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Noise 101 and Airport Noise Management

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Summary

1. Noise 101
2. Measuring Aircraft Noise
3. Airport Noise Standard (NZS 6805)
4. Auckland Airport Noise Management

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Noise **101**

Sound Level - The Decibel (dB) Scale

Acoustic Pressure Pa	Sound Pressure level (dB re 2 x 10^{-5})	Typical Examples
200	140	Engine Test Cell
20	120	Jet Take Off at 50m
		Chain Saw Operator
2	100	Noisy Factory
		Lawnmower (85)
0.2	80	
		Restaurant (70)
0.02	60	Car Interior (60)
		Normal Voice at 1m
0.002	40	Private Office
0.0002	20	Whisper
		TV Studio
0.00002	0	Threshold of Hearing

- Pressure Scale is Impractical
- Decibel scale chosen for convenience
- Hearing response is logarithmic rather than linear
- Lawnmower (85) + Lawnmower (85) = 88 dB

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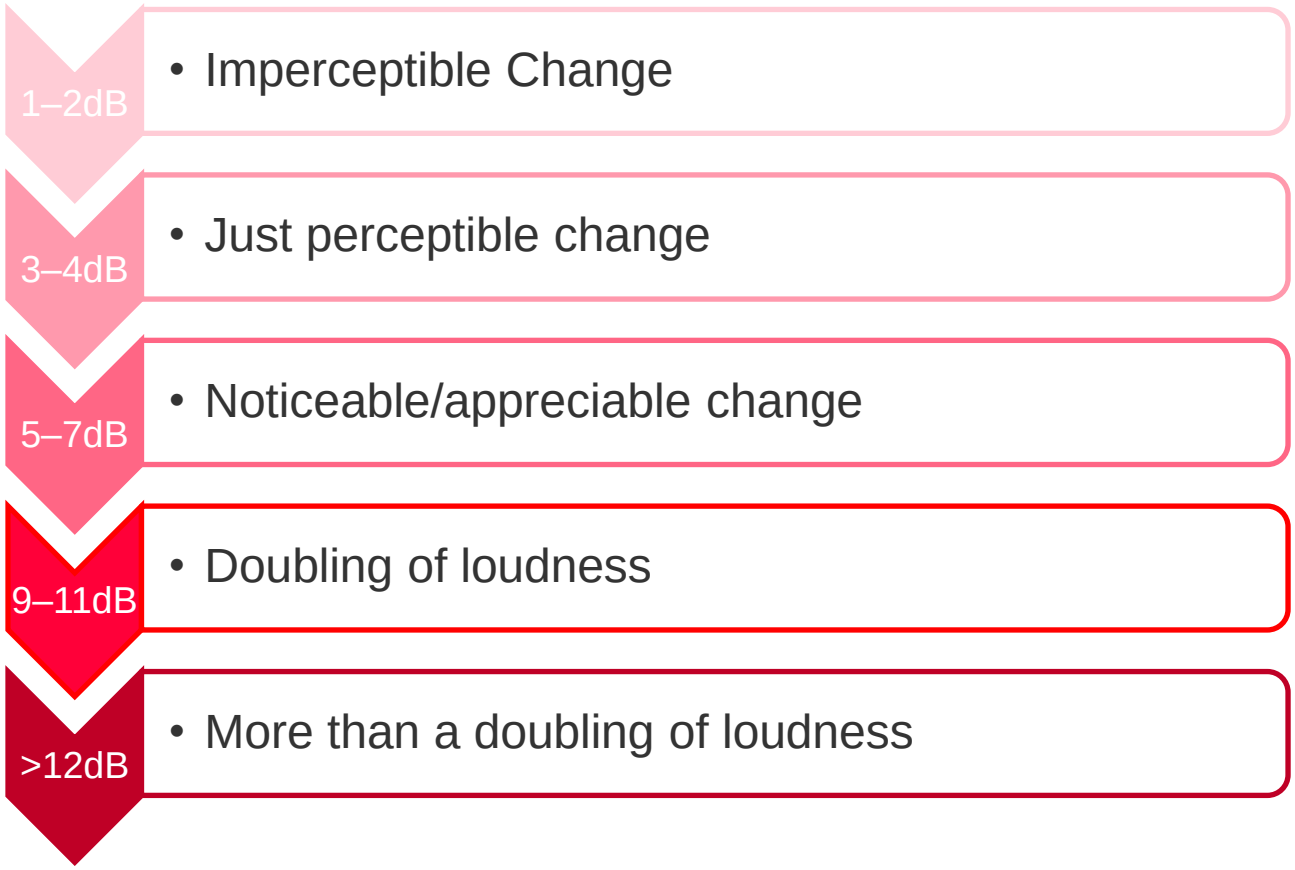
Changes in Noise Level



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Measuring Aircraft Noise

Character of Aircraft Noise

- Aircraft noise is:
  - Not continuous
  - A series of noise events throughout the day and night, with respite at other times
- Therefore standard environmental noise metrics (L_{Aeq} etc.) are not appropriate
- Instead use SEL, L_{dn}

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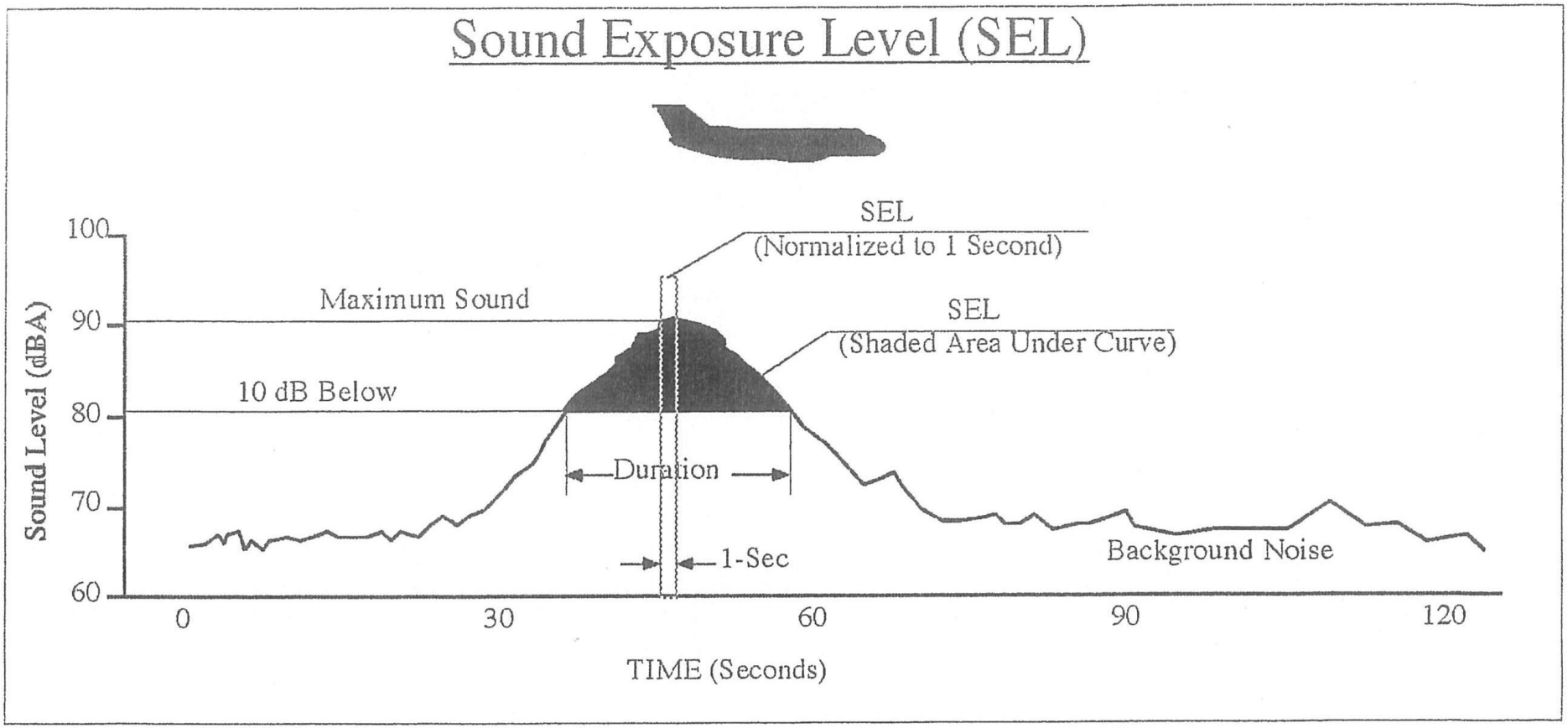
Noise from a Single Event



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Day/Night Level (L_{dn})

- Measure of overall noise exposure
- Takes into account
  - No. of noise events
  - Loudness of each event (SEL)
  - Sensitivity at night
- Main noise metric for aircraft noise in NZ

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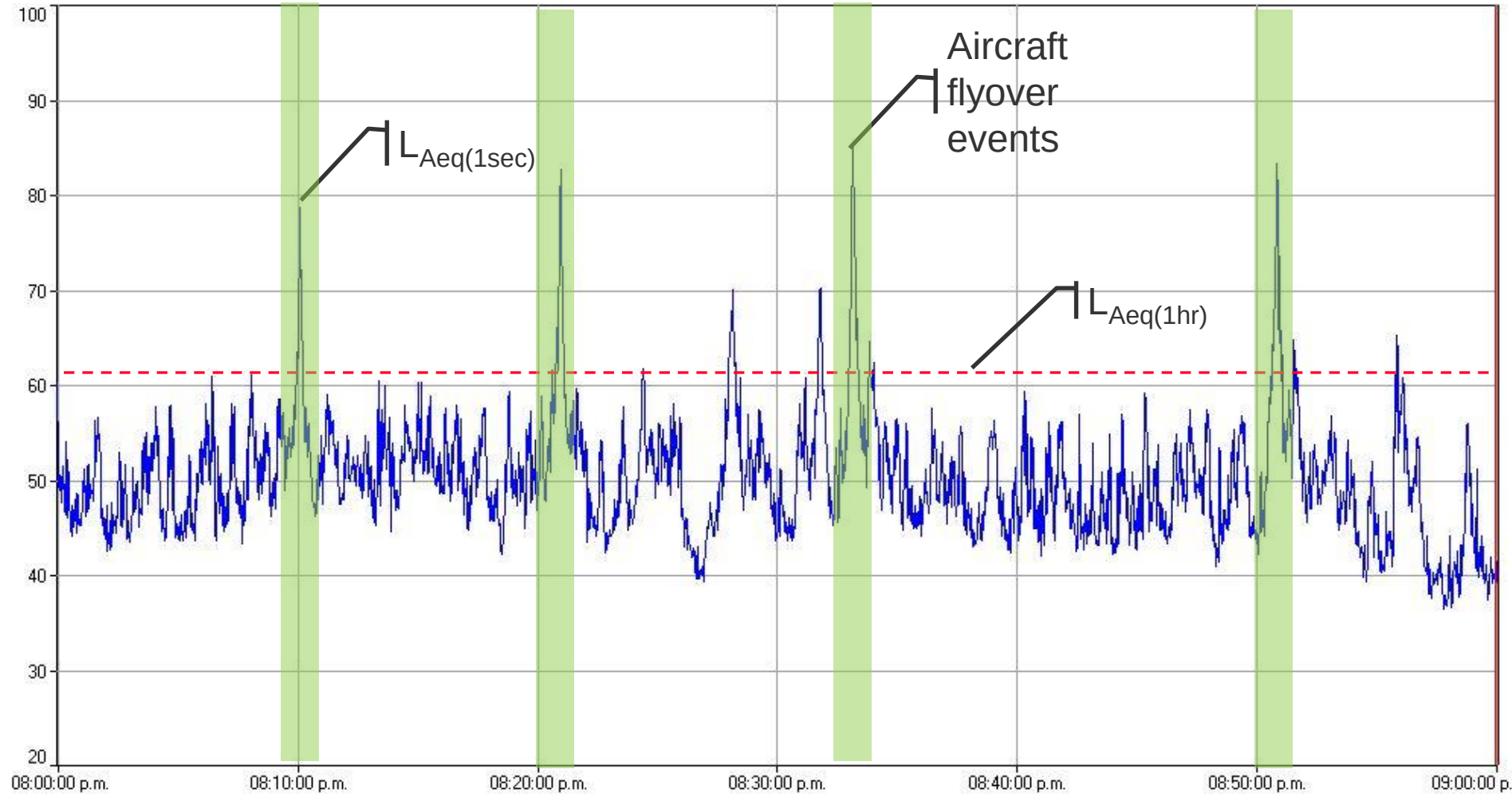
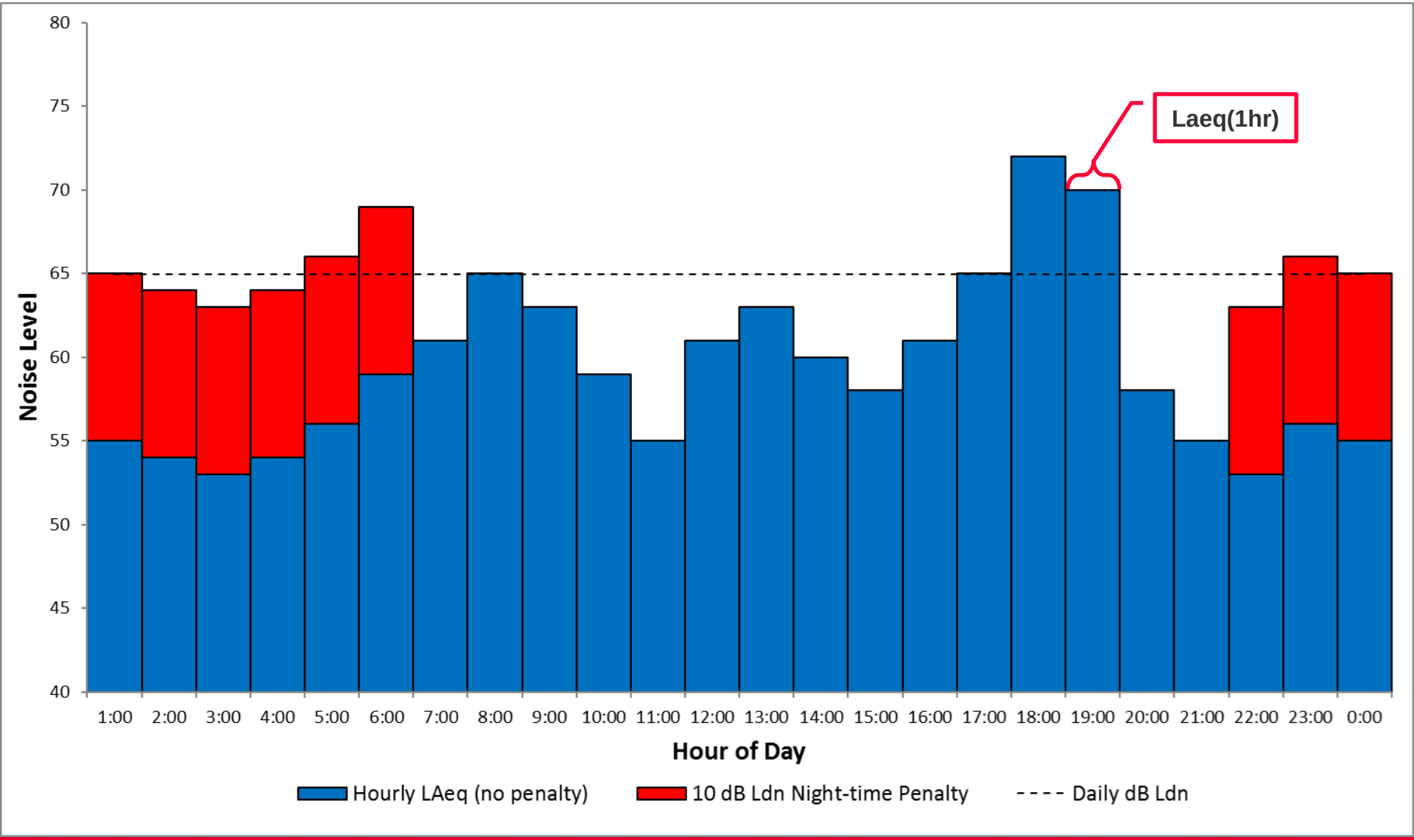
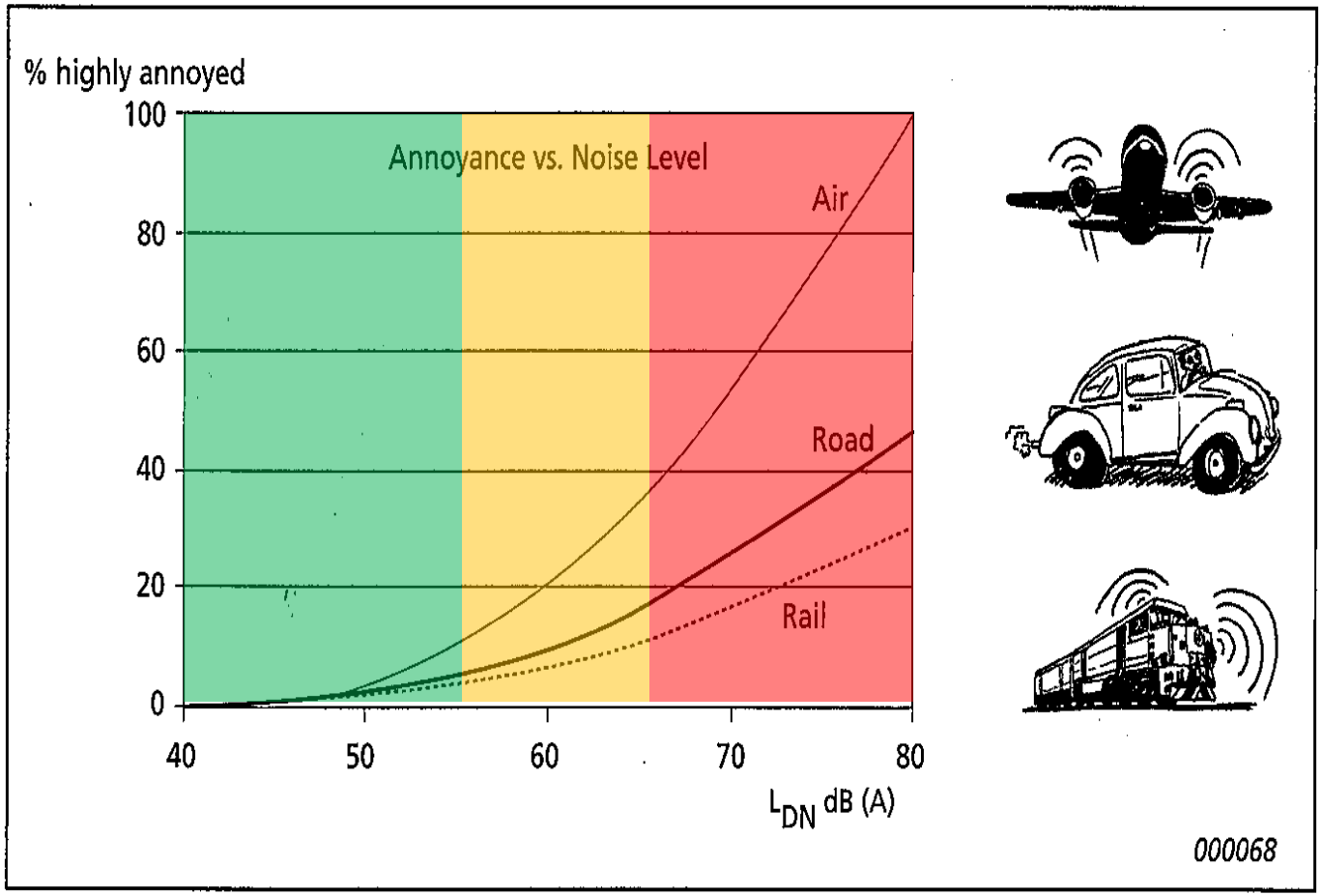
Typical Data



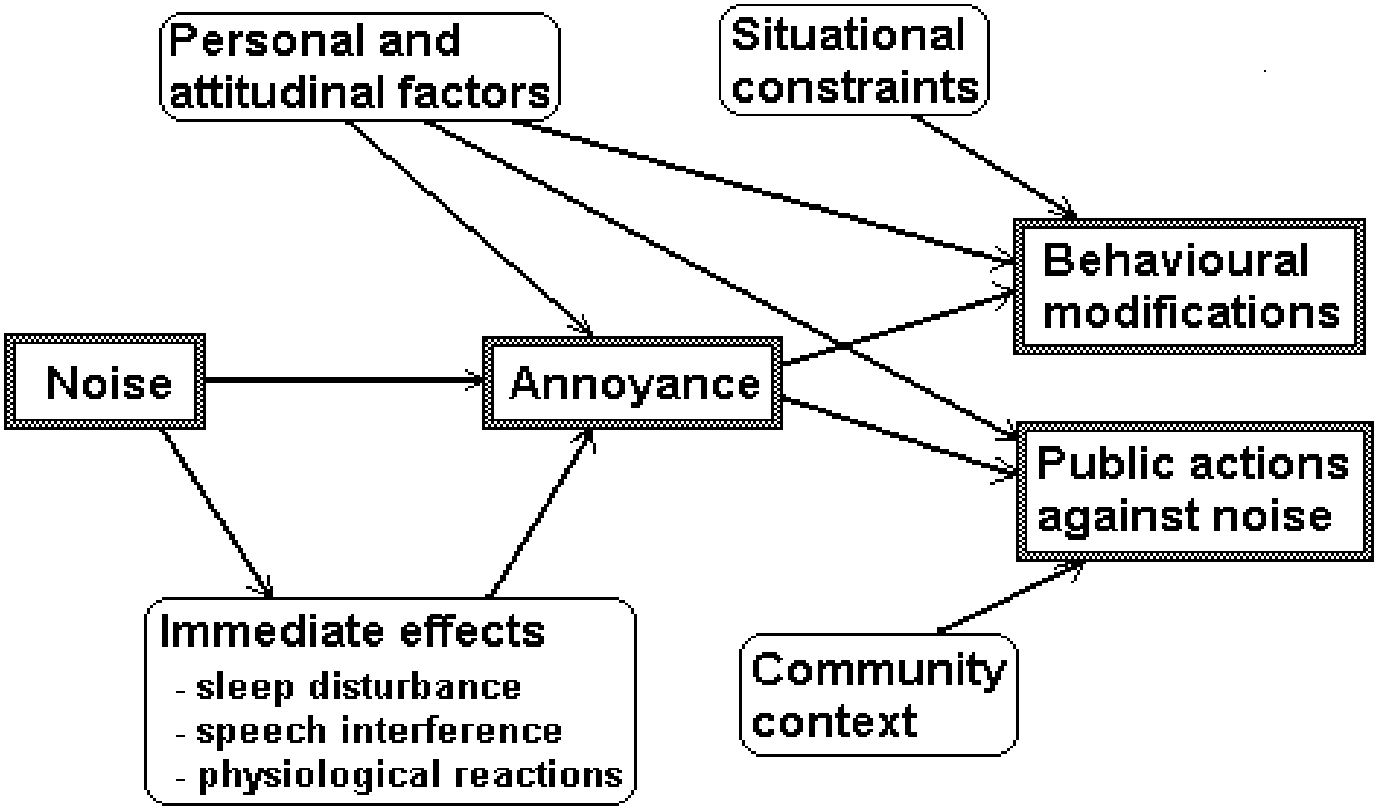
Day Night Level (L_{dn})





- >65 dB L_{dn} is unsuitable for Residential
- 55 – 65 dB L_{dn} is marginal for Residential
- <50/55 dB L_{dn} is suitable for Residential

Annoyance



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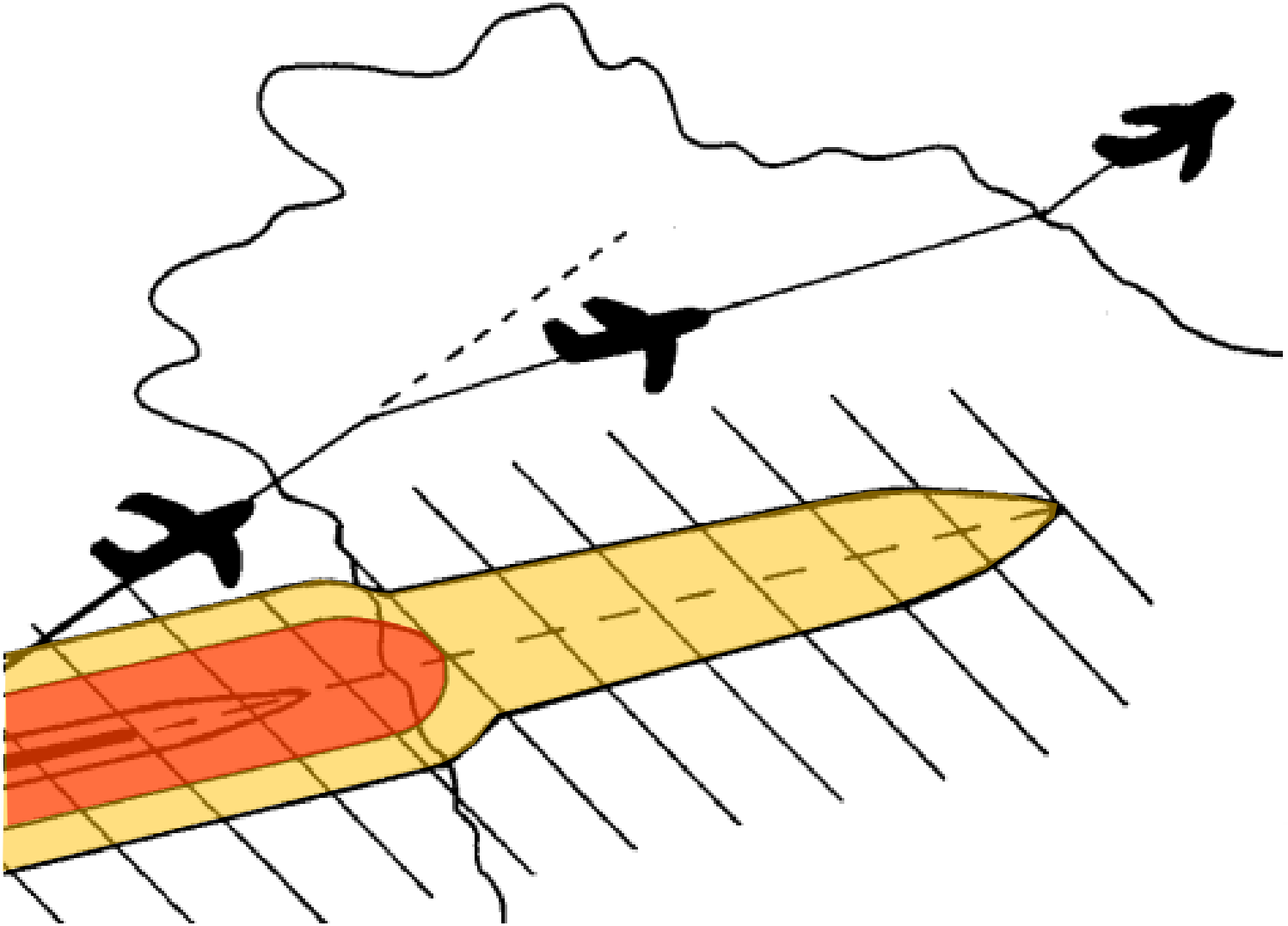
NZ Standard - Airport Noise



New Zealand Standard NZS 6805:1992

"Airport Noise Management & Land Use Planning"

1. Sets a noise limit for Airport Operations based on future operations (allows growth)

2. Recommends Land-use Planning to protect the Airport

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NZS 6805 – Noise Boundary concept

1.4.1 *The airnoise boundary*

1.4.1.1
The airnoise boundary defines an area around an airport within which the current or future daily amount of aircraft noise exposure will be sufficiently high as to require appropriate land use controls (table 1) or other measures to avoid, remedy or mitigate any adverse effect on the environment, including effects on community health and amenity values whilst recognizing the need to operate an airport efficiently.

1.4.1.2
The average night-weighted sound exposure over a 24 hour period (at the airnoise boundary) shall not exceed 100 Pa^2s (65 Ldn), see table 1. The average shall be established over a period of 3 months or such other period as agreed between the operator and the local authority.

1.4.2 *The outer control boundary*

1.4.2.1
The outer control boundary defines an area outside the airnoise boundary within which there shall be no new incompatible land uses (see table 2).

1.4.2.2
The predicted 3 month average night-weighted sound exposure at or outside the outer control boundary shall not exceed 10 Pa^2s (55 Ldn).

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NZS 6805 – Land Use Planning

- Proposes two Boundaries for inclusion in District Plan
  - **Air Noise Boundary** – 65 dB L_{dn}
    Inside – New residential prohibited
  - **Outer Control Boundary** – 55 dB L_{dn}
    Inside – Residential is marginal
    Sound insulation is required

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NZS 6805 – Airport Noise Management

- Airport must comply with the following noise limits:
  - Airport not to exceed 65 dB L_{dn} at the **Air Noise Boundary**
  - Airport not to exceed 55 dB L_{dn} at the **Outer Control Boundary**

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NZS 6805 in Practice

- Different Boundary Concepts:
  - OCB/ANB
  - NNB
  - HANA/MANA/ANNA
  - Composite
- Different Planning Rules:
  - Prohibition in OCB (Queenstown)
  - Permitted in ANB (Wellington)

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Auckland Airport Noise Management

AIAL - Airport Noise Management

- Based on NZS 6805 principles
- AIAL Designation:
  - Noise from aircraft operations
  - Noise from on-wing engine testing
  - Noise monitoring and reporting
  - Actual Noise Contours (ANC)

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Aircraft Operations

- Airport must comply with the following noise limits:
  - Airport not to exceed 65 dB L_{dn} at the **High Aircraft Noise Area (HANA)**
  - Airport not to exceed 60 dB L_{dn} at the **Moderate Aircraft Noise Area (MANA)**

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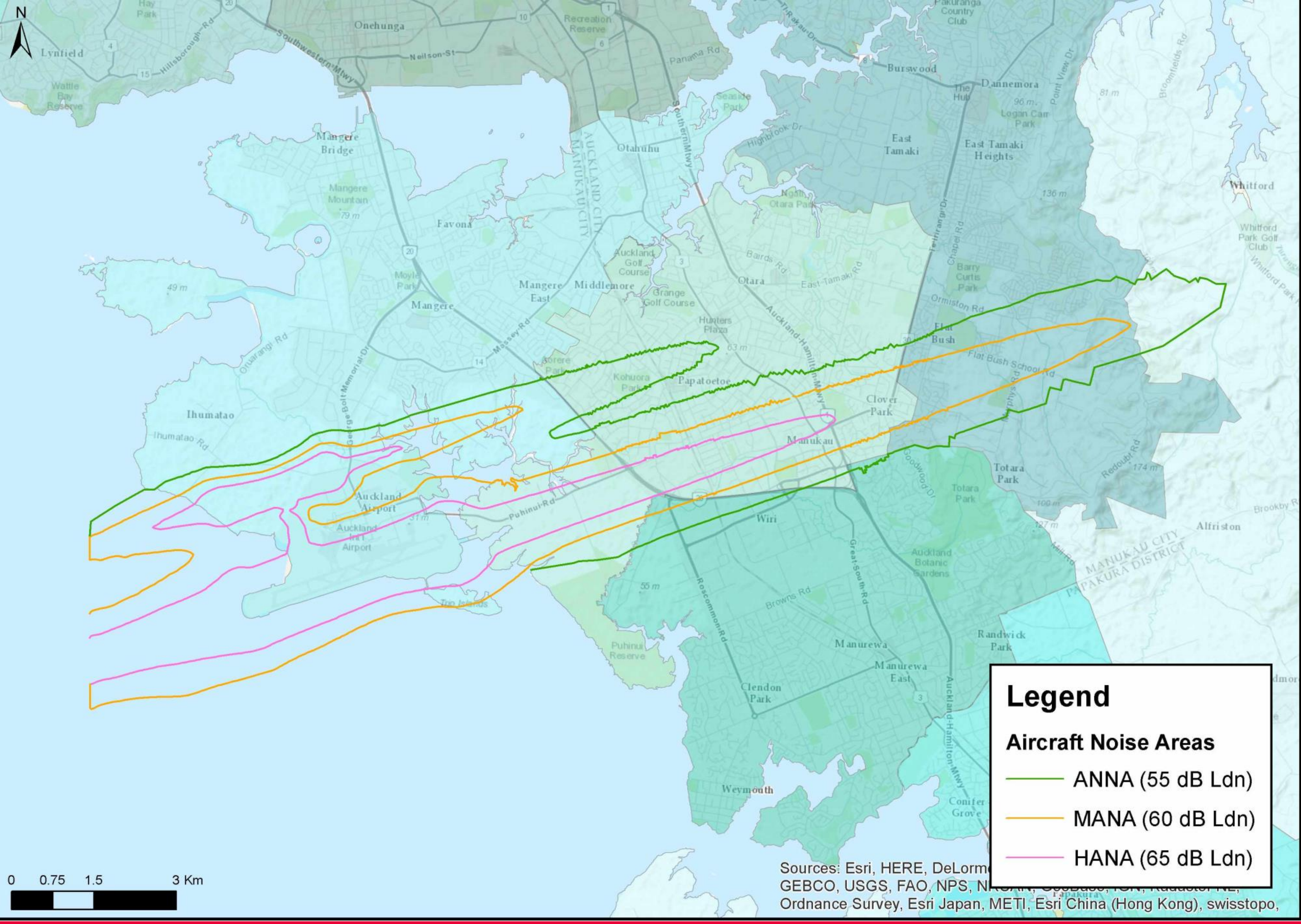
Legend
Aircraft Noise Areas
ANNA (55 dB Ldn)
MANA (60 dB Ldn)
HANA (65 dB Ldn)
0 0.75 1.5 3 Km
Sources: Esri, HERE, DeLorme
GEBCO, USGS, FAO, NPS,
Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo,

Engine Testing

- Moderately high noise levels for moderate duration (during day and night-time)
- Noise from engine testing must not exceed 55 dB L_{dn} (7 day rolling) at dwellings outside the ANNA
- Engine run details recorded and imported into calculation spreadsheet
- Noise at three monitoring locations calculated for each month

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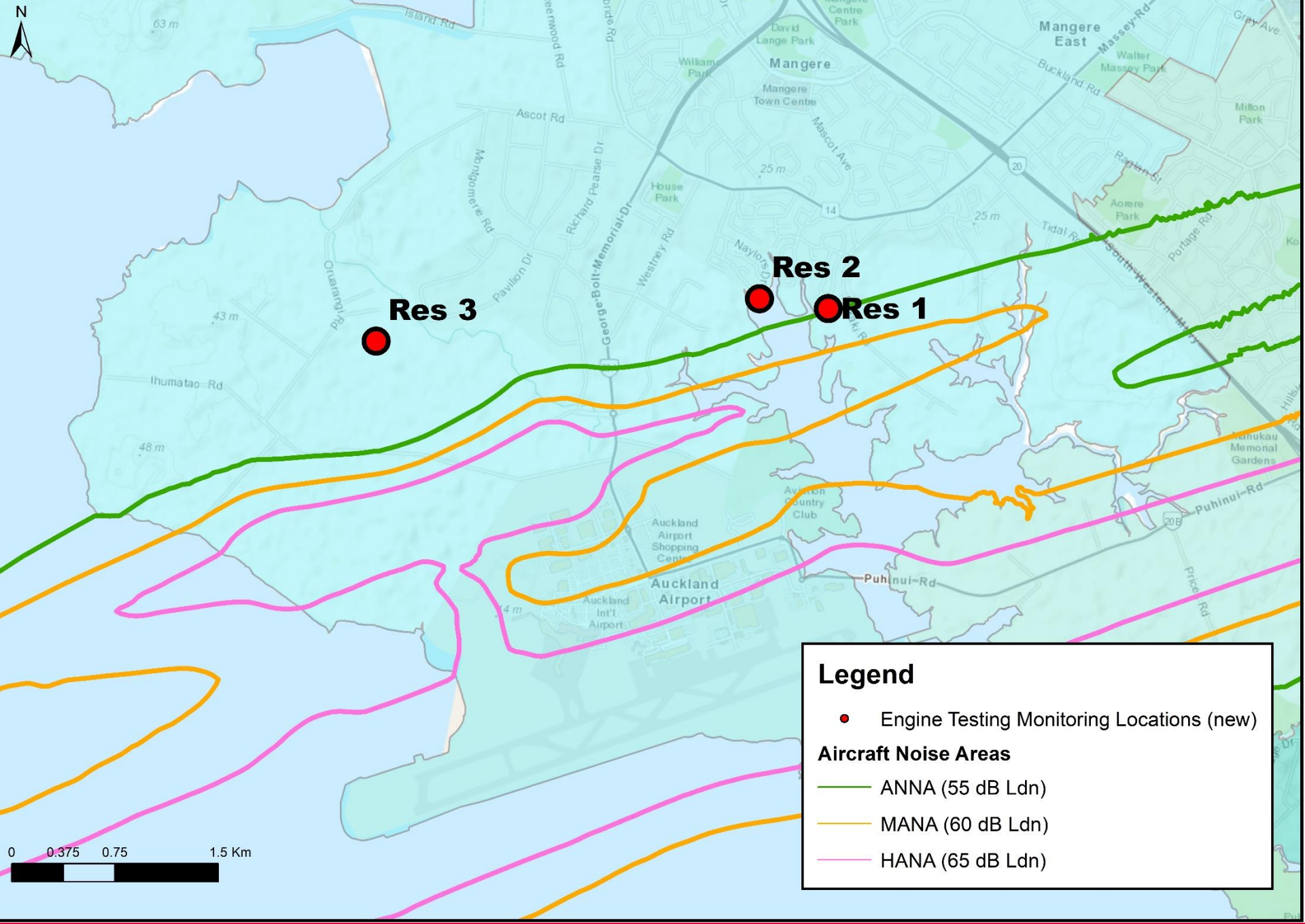
N
Res 3
Res 2
Res 1
Legend
Engine Testing Monitoring Locations (new)
Aircraft Noise Areas
ANNA (55 dB Ldn)
MANA (60 dB Ldn)
HANA (65 dB Ldn)
0
0.375
0.75
1.5 Km
Auckland Airport
Mangere
Mangere East
Ascot Rd
Puhinui Rd
Ihumatao Rd
George Bolt Memorial Dr

Noise Monitoring

- Three permanent monitors + temporary monitors
- Threshold set on monitor to exclude ambient noise sources
- Recorded noise events are correlated to aircraft events using radar data on aircraft movements
- Add 10 decibels to night time noise events
- Calculate night weighted average noise level – L_{dn}.

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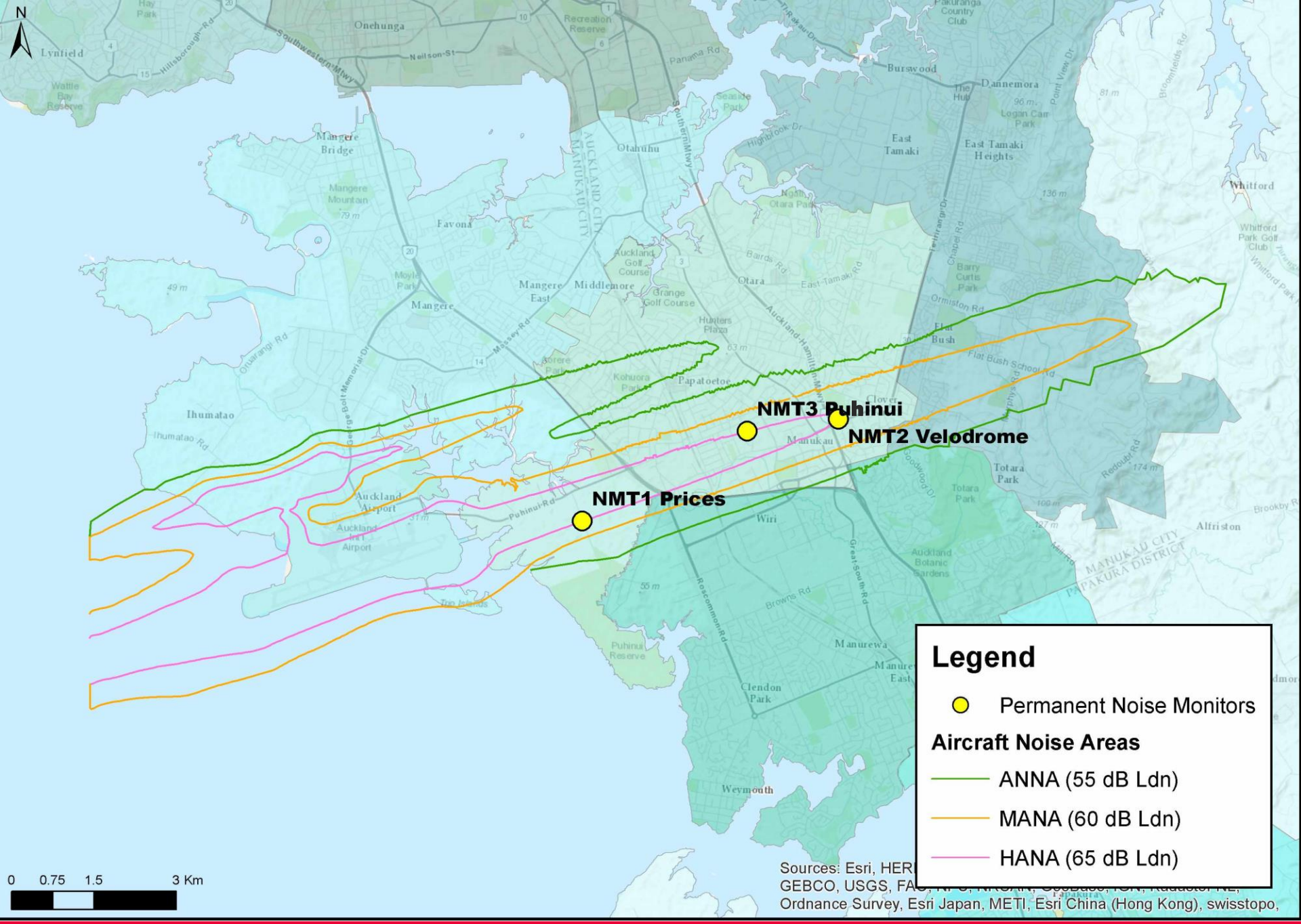
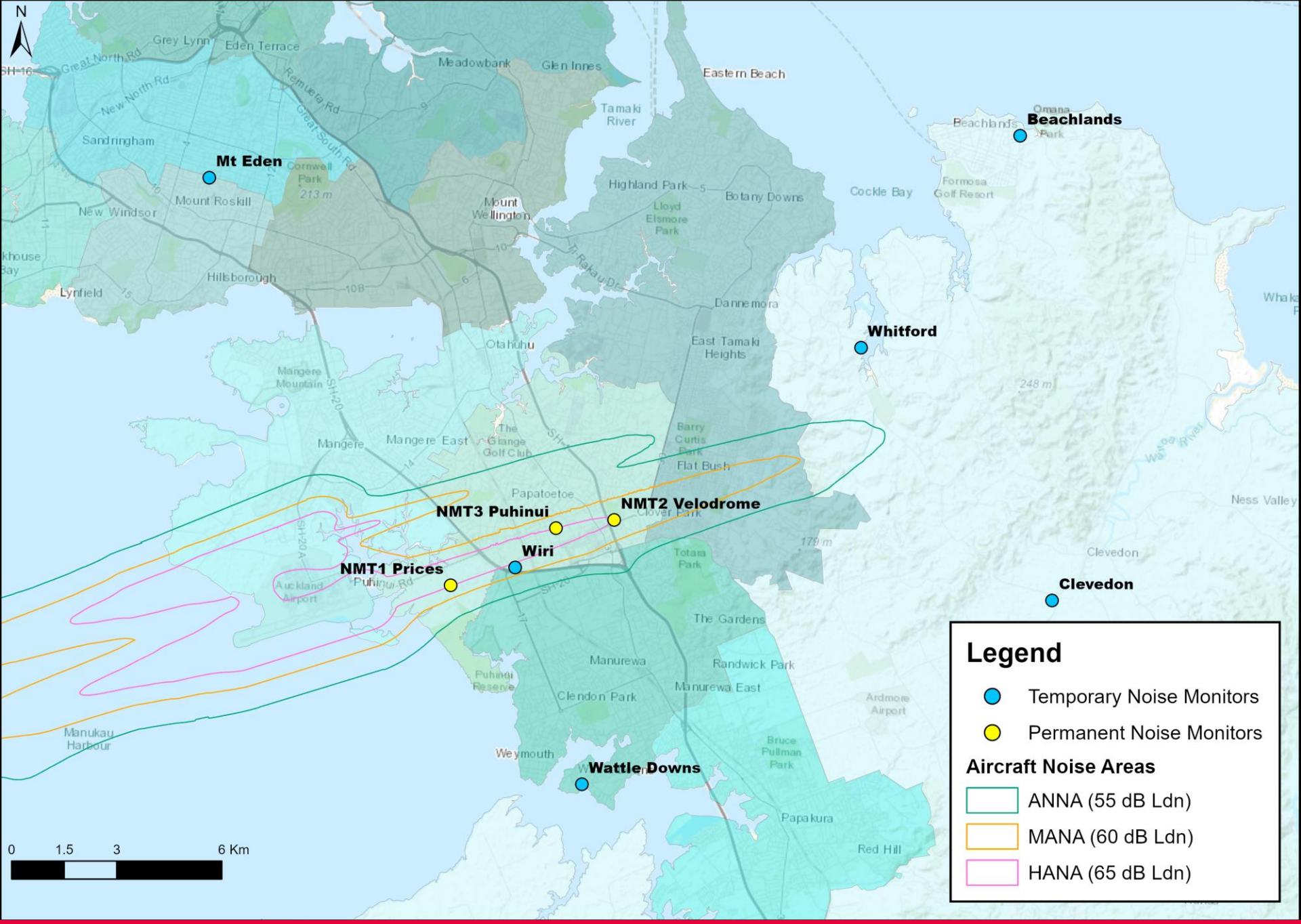
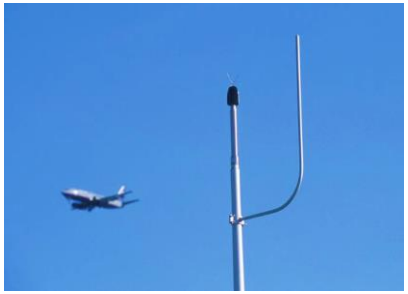

N
NMT3 Puhinui
NMT2 Velodrome
NMT1 Prices
Legend
Permanent Noise Monitors
Aircraft Noise Areas
ANNA (55 dB Ldn)
MANA (60 dB Ldn)
HANA (65 dB Ldn)
0 0.75 1.5 3 Km
Sources: Esri, HERE, GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo,


N
Mt Eden
Beachlands
Whitford
Clevedon
NMT3 Puhinui
NMT2 Velodrome
Wiri
NMT1 Prices
Wattle Downs
Legend
Temporary Noise Monitors
Permanent Noise Monitors
Aircraft Noise Areas
ANNA (55 dB Ldn)
MANA (60 dB Ldn)
HANA (65 dB Ldn)
0
1.5
3
6 Km

Casper System

Airways Radar Data

AIAL Server



Noise Data

Casper Provides

- Noise Level Information
- Flight Information
- Complaint Information
- Summary Reports
- Maps

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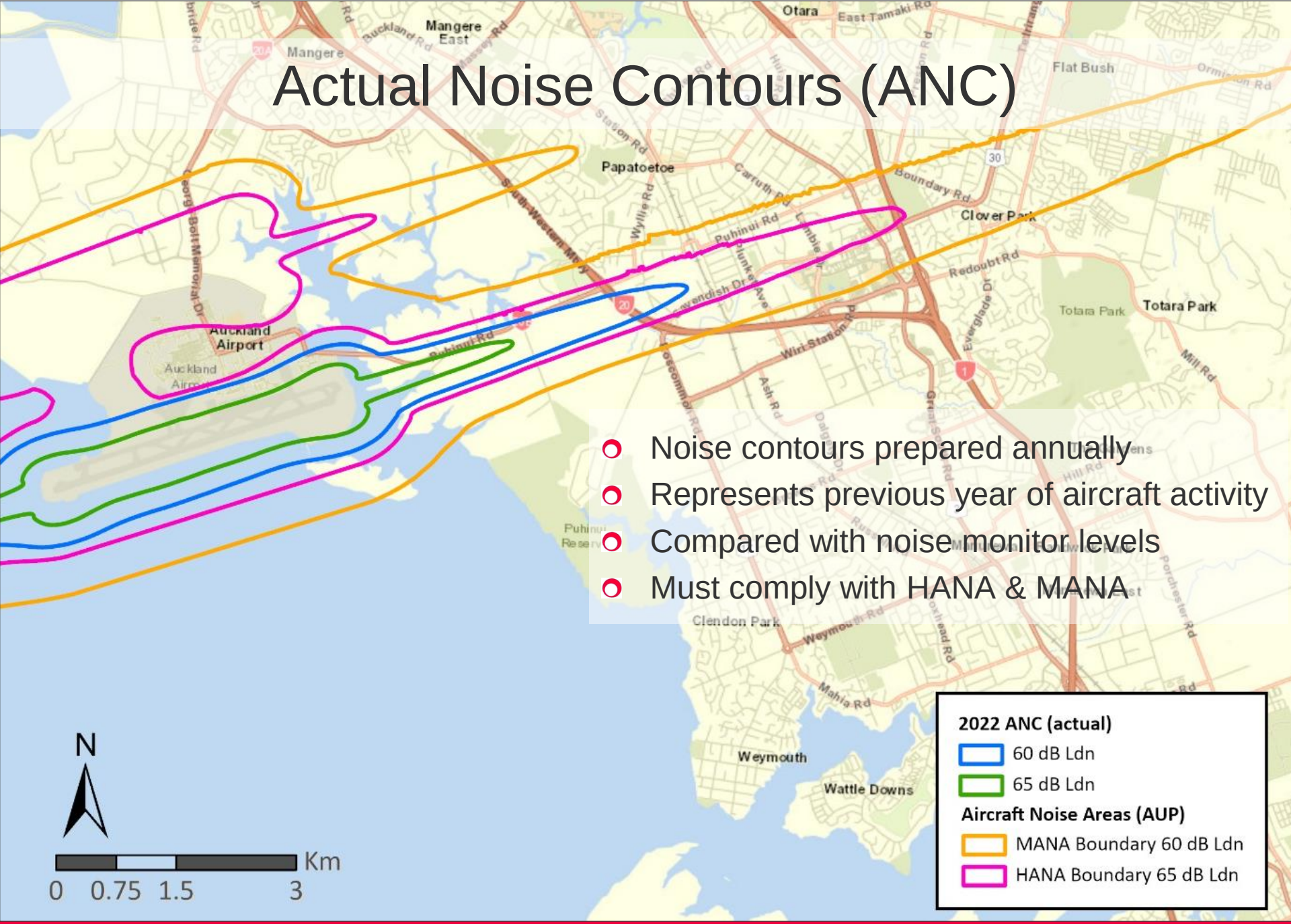
Actual Noise Contours (ANC)



- Noise contours prepared annually
- Represents previous year of aircraft activity
- Compared with noise monitor levels
- Must comply with HANA & MANA

AIAL – Land Use Planning

- Based on NZS 6805 principles
- Sound Insulation Rules
  - Sound insulation requirements for new dwellings
  - Sound insulation programme – existing dwellings

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Sound Insulation – New Dwellings

- Sound insulation requirements
  - **High Aircraft Noise Area (HANA)** – 65 dB L_{dn}

    Inside - New dwelling are prohibited

    Inside - Additions to existing dwellings are restricted discretionary subject to sound insulation
  - **Moderate Aircraft Noise Area (MANA)** – 60 dB L_{dn}

    Inside - New dwellings are permitted subject to sound insulation

    Inside - Additions to existing dwellings are permitted subject to sound insulation

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Sound Insulation Programme - Existing Dwellings

- Applies to existing dwellings only (circa 2002)
- Noise contours calculated for forthcoming financial year
- Homes within MANA & HANA offered sound insulation if currently exposed to > 60 dB L_{dn}

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Sound Insulation Requirements

- Sound insulation must ensure an internal noise level of **40 dB L_{dn}** or less in habitable rooms and sleeping areas and rooms for convalescing and learning
- Windows must be closed to meet the internal noise limit, thus ventilation must also be provided to ensure compliance with the Building Code

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Questions?