.6	3250	3178
DH8D	21	60.6	67.2	4.6	4302	2930
787-8	14	62.3	64.8	1.8	3160	3065
737-MAX8	14	60.5	62.2	1.9	3205	3187
All Jet	**535**	**62.9**	**66.5**	**2.8**	**3260**	**3049**
All Turboprop	**67**	**60.1**	**62.8**	**2.1**	**4433**	**2926**

Note:
1. Presentation of individual aircraft types in **Table 3-1** is limited to the six aircraft types with the most correlated arrival events. Other aircraft had 12 or fewer operations recorded in the monitoring data.
2. The 90th percentile L_{Amax} presents the loudest 10% of events.
3. Slant distance is the nearest three-dimensional distance from the aircraft to the noise monitoring terminal.
4. The 10th percentile slant distance presents the nearest 10% of events.

The following can be observed from the noise monitoring results.

- The most numerous aircraft demonstrate similar average noise levels around 62-66 dB(A).
- Narrow body jets are most prevalent (737-800, A320-200, 737-700, 737-MAX8 and others not shown), representing 83% of the total correlated aircraft arrivals for fixed-wing aircraft.
- Wide body jets (787-8 and others not shown) represent only 3% of the total correlated arrivals for fixed-wing aircraft.

- Turboprop aircraft (DH8D and others not shown) represent approximately 11% of the total correlated aircraft departures for fixed-wing aircraft.
- All aircraft exhibit some variation in L_{Amax}; demonstrated by the standard deviation of L_{Amax} and the difference between the 90th percentile and average. For most aircraft, the 90th percentile L_{Amax} is approximately 2-3 dB higher than the average L_{Amax}.
- Slant distances and altitudes are consistent among most aircraft of a similar type, though some variation is evident. The average slant distance for most jets is a little over 3,000 ft.
- The 10th percentile slant distance (i.e. lowest 10%) is typically in the order of 100 ft lower than the mean across the presented aircraft.
- The DH8D, a turboprop aircraft, exhibits different characteristics to the other presented aircraft, which are all jets. Variations in noise level and slant distances are far greater for the DH8D. It is possible that many of the correlated DH8D events were not operating on the RNP-AR flight path.

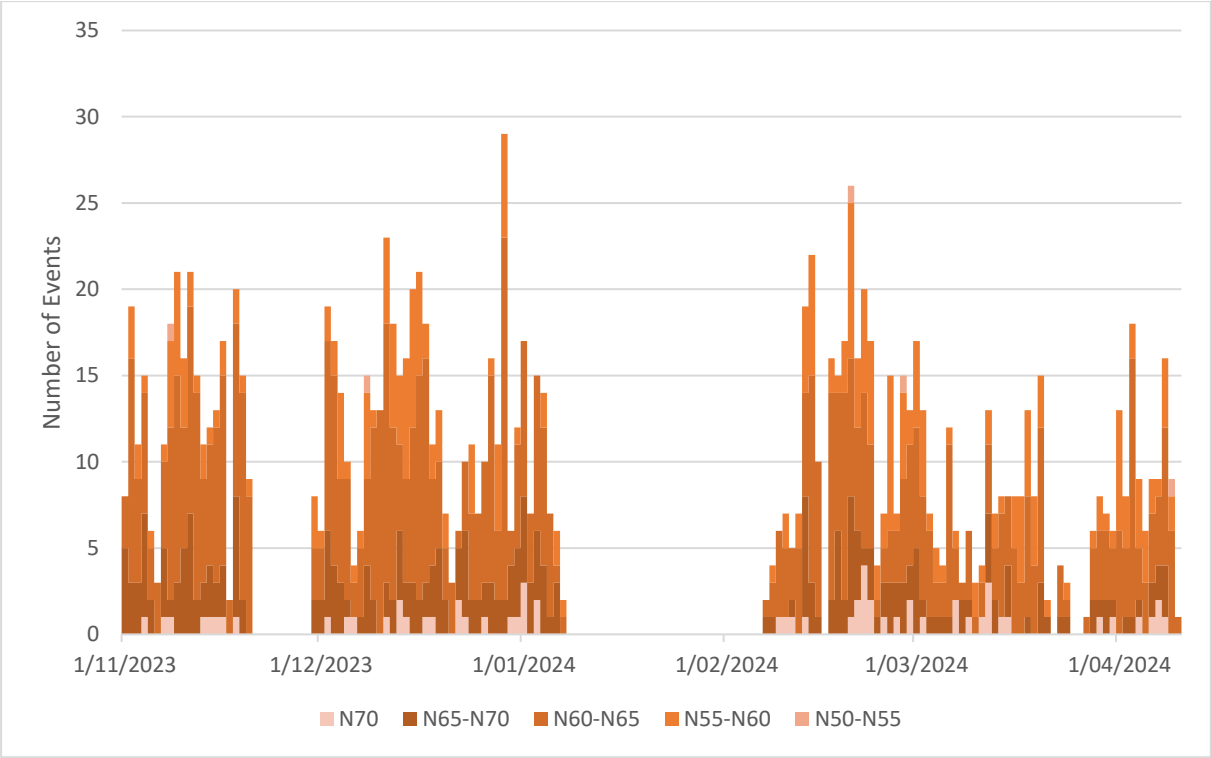
3.2 Daily Distribution of Correlated Noise Events

Figure 3-1 presents the number of events within various noise thresholds for each day of the monitoring. The number of events above a noise level threshold is denoted 'number-above' or 'N-above' and is typically expressed in the form N70 (i.e., the number of events above 70 dB(A)).

The following is noted from **Figure 3-1** and statistical analysis of the daily N-above values.

- Periods of equipment outages are clear in November 2023 and January-February 2024.
- The number of correlated noise events can be seen to vary significantly from day to day. This is likely largely due to different wind conditions requiring Brisbane Airport to utilise different operating modes (i.e., runway directions). Varying traffic numbers and schedules from day to day are also a likely contributing factor.
- The maximum N60 measured was 23 and the average was 8.6 (excluding outages). Aircraft noise events above 70 dBA were occasionally observed; the maximum N70 was 4 and the average was 0.5.
- On most days, the largest proportion of measured aircraft noise events were in the range 60-65 dBA. This accords with the data presented in the previous sections.

Figure 3-1 N-above Distribution During the Monitoring



4 CONCLUSION

SoundIN has undertaken an analysis of short-term aircraft noise monitoring in The Gap.

The following observations have been made in our analysis.

Arrival Aircraft Events at The Gap Site

- The monitor parameters were tailored to primarily capture arrival operations onto the new runway (Runway 01L) via the RNP-AR flight path.
- Average noise levels for arrivals were similar amongst the most prolific aircraft – approximately 62-66 dB(A).
- All aircraft exhibited some variation in L_{Amax}; meaning that even for like operations, the noise level on the ground can be expected to vary from flight to flight. For most aircraft, the 90^{th} percentile L_{Amax} (i.e., the 10^{th} loudest out of every 100 events) is approximately 2-3 dB higher than the average L_{Amax}.
- Slant distances and altitudes are consistent among most aircraft of a similar type, though some variation is evident. The average slant distance for most jets is a little over 3,000 ft.
- The DH8D, a turboprop aircraft, exhibits different characteristics to the other aircraft highlighted in our analysis, which are all jets. Variations in noise level and slant distances are far greater for the DH8D. It is possible that many of the correlated DH8D events were not operating on the RNP-AR flight path.

Daily Distribution of Correlated Noise Events at The Gap Site

- The number of correlated noise events varies significantly from day to day.
- The majority of aircraft noise events produced a maximum noise level in the range 60-65 dB(A).
- Aircraft noise events above 60 dB(A) are frequent, with an average of 23 per day.
- Aircraft noise events above 70 dB(A) are infrequent, with a maximum of 4 events on any day and an average of 0.5 per day.