Acoustics
Vibration
Structural Dynamics

PROPOSED HELICOPTER LANDING FACILITY, 35 - 39 PORT STREET, PORT DOUGLAS (LOT 11 SP273000)

Noise Impact Assessment

26 November 2021

Planz Town Planning

QC416-01F02 Noise Report (r1).docx

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Executive summary

Morris Aviation Australia (Nautilus Aviation) proposes to construct a Helicopter Landing Site (HLS) at 35 – 39 Port Street, Port Douglas. The Real Property Description is Lot 11 on SP273000. The total area of the site is 4,915m^2 and located in an Industry zone. The location is shown in Figures 1 and 2.

Douglas Shire Council is the local regulatory authority. An application for this development has been lodged with Council [Reference MCUI2021_4231/1].

The purpose of this report is to assess potential noise impact from the operation of the proposed HLS on existing and future noise-sensitive uses in the surrounding area.

The assessment has been carried out in accordance with the following Guidelines and Standards:

- Draft Environment Guideline: Helicopter Landing Sites, prepared by the Queensland Environmental Protection Agency (now known as Queensland Department of Environment and Science or DES);
- Superseded Australian Standard AS2363-1990 Acoustics – Assessment of Noise from Helicopter Landing Sites;
- Current Australian Standard AS2363-1999 Acoustics – Measurement of Noise from Helicopter Operations, and;
- Victorian Department of Planning and Community Development and the Noise Control Guidelines (Publication 1254).

The Guidelines and Standards provide guidance by setting an upper noise limit (highest allowable helicopter noise level) and also by capping the number of helicopter movements in any one day.

Operational movements are expected to comply at all noise sensitive receivers with the EPA's Draft Daytime Noise Limit of 82dBA L_{Amax} (Hel) and 85dBA Max L_{pA} (Hel). Operational movements are also expected to comply with Australian Standard AS2363-1990 of 85dBA L_{Amax} (Hel). Refer to Table 2 in Section 4 for locations of the nearest noise sensitive receivers.

Operational movements are expected to comply at all noise sensitive receivers with the EPA's Draft Daytime Noise Limit of 55dBA $L_{Aeq,\ 0700-1900\ (Hel)}$ for less than 40 movements per day. Operational movements are expected to comply at all noise sensitive receivers with Australian Standard AS2363-1990 of 58dBA $L_{Aeq,\ 0700-1900\ (Hel)}$.

This study has relied on various advice provided by the proponents in relation to the operation of the proposed helicopter landing site. The validity of the study and its conclusions depend to a significant degree to an adherence of these operational parameters. It is therefore considered appropriate to set the following conditions for the use of the proposed facility:

- Nautilus Aviation have indicated an upper limit of 24 flight movements in any one day rather than the maximum 40 flight movements in any one day. A flight movement being defined as either one takeoff or one landing operation.

- All site activities including ground running of aircraft shall occur only between the hours of 7am to 7pm;

- The site shall be used by an Airbus H130 (formerly Eurocopter EC130B4 & T2) helicopter and Robinson 44 helicopter, or by aircraft with certified lower noise levels;

- Pilots shall adhere to the recommendations contained within the Fly Neighborly Guide and employ all noise abatement recommendations specific to the Airbus H130 and Robinson 44 helicopters. Refer to Appendix E of this report for the Fly Neighborly Guide, and;

- Landing and Departure approaches shall only follow the path generally as shown in Appendix B of this report.

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1 Introduction

Morris Aviation Australia (Nautilus Aviation) proposes to construct a Helicopter Landing Site (HLS) at 35 – 39 Port Street, Port Douglas. The Real Property Description is Lot 11 on SP273000. The total area of the site is 4,915m^2 and located in an Industry zone. The location is shown in Figures 1 and 2.

Douglas Shire Council is the local regulatory authority. An application for this development has been lodged with Council [Reference MCUI2021_4231/1].

The purpose of this report is to assess the noise impacts from the operation of the proposed HLS on existing and future noise-sensitive uses in the surrounding area.

The assessment has been carried out in accordance with the Draft Environment Guideline: Helicopter Landing Sites, prepared by the Department of Environment & Heritage (now known as the Department of Environment and Science). The assessment also makes reference to the superseded Australian Standard AS2363-1990 Acoustics – Assessment of Noise from Helicopter Landing Sites and current Australian Standard AS2363-1999 Acoustics – Measurement of Noise from Helicopter Operations.

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001. Appendix A contains a glossary of acoustic terms used in this report.

2 Proposed Site

Aerial photographs of the site and surrounding land are shown in Figures 1 and 2.

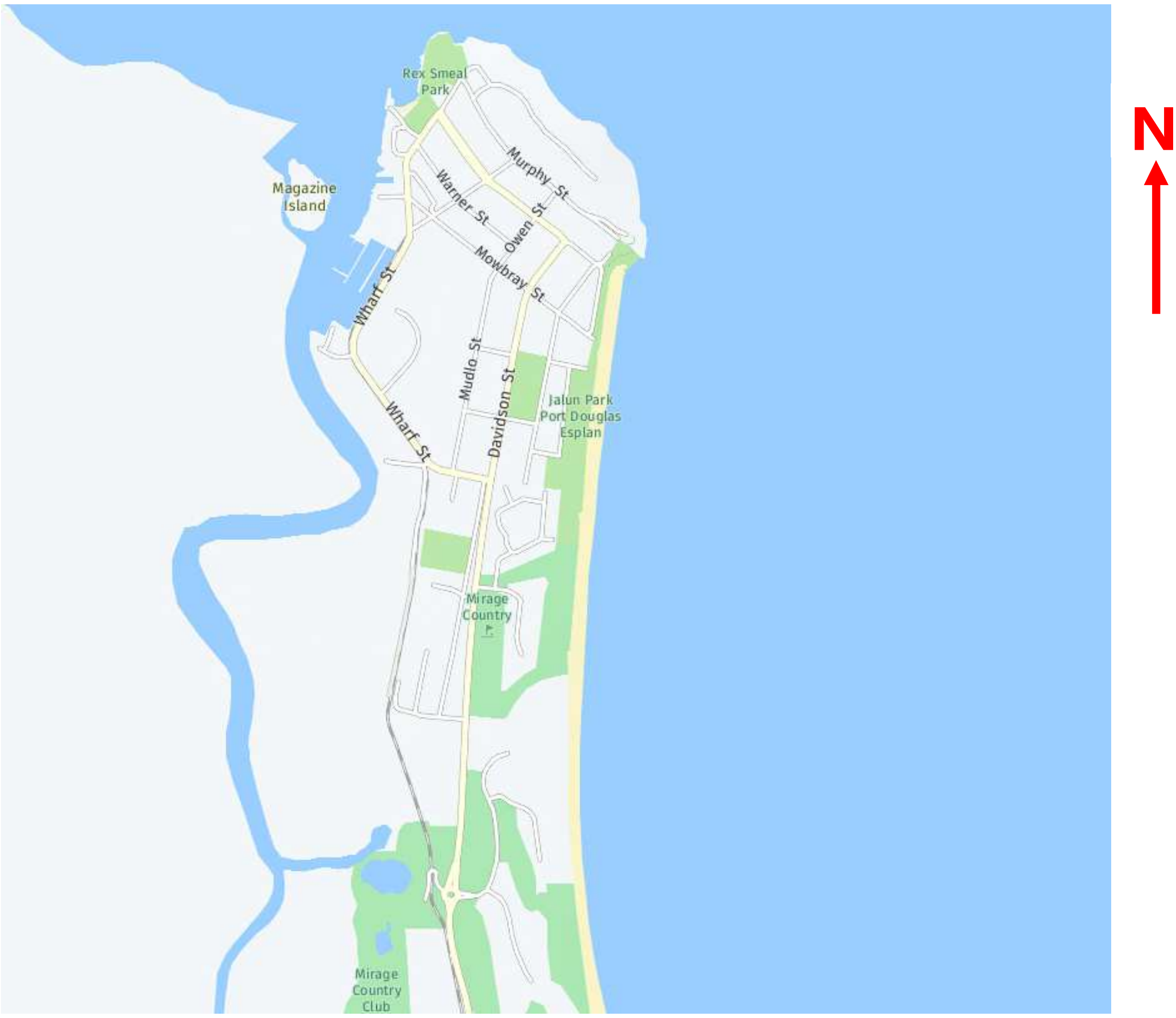

Figure 1 – Proposed Helipad Landing Facility location (35 – 39 Port Street Port Douglas Lot 11 SP273000)

Figure 2 – Proposed Helicopter Landing Site location (35 – 39 Port Street Port Douglas Lot 11 SP273000)

Figure 3 shows the proposed HLS is located approximately 1450m North of the existing HLS.

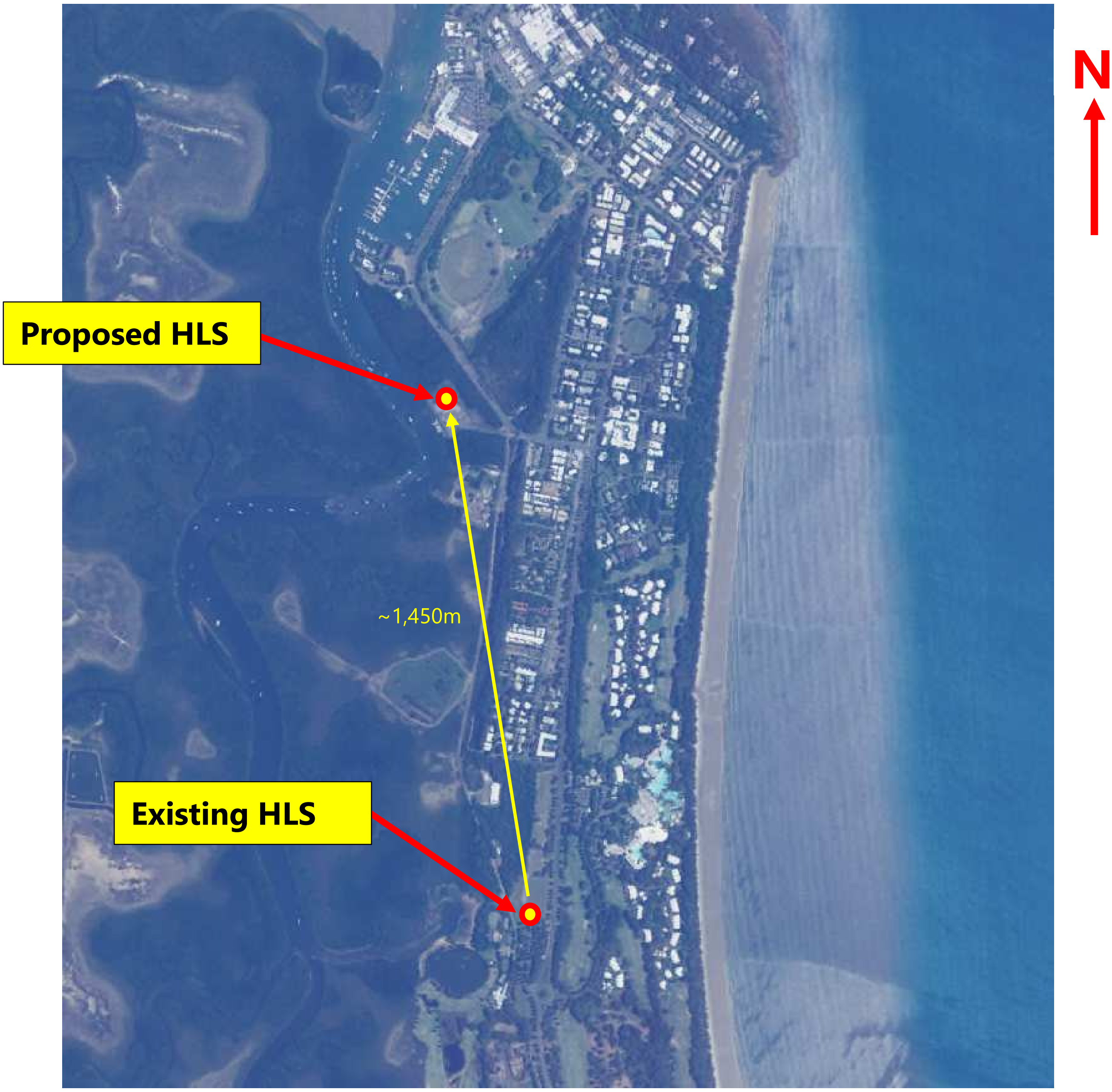

Figure 3 – Locations of Proposed HLS and existing HLS

Table 1 below presents GPS coordinates of existing and proposed Helicopter Landing Sites (HLS).

Table 1: Locations of Existing HLS and Proposed HLS

HLS Site Locations	GPS Locations (UTM co-ordinates, Zone 55K)
Proposed HLS	Easting: 335666.00mE Northing: 8176098.00mS
Existing HLS	Easting: 335891.00mE Northing: 8174655.00mS

3 Proposed Development

The layout of the site and the proposed HLS are shown in Figures 4 and 5. The proposed operational details include:

- Relocate the existing operation approximately 1,450m North of the existing HLS;
- The proposed HLS is for commercial use only;
- The helicopter models proposed for use onsite include an Airbus H130 (also identified as an Eurocopter EC130B4 & T2 helicopter) described as a light turbine engine aircraft capable of carrying the pilot and up to six passengers and Robinson 44 carrying the pilot and up to two passengers;
- Normally there will be no more than 40 flight movements per day; a flight movement being defined as either one takeoff or one landing operation;
- Operations of the HLS will be confined to daylight hours nominally hours 7am to 7pm;
- The helicopters will be based onsite in a hangar;
- Maintenance and repair of the helicopters will be undertaken offsite;
- The site will be made available in emergencies for medical transfers (rather than Mossman), aerial firefighting and search rescue operations;
- There will be no scheduled maintenance of the helicopter on the site. Unscheduled maintenance may be conducted from time to time if breakdowns occur, and;
- Flight operations at the site are to be carried out in accordance with the recommendations of the Fly Neighbourly Guide prepared by the International Helicopter Association.

Two flight paths are proposed for this development, namely the approach from the North-West and departure to the South of the HLS.

The proposed Airbus H130 and Robinson 44 helicopters are capable of changing altitude in very short distances. The legal height limit required by CASA to travel over populated areas is 1000 feet. After reaching 1000 feet the helicopter is to climb gradually up to 1500 feet or cruising altitude.

Figure 4 – Proposed Helipad Landing Facility location (35 – 39 Port Street Port Douglas Lot 11 SP273000)

Figure 5 – Proposed Helipad Landing Facility layout

Figure 6 presents an aerial view of the proposed flight paths.

Figure 6 – Proposed Approach and Departure Flight Paths

Nautilus Aviation currently operates two helicopter helicopters from the existing HLS. These include:

- Airbus H130 (also identified as an Eurocopter EC130B4 & T2 helicopter) described as a light turbine engine aircraft capable of carrying the pilot and up to six passengers, and;
- Robinson 44 carrying the pilot and up to two passengers.

Figures 7, 8, 9 and 10 present photographs of the two helicopters proposed to operate at the new HLS.

Figure 7 – Current Helicopter Fleet - Robinson 44 (shown at existing HLS#1)

Figure 8 – Current Helicopter Fleet - Robinson 44 (shown at existing HLS#1)

Figure 9 – Current Fleet - Robinson 44 (shown at existing HLS#1) & Airbus H130 (shown at existing HLS#2)

Figure 10– Current Helicopter Fleet - Airbus H130 (shown at Temporary HLS)

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4 Noise-Sensitive Land Uses

Douglas Shire Council is the regulatory authority for this site. Figure 11 shows Council's land zoning at the site and surrounding properties. (Source: https://douglas.qld.gov.au/download/planning-scheme/1.-Zoning-Maps-70K-1-to-11.pdf).

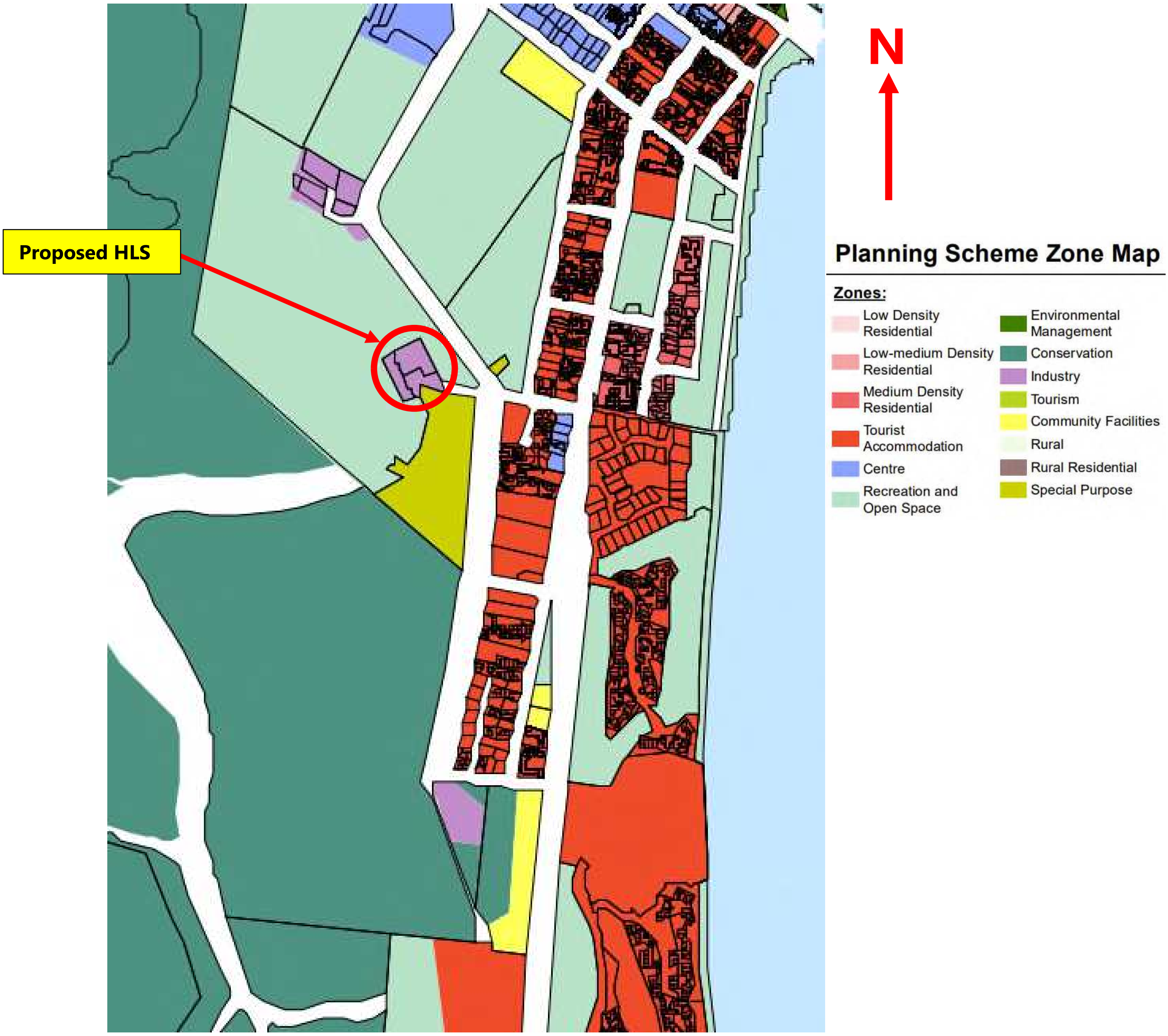


Figure 11 – Site Location & Land Zoning Map

Figure 11 shows the surrounding area potentially impacted by the HLS mostly lies within Tourist Accommodation and Medium Density Residential zoning.

Table 2 presents a list of the nearest noise sensitive residential receivers identified during our site inspections.

Table 2: Nearest Noise Sensitive Receivers (NSR's)

NSR's	Description (Residential Receivers)	Separation Distance to HLS (approx.)
NSR1 (Group) Refer to Figure 13	Coral Beach Lodge (1-7 Craven Close)	260
NSR2 (Group) Refer to Figure 14	3 Port Street	330
	Marlin Court Units (15 Craven Close)	340
	Port Colonial (13 Craven Close)	350
	79 Davidson Street	370
	81 Davidson Street	380
	83 Davidson Street	390
	85 Davidson Street	390
NSR3 (Group) Refer to Figure 15	Full Moon Terraces (9 Craven Close)	310
	11 Craven Close	360
	87-89 Davidson St	400
	Mango Tree Holiday Apartments (91-93 Davidson St)	340
NSR4 (Group) Refer to Figure 15	Lychee Tree Holiday Apartments (95 Davidson St)	360
	Pandanus Caravan Park (97 Davidson St)	400
NSR5 (Group) Refer to Figure 16	60-62 Mudlo Street	300
	58 Mudlo Street	305
	56 Mudlo Street (empty block)	310
	54 Mudlo Street	310
	52 Mudlo Street	310
	48 Mudlo Street	320
	Wayfarer Port Douglas (1 Blake Street)	330
	77 Davidson Street	360
	73-75 Davidson Street	355
	71 Davidson St	360
	67 Davidson St	360
	63-65 Davidson St	370
	59-61 Davidson St	380
NSR6 (Group) Refer to Figure 17	42 Mudlo St	360
	Sama Sama Tropical Apartment (40 Mudlo St)w	375
	36-38 Mudlo St	390
	32-34 Mudlo St	420
	30 Mudlo St	440
	28 Mudlo St	455
	26 Mudlo St	470
	24 Mudlo St	485

NSR's	Description (Residential Receivers)	Separation Distance to HLS (approx.)
	55-57 Davidson St	405
	Bay Villas Resort (53 Davidson St)	395
	Freestyle Resort (47 Davidson St)	450
	41 Davidson St	500
	39 Davidson St	515

Figure 12 shows an aerial view of the proposed HLS and nearest noise sensitive receivers (NSR's).

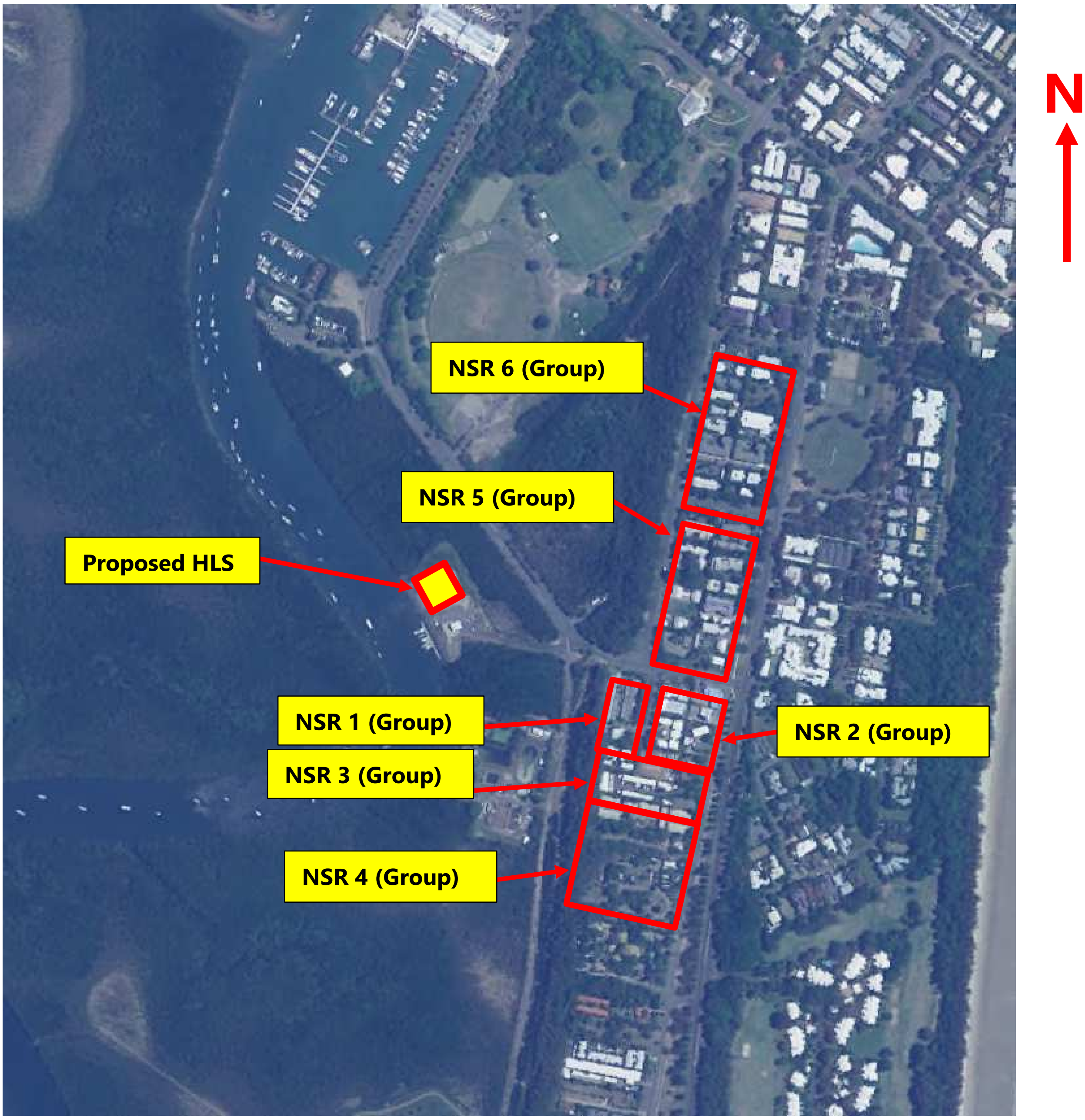


Figure 12 – Aerial View of Proposed Helicopter Landing Site (HLS) and NSR Groups

Figures 13, 14, 15, 16 and 17 show the nearest noise sensitive receivers (NSR's) selected in this report for assessment purposes.

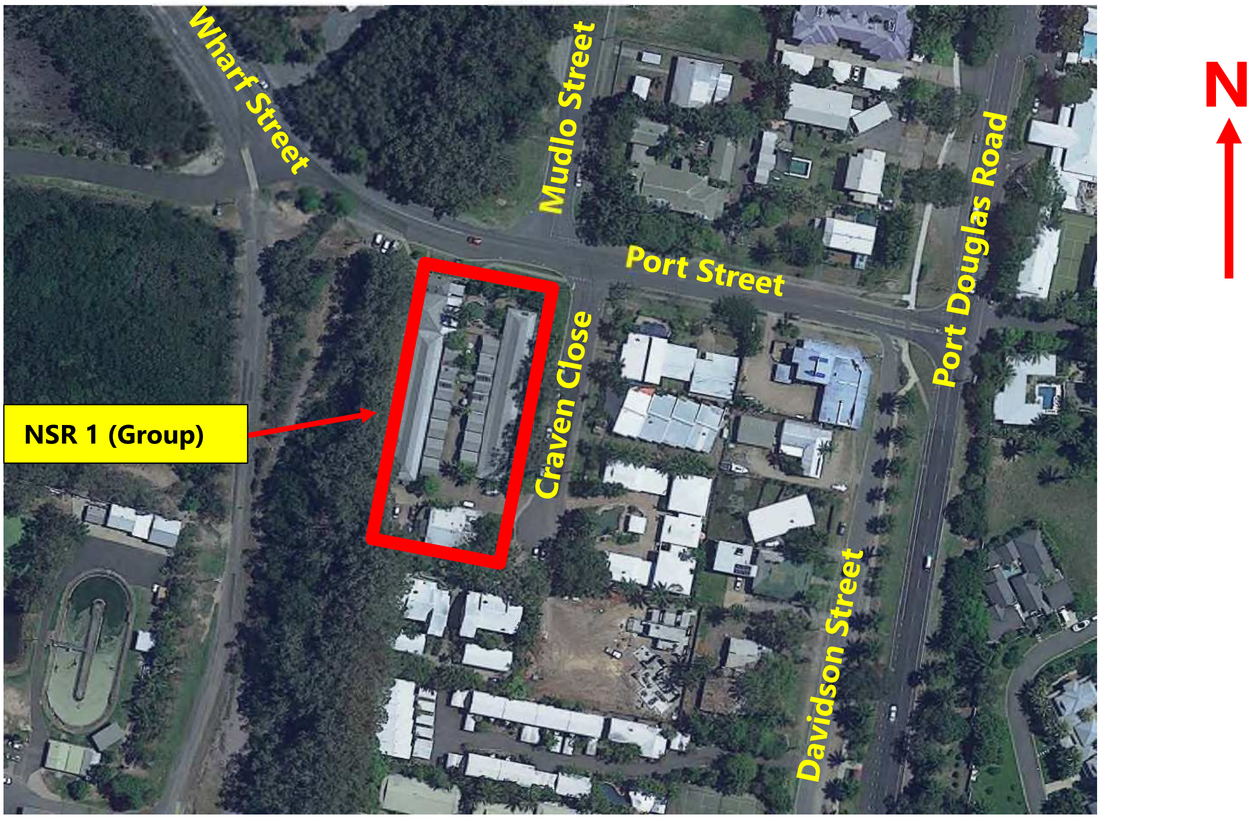


Figure 13 – Nearest Noise Sensitive Residential Receivers [NSR 1 (Group)]

Figure 14 – Nearest Noise Sensitive Residential Receivers [NSR 2 (Group)]

Figure 15 – Nearest Noise Sensitive Residential Receivers [NSR 3 (Group) and NSR 4 (Group)]

Figure 16– Nearest Noise Sensitive Residential Receivers [NSR 5 (Group)]

Figure 17 – Nearest Noise Sensitive Residential Receivers [NSR 6 (Group)]

5 Noise Criteria

The proposed development constitutes an environmentally relevant activity (ERA), however responsibility for the ERA has been devolved to the Local Authority namely Douglas Shire Council. Referral to the Department of Environment and Science (formerly known as the Environmental Protection Agency) as a concurrence agency is not required for this development.

Guidance for suitable noise criteria have therefore been taken from the following documents:

1. Douglas Shire Council Planning Scheme 2018;
2. Draft Environment Guideline: Helicopter Landing Sites prepared by the Queensland Environmental Protection Agency (now known as Queensland Department of Environment and Science or DES);
3. Australian Standard AS2363-1990 Acoustics – Assessment of Noise from Helicopter Landing Sites (superseded);
4. Australian Standard AS2363-1999 Acoustics –Measurement of Noise from Helicopter Operations (withdrawn); and
5. Victorian Department of Planning and Community Development and the Noise Control Guidelines (Publication 1254).

5.1 Douglas Shire Planning Scheme 2018

Douglas Shire Council has no specific criteria for noise from Helicopter Landing Sites (HLS).

Table 9.4.3.3.a – Environmental performance code – assessable development in Section 9.4.3.3 Criteria for assessment of the Douglas Shire Planning Scheme 2018 nominates the following general information relating to noise impacts from a new development.

Table 3: Environmental performance code – assessable development (extract from Section 9.4.3.3 of Douglas Shire Planning Scheme 2018)

Performance Outcomes	Acceptable Outcomes
PO2 Potential noise generated from the development is avoided through design, location and operation of the activity. Note – Planning Scheme Policy SC6.4 – Environmental management plans provides guidance on preparing a report to demonstrate compliance with the purpose and outcomes of the code.	AO2.1 Development does not involve activities that would cause noise related environmental harm or nuisance; or AO2.2 Development ensures noise does not emanate from the site through the use of materials, structures and architectural features to not cause an adverse noise impact on adjacent uses. AO2.3 The design and layout of development ensures car parking areas avoid noise impacting directly on adjacent sensitive land uses through one or more of the following: (a) car parking is located away from adjacent sensitive land uses; (b) car parking is enclosed within a building; (c) a noise ameliorating fence or structure is established adjacent to car parking areas where the fence or structure will not have a visual amenity impact on the adjoining premises; (d) buffered with dense landscaping. Editor's note - The Environmental Protection (Noise) Policy 2008, Schedule 1 provides guidance on acoustic quality objectives to ensure environmental harm (including nuisance) is avoided.

5.2 Draft EPA Document

The Draft Environmental Guideline Helicopter Landing Sites has remained in draft format since 1993. We understand that it is unlikely this document will be updated or finalised in the near future. Nevertheless, we have obtained guidance from this document in the absence of more recent information issued by the Department of Environment and Science (DES) or Douglas Shire Council.

The Draft Environmental Guideline presents a range of daytime noise limits depending on whether the helicopter is used for commercial or private use. Daytime is defined under the guideline as 7am to 7pm.

Table 3 of the Guideline sets noise limits according to the location and type of use of the HLS. The following table presents daytime noise limits at neighbouring commercial and residential land areas.

Table 4 - Daytime Noise Limits – Commercial / Private Daytime Use, dBA

HLS Receptor	LAeq (Hel)	LAmax (Hel)	Max LpA (Hel)
Commercial Area	65	90	93
Noise Sensitive Area - Helipad greater than 10 movements a day	55[1,2,3]	82	85
Noise Sensitive Area - Helipad less than 10 movements a day	55[1,2,3]	85	88

Notes:

1. Where existing ambient noise LAeq,T (Amb) is 53dBA or greater, criterion becomes ambient Leq + 2dBA.
2. Where existing ambient noise LAeq,T (Amb) is less than 45dBA the criterion becomes ambient Leq + 5dBA.
3. The superseded Australian Standard AS 2363 -1990 states that for residential and hospital areas LAeq,T (Amb) + 10dBA can be used instead of LAeq (Hel) if the LAeq,T (Amb) + 10dBA is lower.

The following definitions are briefly explained:

Flight movements: A flight movement is either one takeoff or one landing.

Operational modes: These may include operational activities in the takeoff, landing, hovering and idling functions of a helicopter.

Landing: The lowering of a helicopter to bring in contact with surface, including the final landing manoeuvres.

Lift-off: The rising of a helicopter into the air.

Takeoff: Acceleration to and commencement of safe climbing speed including the lift -off manoeuvres.

LAeq (Hel) is defined as the daily average noise level. It is measured as the equivalent continuous A-weighted sound pressure level and includes ambient plus helicopter noise contributions.

LAmax (Hel) is defined as the logarithmic average of the maximum recorded noise levels for a number of repetitions of a particular operational mode such as a takeoff, landing or overflight. Different modes will each have a different LAmax (Hel) value.

Max LpA (Hel) is defined as the absolute maximum noise level for all operational modes and all types of aircraft.

Noise sensitive areas: Measurement locations for urban areas are at the property boundary.

Noise sensitive premises: In all cases noise sensitive premises are defined as residences or dwellings.

Helicopter Landing Site (HLS): An existing or proposed area used by helicopters when landing or taking off. This term includes sites known as helipads.

5.3 Australian Standard AS2363

Australian Standard AS2363-1999 Acoustics –Measurement of Noise from Helicopter Operations (withdrawn) provides methods for measurement of noise impact from helicopter operations. The standard states that it '*does not provide an evaluation of the noise compatibility of sites considered for helicopter operation as criteria for the assessment of helicopter sites are governed by the environmental authority in each State*.' The methodology described in the Australian Standard AS2363-1999 was used to measure noise levels from helicopter operations at the proposed site. These noise measurements and results are described in Sections 6 and 7 of this report.

Australian Standard AS2363-1990 Acoustics – Assessment of Noise from Helicopter Landing Sites (superseded) provides methods for measurement of noise impact from helicopter operations. In addition, this superseded standard also provides guidelines for assessing the compatibility of helicopter landing sites and various land-uses. The 1999 standard has removed all references to the 'guidelines for assessing compatibility' previously shown in Appendix A of AS2363-1990. Nevertheless, we have obtained guidance from this superseded document in the absence of more recent information issued by the DES or Douglas Shire Council. It is also noted that the Draft Environmental Guideline references the superseded AS2363-1990.

Appendix A, Table A1 of the superseded AS2363-1990 recommends acceptability criteria for 12-hour periods. The following table presents daytime and night time noise limits at neighbouring land areas.

Table 5 – Daytime & Night time Noise Limits – Commercial / Private Use, dB

Usage of Premises & Zoning	LAeq, T (Hel)		LAmax (Hel)	
	Daytime	Night time	Daytime	Night time
Residential and hospital areas	60[1]	50[1]	85	80
Commercial Areas	65	65	95	90
Other areas (churches, schools, theatres etc.)	60	60	90	90

Notes:

1. For these area classifications, LAeq,T (Amb) + 10dBA can be used instead of LAeq (Hel) if the LAeq,T (Amb) + 10dBA is lower.
2. In the absence of further information, daytime is understood to be between 0700 hours and 1900 hours and night time between 1900 hours and 0700 hours.
3. If the existing ambient level exceeds the LAeq level specified in the table, the introduction of helicopter operations should not raise the level by more than 2dBA

5.4 EPA Victoria

Consideration was also given to noise guidelines and/or legislation used in other jurisdictions to limit noise from helicopter movements. Reference is made to the following documents:

- Planning requirements for heliports and helicopter landing sites (Practice Note 75, December 2012) published by the Victorian Department of Planning and Community Development; and
- Noise Control Guidelines (Publication 1254) published by EPA Victoria.

Review of these documents confirms that, for heliports located closer than 500 m from a building used for a sensitive use, planning approval is required. In applying for planning approval, the applicable noise limits are provided in Section 16 of the Noise Control Guidelines as follows:

The measured LAeq,T (measured over the entire daily operating time of the helipad) shall not exceed 55 dB(A) for a residence.

The measured maximum noise level LAmax shall not exceed 82 dB(A) at the nearest residential premises (See Note Below).

Operation outside the hours between 7 am and 10 pm shall not be permitted except for emergency flights.

Note: These levels will generally be met by a separation distance between the landing site and the residential premises of 150 m for helicopters of less than two tonnes all-up-weight, and 250 m for helicopters of less than 15 tonnes all-up-weight.

Comparison of the noise limits adopted by both the draft Queensland guideline and the Victorian Noise Control Guidelines indicates they seek to achieve consistent outcomes.

This finding is considered to be consistent with the Victorian Noise Control Guideline which notes that compliance with the maximum noise level L_{Amax} limit should be achieved at distances of 150 m for helicopters of less than two tonnes all-up weight.

Review of the specifications for the Airbus H130 indicates it has a maximum take-off weight of 1.36 tonnes and Robinson R44 has a maximum take-off weight of 0.66 tonnes. The nearest sensitive receiver is located approximately 260m from the proposed HLS.

That is, according to the Victorian Noise Control Guidelines, the measured maximum noise level LAmax of 82 dB(A) at the nearest residential premises would be satisfied based on both the proposed maximum take-off weight and separation distance.

6 Ambient Noise Measurements

Typical ambient noise levels in the area, environmental noise logging was conducted over several days between Friday 10th and Saturday 25th September 2021.

The location of the noise logger was selected in bushland, close to the nearest residential receivers. The location of the noise logger is shown in Figure 18. This location was selected due to security concerns for the sensitive equipment.

The noise logger was set to measure noise levels at the site over 15-minute intervals. The microphones were positioned at a height of 1.5m above the ground level.

The test instrumentation consisted of:

- *Noise Logger L1*: RTA05, NTi-XL2 (S/N: A2A-02422-D0, FW2.72);
- *Acoustical Calibrator*: B&K 4230 (S/N 1206747).

The noise logger was calibrated before and after the noise monitoring period using a Bruel and Kjaer Type 4230 calibrator. No significant drift in calibration was observed.

Table 6 and Figure 18 present the noise monitoring of Location L1.

Table 6: Ambient Noise Monitoring Location

Monitoring Location	Sound Level Meter	Monitoring Position (UTM co-ordinates)
Location L1	NTi XL2 logger S/N 02422	Easting: 335859.00mE Northing: 8176159.00mS

Figure 18– Noise Logger Location L1 (Easting: 335859.00mE Northing: 8176159.00mS)

Figure 19– Logger Location L1 (Easting: 335859.00mE Northing: 8176159.00mS)

Weather information was obtained from Cairns Weather Station for the monitoring period Friday 9th to Saturday 25th September 2021. The meteorological conditions were generally conducive for measuring noise under typical conditions.

Some rainfall and light breezes (less than 5 metres per second [m/s]) were observed during the monitoring period. Noise data acquired during days that may have experienced wind conditions greater than 5 m/s conditions were compared to the data acquired during fine periods and where the data was found to be affected by adverse weather conditions, it was discarded from further analysis.

The results of the ambient noise logging are presented graphically in Appendix D.

Table 7 presents a summary the existing ambient noise daytime LAeq,T (Amb) between 7am and 7pm based on 16 days of data.

Table 7: Ambient Noise Monitoring Results (7am to 7pm)

Day	September 2021	LAeq,T (Amb) where T = 7am to 7pm
1	Friday 10th	49*
2	Saturday 11th	51
3	Sunday 12th	49
4	Monday 13th	49
5	Tuesday 14th	49
6	Wednesday 15th	50
7	Thursday 16th	49
8	Friday 17th	50
9	Saturday 18th	51
10	Sunday 19th	48
11	Monday 13th	49
12	Tuesday 14th	49
13	Wednesday 15th	51
14	Thursday 16th	50
15	Friday 17th	50
16	Saturday 18th	50*
Logarithmic Average (of all 15 minute intervals)		48

Note: *partial day (3 hours of monitoring)

Table 7 shows the results of unattended noise monitoring at Location L1 determined a representative ambient noise level of L_{Aeq}, T (Amb) = 48dBA daytime between 7am and 7pm.

A suitable LAeq (Hel) may be determined from the representative ambient noise level of L_{Aeq}, T (Amb) = 48dBA.

Table 8 presents Daytime Noise Limits based on Draft EPA document (refer to Section 5.2 of this report) for residential receivers.

Table 8 - Daytime Noise Limits based on Draft EPA document – Residential Receivers, dBA

HLS Receptor	LAeq (Hel)	LAmax (Hel)	Max LpA (Hel)
Noise Sensitive Area - Helipad greater than 10 movements a day	55	82	85

Table 8 shows a daytime noise limit of 55dB LAeq (Hel) based over 12 hours (7am to 7pm) and an average maximum noise level of 82dB LAmax (Hel) and highest maximum noise level of 85dB Max LpA (Hel).

Table 9 presents Daytime Noise Limits based on Australian Standard AS2363 1990 (refer to Section 5.3 of this report) for residential receivers.

Table 9 - Daytime Noise Limits based on AS2363-1990 – Residential Receivers, dBA

HLS Receptor	LAeq (Hel)	LAmax (Hel)	Max LpA (Hel)
Noise Sensitive Area - Helipad greater than 10 movements a day	48 + 10 = 58	85	-

Table 9 shows a daytime noise limit of 58dB LAeq (Hel) based over 12 hours (7am to 7pm) and an average maximum noise level of 85dB LAmax (Hel).

Table 10 presents Daytime Noise Limits based on Victorian Noise Control Guidelines document (refer to Section 5.4 of this report) for residential receivers.

Table 10 - Daytime Noise Limits based on Draft EPA document – Residential Receivers, dBA

HLS Receptor	LAeq (Hel)	LAmax (Hel)	Max LpA (Hel)
Noise Sensitive Area - Helipad greater than 10 movements a day	55	82	-

Table 10 shows a daytime noise limit of 55dB LAeq (Hel) based over 12 hours (7am to 7pm) and an average maximum noise level of 82dB LAmax (Hel).

7 Helicopter Noise Measurements

Inspections of the site and surrounding area was conducted on Friday 10th, Tuesday 28th and Wednesday 29th September 2021.

Noise measurements of typical operational modes were recorded for the Airbus H130 and Robinson 44 helicopters on the following dates:

Friday 10th September	Measurements of R44 at existing HLS;
Tuesday 28th September	Measurements of R44 at existing HLS and measurements of H130 at the proposed HLS (temporary HLS), and;
Wednesday 29th September	Measurements of R44 and H130 at existing HLS.

All noise measurements followed the methodology presented in Australian Standard AS2363-1999 *Acoustics – Measurement of Noise from Helicopter Operations*. These included recording four individual discrete samples of the four operational modes (ie approach, hover, idle and departure). Each individual discrete sample was recorded over a time period which was at least the duration for which the sound level of the helicopter was within 10dBA of the L_{Amax} for that event.

7.1 Noise Measurement Equipment

The equipment used for the noise measurements included NTi XL2 precision sound level analysers. Statistical noise levels were acquired in both overall and one third octave band frequencies.

A noise logger consists of a sound level meter and a computer housed in a weather resistant enclosure. Ambient noise levels were recorded at a rate of 10 samples per second. Every 15 minutes, the data is processed statistically and stored in memory.

The equipment used for noise measurements were class 1 instruments having accuracy suitable for field and laboratory use.

The instrument was calibrated prior and subsequent to measurements using a Larson Davis / NTi Type CAL200 calibrator. No significant drift in calibration was observed. All instrumentation complies with AS/NZS International Electrotechnical Commission (IEC) 61672.1:2019 *Electroacoustics – Sound Level Meters* and carries current National Association of Testing Authorities, Australia (NATA) certification (or if less than 2 years old, manufacturer's certification).

All noise monitoring was conducted in accordance with Australian Standard AS1055-2018 "*Acoustics – Description and Measurement of Environmental Noise*" and the Department Environment and Science *Noise Measurement Manual March 2020*.

7.2 Noise Measurements at Proposed HLS

Noise measurements of the Airbus H130 were conducted at the proposed HLS between 4pm and 5pm on Tuesday 28th September 2021. For the purposes of this report the will be referred to as the Temporary HLS.

Noise measurements were selected close to noise sensitive receivers, away from the take-off / landing position in order to minimise effects of downwash drafts.

Table 11 presents noise measurement locations around the temporary HLS.

Table 11: Noise Monitoring Locations around the Temporary HLS

Monitoring Location	Sound Level Meter	Monitoring Position (UTM co-ordinates, Zone 55K)
Location S1	NTi XL2 logger S/N 16117	Easting: 335685.00mE Northing: 8175610.00mS
Location S2	NTi XL2 logger S/N 13505	Easting: 335711.00mE Northing: 8176019.00mS
Location S3	NTi XL2 logger S/N 15538	Easting: 335849.00mE Northing: 8175983.00mS
Location S4	NTi XL2 logger S/N 18950	Easting: 335936.00mE Northing: 8175968.00mS
Location S5	NTi XL2 logger S/N 02422	Easting: 335967.00mE Northing: 8176059.00mS
Location S6	NTi XL2 logger S/N 03909	Easting: 335816.00mE Northing: 8175610.00mS
Location S7	NTi XL2 logger S/N 15733	Easting: 335648.00mE Northing: 8176379.00mS

The microphones were positioned 1.5m above ground level, on relatively flat ground and where possible greater than 4m away from any reflective surfaces (ie free field).

The following measurement locations were selected:

Location S1 - ~ 45m SSE of the temporary HLS, unattended noise logger, measure operational modes (takeoff, landing, hovering and idling functions);

Location S2 – ~ 90m SSE of the temporary HLS, operator attended location, measure operational modes (takeoff, landing, hovering and idling functions);

Location S3 – ~ 215m SE of the temporary HLS, unattended noise logger, measure operational modes (takeoff, landing, hovering and idling functions);

Location S4 – ~ 300m SE of the temporary HLS operator attended location, measure operational modes (takeoff, landing, hovering and idling functions);

Location S5 – ~ 300m E of the temporary HLS, unattended noise logger, measure operational modes (takeoff, landing, hovering and idling functions);

Location S6 – ~ 500m SSE of the temporary HLS, unattended noise logger, measure operational modes (takeoff, landing, hovering and idling functions);

Location S7 – ~ 280m N of the temporary HLS, unattended noise logger, measure operational modes (takeoff, landing, hovering and idling functions).

Figures 20 to 27 show the seven (7) measurement locations selected around the temporary HLS.

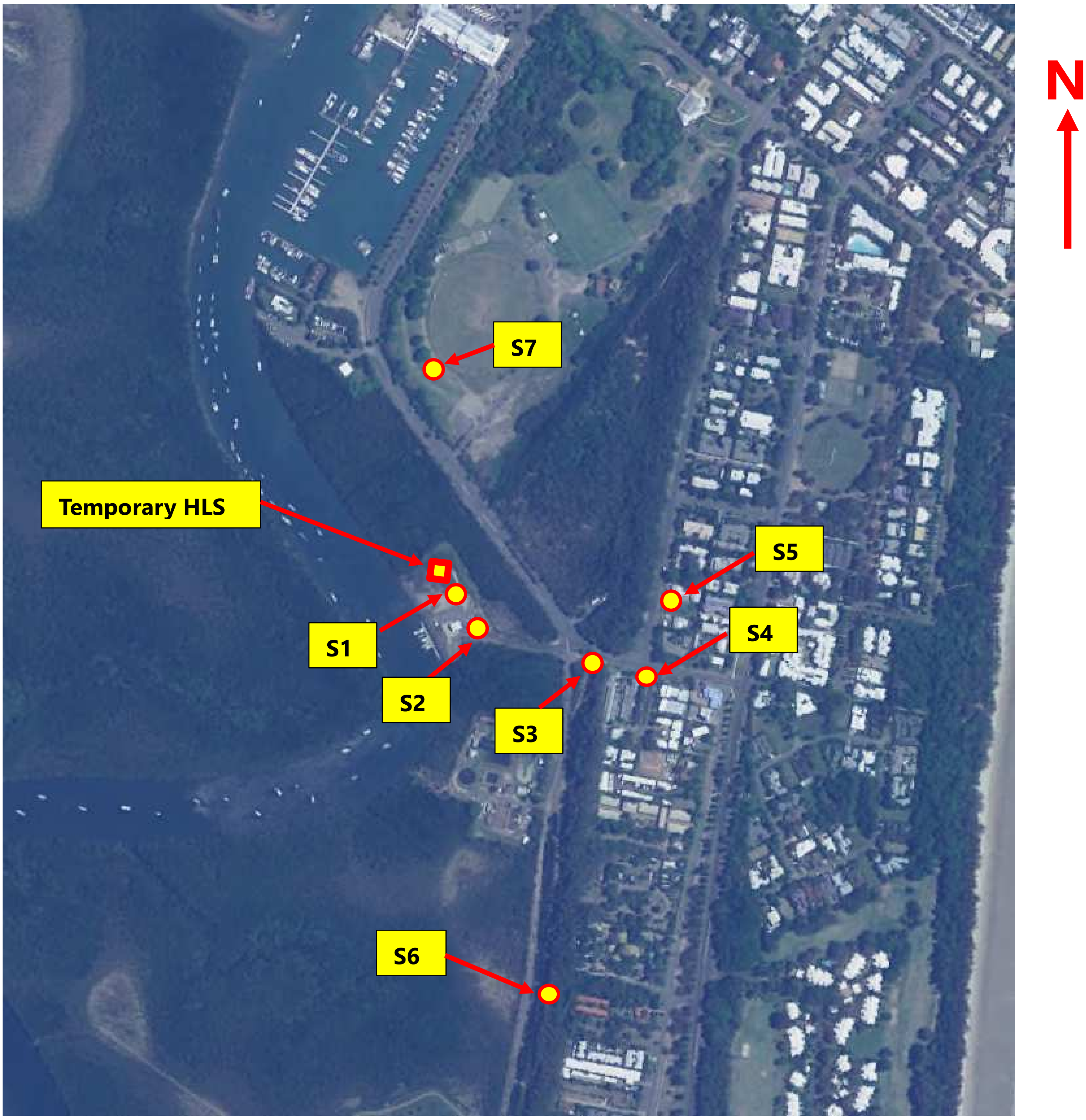


Figure 20– Noise Measurement Locations around temporary HLS

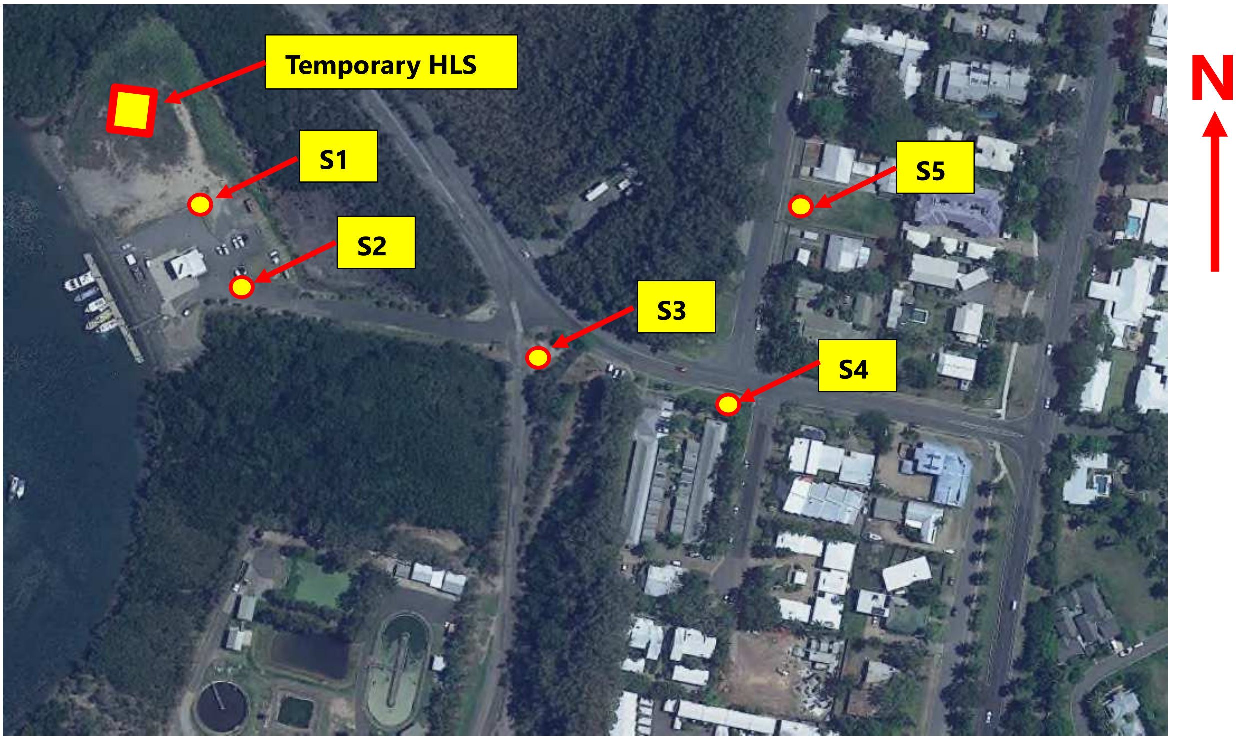


Figure 21 – Noise Measurement Locations around temporary HLS

Figure 22– Noise Monitoring Location S1

Figure 23– Noise Monitoring Location S2 (view towards Temporary HLS)

Figure 24– Noise Monitoring Location S3 (view towards Temporary HLS)

Figure 25– Noise Monitoring Location S4

Figure 26 – Noise Monitoring Location S5

Figure 27– Noise Monitoring Location S7 (view towards Temporary HLS)

Note no photo was available for Location S6 located in bushland close to NSR 4 (Group).

7.3 Measurement Results

The following tables present noise measurements from operational modes conducted at the seven spot locations around the temporary HLS. Discrete samples of the four operational modes (ie approach, hover, idle and departure) were recorded for the proposed corridor flight path.

Tables 12 to 19 present L_{Amax} and L_{AE} noise levels measured at Locations S1 to S7 during helicopter operational movements. The helicopter approached and departed as shown in Figure 6 during measurements. Refer to Figure 20 for an aerial view of Locations S1 to S7 in relation to the temporary HLS.

Table 12 – Airbus H130 Departure L_{Amax} noise levels measured at Locations S1 to S7, dB

Test	S1	S2	S3	S4	S5	S6	S7
Sample 1	94	90	75	75	62	71	65
Sample 2	95	91	74	74	59	71	65
Sample 3	95	92	76	78	61	66	68
Sample 4	93	89	75	74	58	65	68
Sample 5	94	88	77	75	59	65	66
Sample 6	97	87	75	77	59	68	65

Test	S1	S2	S3	S4	S5	S6	S7
LAmax (Hel) Energy Average	95	89	76	76	60	69	66
Max LpA (Event)	97	92	77	78	62	71	68

Table 13 – Airbus H130 Approach L_{Amax} noise levels measured at Locations S1 to S7, dB

Test	S1	S2	S3	S4	S5	S6	S7
Sample 1	94	89	66	-	-	52	69
Sample 2	91	88	69	66	53	50	69
Sample 3	92	91	66	70	55	57	71
Sample 4	93	87	67	69	54	51	71
Sample 5	92	85	69	72	57	51	72
Sample 6	93	-	67	69	56	54	70
LAmax (Hel) Energy Average	92	88	68	70	54	53	70
Max LpA (Event)	94	91	69	72	57	57	72

Table 14 – Airbus H130 Hover at 3m L_{Amax} noise levels measured at Locations S1 to S7, dB

Test	S1	S2	S3	S4	S5	S6	S7
Sample 1	95	89	64	70	55	51	70
Sample 2	94	89	65	64	61	51	67
Sample 3	96	90	67	68	56	51	71
Sample 4	94	87	68	67	56	51	69
Sample 5	96	87	-	-	65	51	74
LAmax (Hel) Energy Average	95	88	66	68	60	51	71
Max LpA (Event)	96	90	68	70	65	51	74

Table 15 – Airbus H130 Idling L_{Amax} noise levels measured at Locations S1 to S7, dB

Test	S1	S2	S3	S4	S5	S6	S7
Sample 1	83	81	56	74*	61	49	56
Sample 2	82	83	58	72*	51	48	55
Sample 3	86	86	56	76*	56	47	57
Sample 4	84	80	55	76*	64	47	55
Sample 5	83	80	53	-	50	49	64
Sample 6	86	79	55	-	54	48	73
Sample 7	86	82	65	-	54	50	55
Sample 8	85	81	59	-	50	48	58
LAmax (Hel) Energy Average	84	81	59	75	58	48	65
Max LpA (Event)	86	86	65	76	64	50	73

Table 16 – Airbus H130 Departure L_{AE} noise levels measured at Locations S1 to S7, dB

Test	S1	S2	S3	S4	S5	S6	S7
Sample 1	100	99	82	82	71	75	74
Sample 2	102	98	79	77	68	75	74
Sample 3	101	97	82	80	70	73	75
Sample 4	102	98	80	77	68	73	76
Sample 5	101	97	81	81	68	73	74
Sample 6	102	97	80	77	68	72	76
LAE (Hel) Energy Average	101	98	81	79	69	74	75

Table 17 – Airbus H130 Approach L_{AE} noise levels measured at Locations S1 to S7, dB

Test	S1	S2	S3	S4	S5	S6	S7
Sample 1	103	95	78	-	-	67	80
Sample 2	102	97	76	75	64	62	78
Sample 3	101	96	77	79	65	64	80
Sample 4	101	97	75	79	63	63	80
Sample 5	101	94	81	82	67	64	80
Sample 6	100	-	77	79	65	64	77
LAE (Hel) Energy Average	102	96	78	79	64	64	79

Table 18 – Airbus H130 Hover at 3m L_{AE} noise levels measured at Locations S1 to S7, dB

Test	S1	S2	S3	S4	S5	S6	S7
Sample 1	103	101	76	79	66	62	79
Sample 2	102	101	76	73	66	62	78
Sample 3	104	102	78	77	66	64	81
Sample 4	104	100	80	78	68	63	81
Sample 5	105	102	-	-	71	64	80
LAE (Hel) Energy Average	104	101	78	77	68	63	80

Table 19 – Airbus H130 Idling L_{AE} noise levels measured at Locations S1 to S7, dB

Test	S1	S2	S3	S4	S5	S6	S7
Sample 1	96	95	66	79*	68	60	67
Sample 2	95	93	70	77*	61	59	67
Sample 3	96	90	68	80*	61	58	65
Sample 4	96	93	67	81*	70	59	66
Sample 5	95	93	63	-	61	59	69
Sample 6	98	93	63	-	62	59	75
Sample 7	98	94	73	-	62	61	69
Sample 8	95	88	69	-	60	57	68
LAE (Hel) Energy Average	96	92	68	-	65	59	69

Note * denotes this operator attended measurement was affected by road traffic passby along Port Street during the idling event. This data was considered extraneous noise and should be discarded from any assessment.

Tables 12 to 15 show results from operational modes conducted at the seven spot locations around the temporary HLS. The tables show maximum noise levels for each event (takeoff, landing, hover and idle) measured at the location. The event samples are shown as an average [LAmax (Hel) Energy Average] and an absolute or highest maximum level [Max LpA (Event)].

As an example measurements conducted at Location S3 (close to Coral Beach Lodge) shows an average maximum noise level of 76dBA and highest maximum level of 77dBA based on the six sample movements for departure.

Similarly measurements conducted at Location S3 (close to Coral Beach Lodge) shows an average maximum noise level of 68dBA and highest maximum level of 69dBA based on the six sample movements for approach/landing.

Operator attended measurements were conducted at Spot Locations S2 (90m from temporary HLS) and S4 (300m from temporary HLS). At Location S2 all helicopter movements were visible and clearly audible.

At Location S3, the helicopter was visible during approach and departure, once above the tree line. At Location S3, helicopter noise was audible during landing, departure and hovering movements. Helicopter noise was not audible during idling due to masking by local traffic noise and just or barely audible during brief lulls in traffic noise.

Maximum noise levels shown in Tables 11 to 14 may be compared to the maximum noise limits previously derived in Section 6.0 of this report.

Tables 16 to 19 also show results from operational modes conducted at the seven spot locations around the temporary HLS. The results are expressed in terms of LAE (Hel) Energy Average value and will be used to calculate the maximum number of helicopter movements per day (between 7am to 7pm) from the proposed HLS.

Figure 28 presents a summary of highest maximum levels [Max LpA (Event)] for departures or take-offs recorded at the seven spot locations.

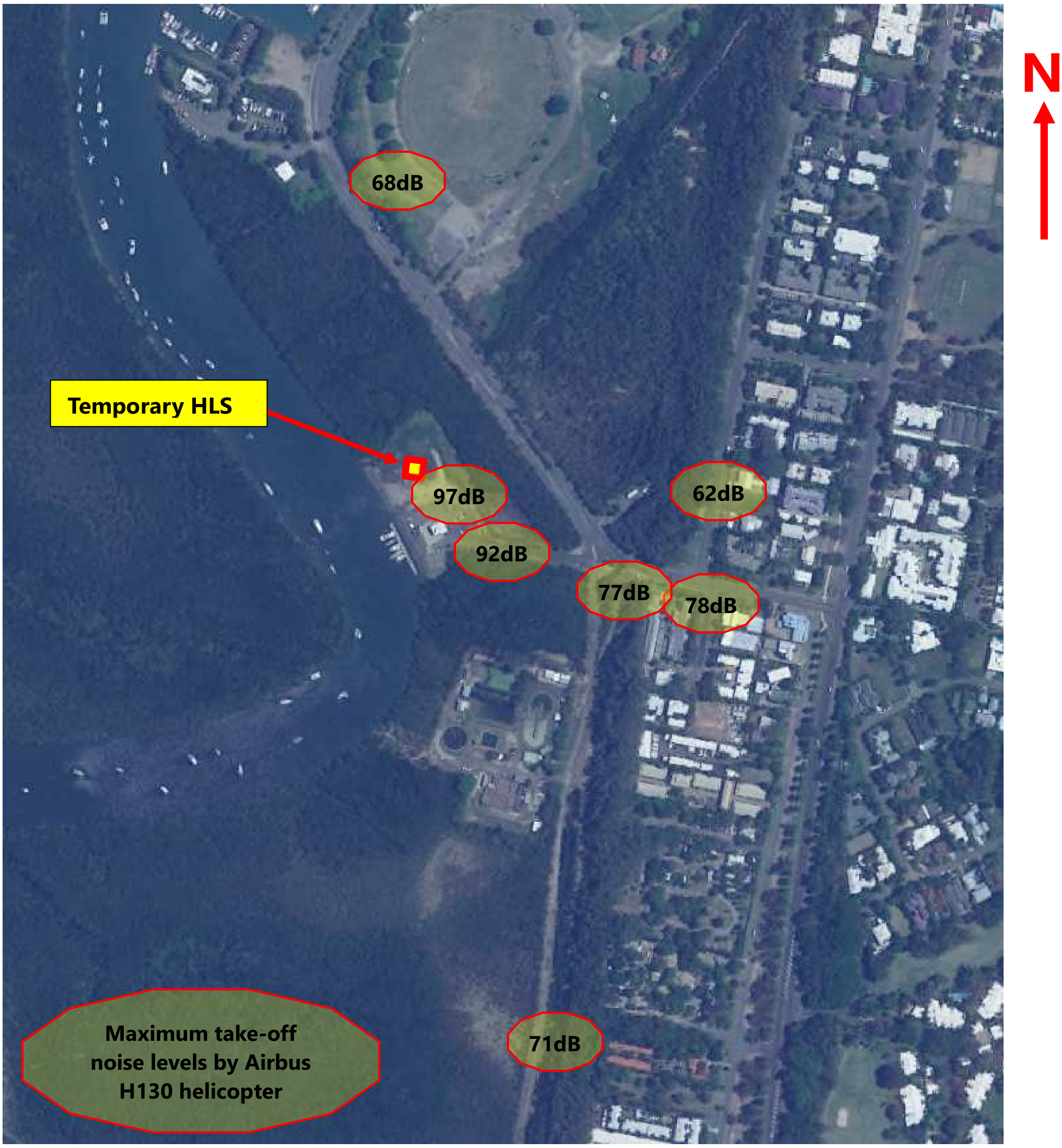


Figure 28 – Highest maximum levels during H130 take-off [MaxLpA (Departure)] from temporary HLS

Figure 29 presents a summary of highest maximum levels [Max LpA (Event)] for approach / landings recorded at the seven spot locations.

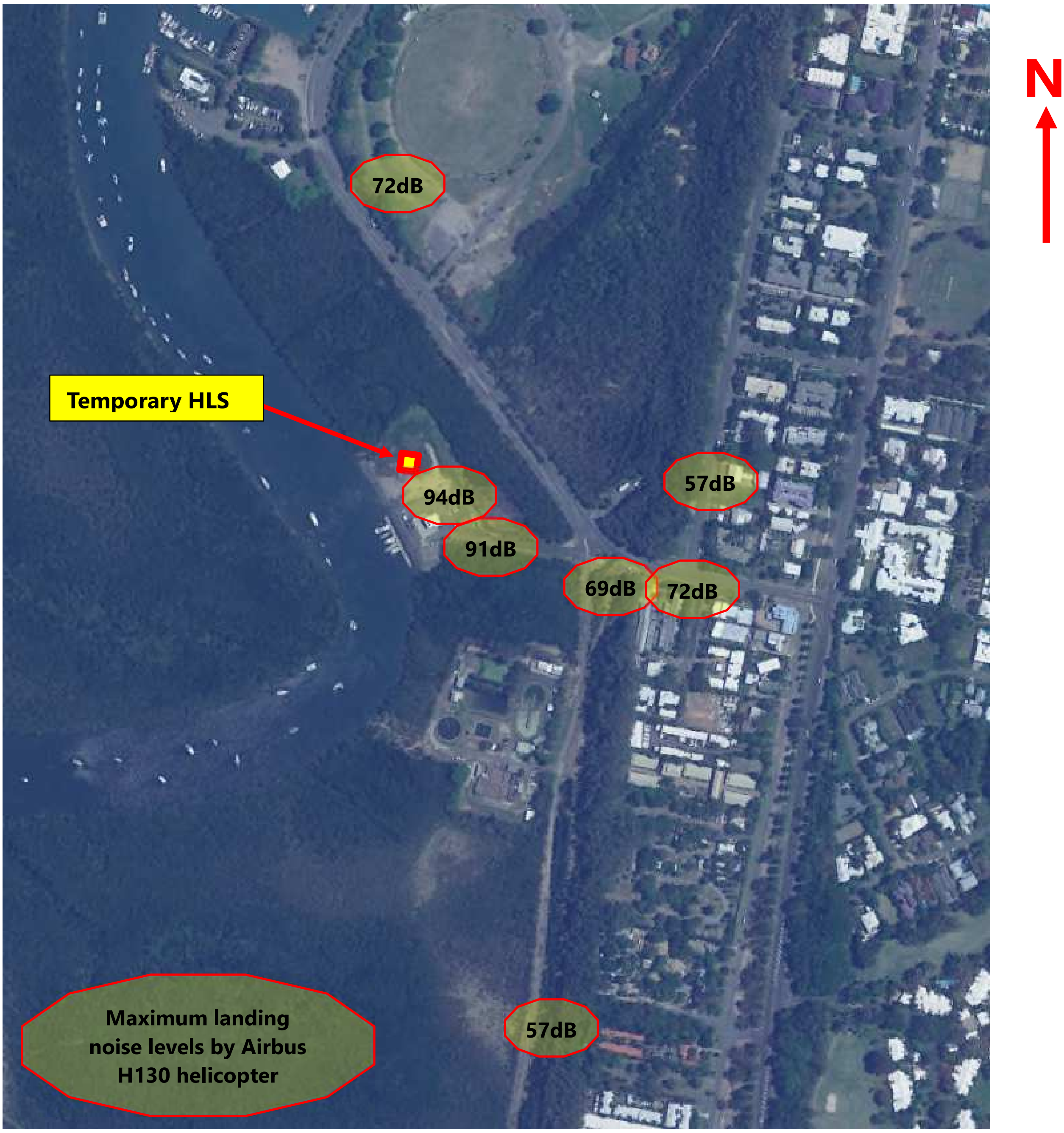


Figure 29 – Highest maximum levels during H130 landing [MaxLpA (Approach / Landing)] at temporary HLS

NSR 1 (Group) is considered the nearest noise sensitive residential receiver, located approximately 260m from the proposed HLS.

The measurement results obtained at Spot Location S3 were considered representative of noise exposure at the NSR 1 (Group) or Coral Beach Lodge and suitable for assessment purposes.

Table 20 presents a summary of results recorded at Spot Location S3.

Table 20 – Airbus H130 - L_{Amax} & L_{AE} noise levels at Location S3, dB

Test	LAmax (Hel) Energy Average	Max LpA (Event)	LAE (Hel) Energy Average
Departure	76	77	81
Approach	68	69	78
Idle	59	65	68
Hover	66	66	78

The results shown in Table 20 are used later in Section 8 of this report to calculate noise exposure limits.

7.4 Noise Measurements at Existing HLS

Noise measurements of the Airbus H130 and Robinson 44 helicopters were conducted at the existing HLS on Friday 10th, Tuesday 28th and Wednesday 29th September 2021.

Noise measurements were selected close to the take-off / landing position.

Table 21 presents noise measurement locations around the existing HLS.

Table 21: Noise Monitoring Locations around the Existing HLS

Monitoring Location	Sound Level Meters	Monitoring Position (UTM co-ordinates, Zone 55K)
Location S8	NTi XL2 logger S/N 15538, S/N 18950	Easting: 335896.00mE Northing: 8174641.00mS
Location S9	NTi XL2 logger S/N 13505, S/N 15804	Easting: 335920.00mE Northing: 8174648.00mS

The microphones were positioned 1.5m above ground level, on relatively flat ground and where possible greater than 4m away from any reflective surfaces (ie free field).

The following measurement locations were selected:

Location S8 - ~ 15m from existing HLS#1 and ~ 30m from existing HLS#2, operator attended location, measure operational modes (takeoff, landing and idling functions), and;

Location S9 – ~ 30m from existing HLS#1 and ~ 35m from existing HLS#2, operator attended location, measure operational modes (takeoff, landing and idling functions).

Figures 30, 31 and 32 show the two (2) measurement locations selected around the existing HLS's.

Figure 30– Noise Measurements at existing HLS

Figure 31 – View from Measurement Location S8 with Robinson 44 (at existing HLS#1) and Airbus H130 (at existing HLS#2)

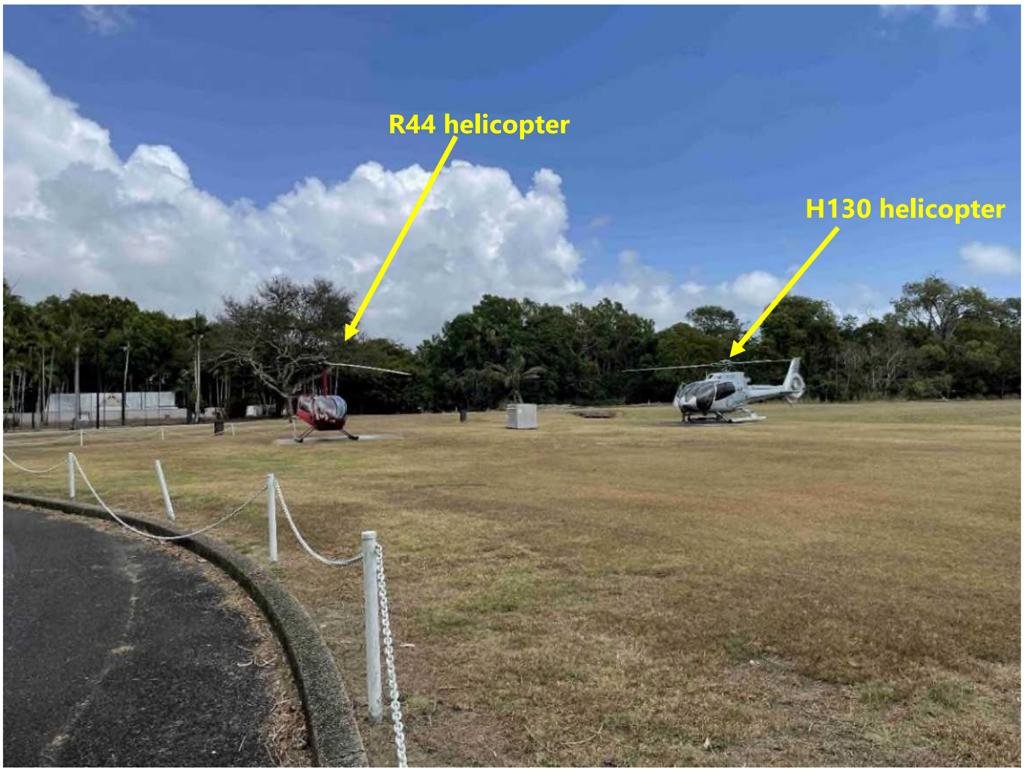


Figure 32 – View from Measurement Location S9 with Robinson 44 (at existing HLS#1) and Airbus H130 (at existing HLS#2)

Table 22 presents noise measurement results during helicopter movements at the existing HLS. Measurements were conducted during pickup and drop off of sightseeing customers.

Table 22: Noise Measurement Results at the Existing HLS

Measurement Location	Helicopter Type	Date (September 2021)	LAmax (Event) / LAE (event)	
			Approach/Landing	Take off
Location S8 (15m away)	R44	Friday 10th	98 / 107	104 / 110
Location S8 (15m away)	R44	Friday 10th	97 / 107	95 / 105
Location S8 (15m away)	R44	Tuesday 28th	97 / 105	97 / 105
Location S8 (15m away)	R44	Tuesday 28th	97 / 105	94 / 103
Location S8 (15m away)	R44	Tuesday 28th	95 / 101	96 / 103
Location S8 (15m away)	R44	Wednesday 29th	96 / 103	89 / 98
Location S8 (30m away)	H130	Wednesday 29th	80 / 93	96 / 106
Location S9 (30m away)	R44	Tuesday 28th	87 / 96	94 / 102
Location S9 (30m away)	R44	Tuesday 28th	89 / 97	87 / 97
Location S9 (30m away)	R44	Wednesday 29th	89 / 96	95 / 102
Location S9 (35m away)	H130	Wednesday 29th	93 / 100	91 / 101

Table 22 shows maximum noise levels of 99dB [Max LpA (Approach/Landing)] and 104dB [Max LpA (Departure/Take-off)] for the Robinson R44 helicopter when measured 15m away from the existing HLS#1.

Table 22 shows maximum noise levels of 93dB [Max LpA (Approach/Landing)] and 91dB [Max LpA (Departure/Take-off)] for the Airbus H130 helicopter when measured 35m away from the existing HLS#2.

The results shown in Table 21 at the existing HLS are comparable with the closest measurements (ie Locations S1 and S2) conducted near the temporary HLS.

The purpose of conducting noise measurements at the existing HLS was to compare noise levels from both the Airbus H130 and R44 helicopters. Initially it was assumed noise from the smaller R44 would be considerably lower than noise from larger H130 helicopter.

The results indicate there was minimal difference in maximum noise levels from the two helicopters.

Based on our analysis of the results obtained at the existing HLS and temporary HLS, it was concluded the results shown in Table 20 will be used to calculate allowable noise exposure limits.

.

8 Predicted Noise Levels

Helicopter noise exposures were determined at the nearest potentially affected noise sensitive receivers close to the proposed HLS.

8.1 Allowable Maximum Noise Levels

Table 23 presents a comparison of results recorded at Spot Location S3 (refer to Table 20) against the daytime noise limits previously derived in Table 8.

Table 23 – Comparison of results at Spot S3 against daytime noise limits, dBA

Descriptor	Daytime Noise Limits (7am to 7pm)	Measurement results at Spot S3 (Depart / Approach / Idle / Hover)	Highest Result at Spot S3	Complies with noise limits?
LAmax (Hel) Energy Average	82	76 / 68 / 59 / 66	76	Yes, by 6dBA
Max LpA (Hel)	85	77 / 69 / 65 / 68	77	Yes, by 8dBA

Table 23 shows average maximum noise levels [LAmax (Hel) Energy Average] and the highest maximum level [Max LpA (event)] comply with the daytime noise limits.

Comparison of average maximum noise levels and highest maximum levels for other spot locations (ie S4, S5 and S6) also confirms compliance against the daytime noise limits.

8.2 Allowable Number of Helicopter Movements

The calculation of $L_{Aeq,\,T}$ (Hel) is outlined in the current Australian Standard AS2363-1999 *Acoustics – Measurement of Noise from Helicopter Operations*. Paragraph A2 in Appendix A of the Standard provides the following equation to calculate helicopter noise exposure:

$$L_{Aeq,\,0700-1900\,(Hel)} = 10\log_{10}\{\sum_h \sum_p \sum_m Q_{hpm,T}\ \text{antilog}\,(L_{AE,hpm}/10)\} - 46.4$$

Where:

Landing LAE (Hel)	L_L = 78dBA
Idling LAE (Hel)	L_I = 68dBA
Take off LAE (Hel)	L_{TO} = 81dBA
Number of take offs or landings	Q = 20
Number of idles (idle after landing or before take off)	2Q = 40
Number of hours in the measurement period	T = 12 (ie 7am to 7pm)

One helicopter is used (in this instance Airbus H130)

One flight path is used (Approach and Departure)

Three modes of operation: landing, idle, take off

The LAE (Hel) values for landing, idling and take off were derived from Table 19 (for Location S3). The highest values in Table 19 (approach, idling and departure) were used for calculation purposes of L_L, L_I and L_{TO}. This represents the most conservative approach.

$L_{Aeq,\ 0700-1900\ (Hel)}$ = $10 \log_{10} \{Q \text{ antilog } (L_L/10) + 2Q \text{ antilog } (L_I/10) + Q \text{ antilog } (L_{TO}/10)\} - 46.4$

$L_{Aeq,\ 0700-1900\ (Hel)}$ = $10 \log_{10} \{10 \text{ antilog } (78/10) + 40 \text{ antilog } (68/10) + 10 \text{ antilog } (81/10)\} - 46.4$

$L_{Aeq,\ 0700-1900\ (Hel)}$ = 50dBA at Spot S3 (215m away from the HLS)

This value complies with both the EPA's Draft Daytime Noise Limit of $L_{Aeq,\ 0700-1900\ (Hel)}$ = 55dBA [Refer to Table 8], Australian Standard AS2363-1990 of $L_{Aeq,\ 0700-1900\ (Hel)}$ = 58dBA [Refer to Table 9] and Victorian Guideline $L_{Aeq,\ 0700-1900\ (Hel)}$ = 55dBA [Refer to Table 10]. This calculation assumes up to Q = 20 take-offs and Q = 20 landings in any 12 hour period (ie 7am to 7pm).

Increasing the number of take offs and landings to 40 each increases the noise level by 3dBA to 53dBA $L_{Aeq,\ 0700-1900\ (Hel)}$..

Nautilus Aviation have indicated the site will be limited to 24 flight movements in any one day rather than the maximum 40 flight movements in any one day. A flight movement being defined as either one takeoff or one landing operation.

Noise levels further away from the HLS is expected to be lower than at the measured location of 215m (ie Spot S3) from the proposed HLS.

9 Assessment of Noise Impact

It can be seen in Section 8 of this report that the helicopter noise exposures are less than the recommended noise limits. Therefore, it is considered that the proposed HLS can achieve compliance with the EPA Draft Guideline, Australian Standard AS2363-1990 and the Victorian Department of Planning and Community Development and the Noise Control Guidelines (Publication 1254).

Nautilus Aviation have indicated the site will be limited to 24 flight movements in any one day. In all instances, take-off, approaches and landing will be conducted in accordance with the Civil Aviation Regulations.

It is proposed that the HLS facility will operate in accordance with the *Fly Neighbourly Guide*. Airservices Australia in the document *Environmental Principles and Procedures for Minimising the Impact of Aircraft Noise* (Revised 21 November 2002) recommends that:

> *Helicopter operators adopt "Fly Neighborly" piloting techniques such as those set out in the Helicopter Association International (HAI) "Fly Neighborly Guide*".

Refer to Appendix C of this report for the *Fly Neighborly Guide*.

In the Australian context, these techniques would include:

Avoid noise sensitive areas

- Follow high ambient noise routes (Highways, etc)
- Follow unpopulated routes (Waterways, etc)

Near Noise sensitive areas:

- Maintain a flyover altitude of 1,500ft for twin engine helicopters (1,000ft for single engine helicopters) where possible.
- Maintain a hover/circling altitude of 2,000ft where possible
- Reduce speed
- Observe low noise speed/descent settings
- Avoid sharp manoeuvres (sic)
- Use high take-off/descent profiles.

10 Recommended Conditions

This study has relied on various advice provided by the proponents in relation to the operation of the proposed helicopter landing site. The validity of the study and its conclusions depend to a significant degree to an adherence to these operation parameters. It is therefore considered appropriate to set the following conditions for the use of the proposed facility:

- The site shall be used for up to 24 flight movements in any one day;
- One flight movement constitutes a take off or landing;
- All site activities including ground running of aircraft shall occur only between the hours of 7am to 7pm;
- The site shall be used only by Airbus H130 helicopter, or by aircraft with certified lower noise levels;
- Pilots shall adhere to the recommendations contained within the *Fly Neighborly Guide* and employ all noise abatement recommendations specific to the Airbus H130 helicopter or other helicopter(s) certified to a lower noise level to be used at the proposed HLS, and;
- Landing and Departure approaches shall only follow the path generally defined in Figure 6 and Appendix B of this report.

APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment Point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of common sounds in our daytime environment:

threshold of hearing	0 dB	The faintest sound we can hear
	10 dB	Human breathing
almost silent	20 dB	
	30 dB	Quiet bedroom or in a quiet national park location
generally quiet	40 dB	Library
	50 dB	Typical office space or ambience in the city at night
moderately loud	60 dB	CBD mall at lunch time
	70 dB	The sound of a car passing on the street
loud	80 dB	Loud music played at home
	90 dB	The sound of a truck passing on the street
very loud	100 dB	Indoor rock band concert
	110 dB	Operating a chainsaw or jackhammer
extremely loud	120 dB	Jet plane take-off at 100m away
threshold of pain	130 dB	
	140 dB	Military jet take-off at 25m away

dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.

Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) or LAE is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

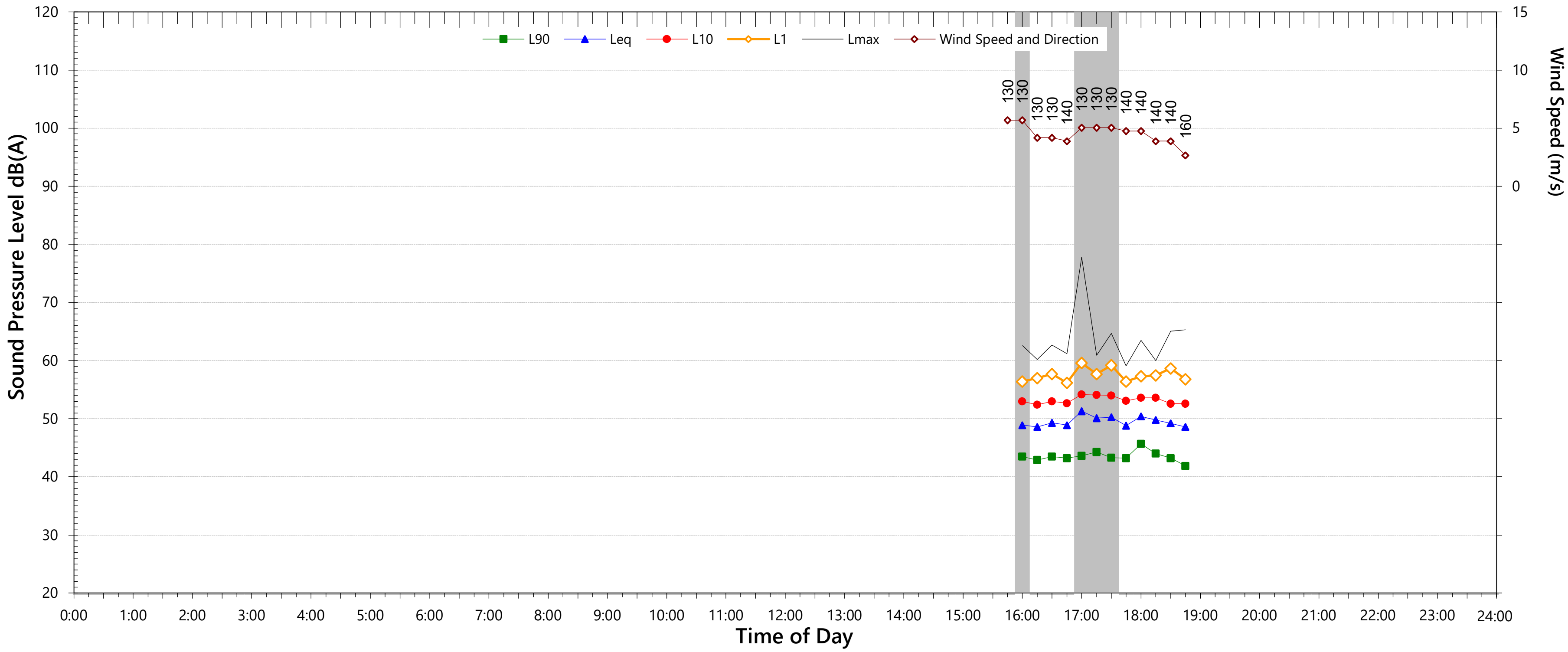
APPENDIX B Proposed Flight Paths

Figure B1 – Proposed Approach & Departure Flight Paths

APPENDIX C Noise Logger Results (Location L1)

Unattended Noise Monitoring Results

Location L1 [Easting: 335859mE, Northing: 8176159mS] **Friday, 10 September 2021**

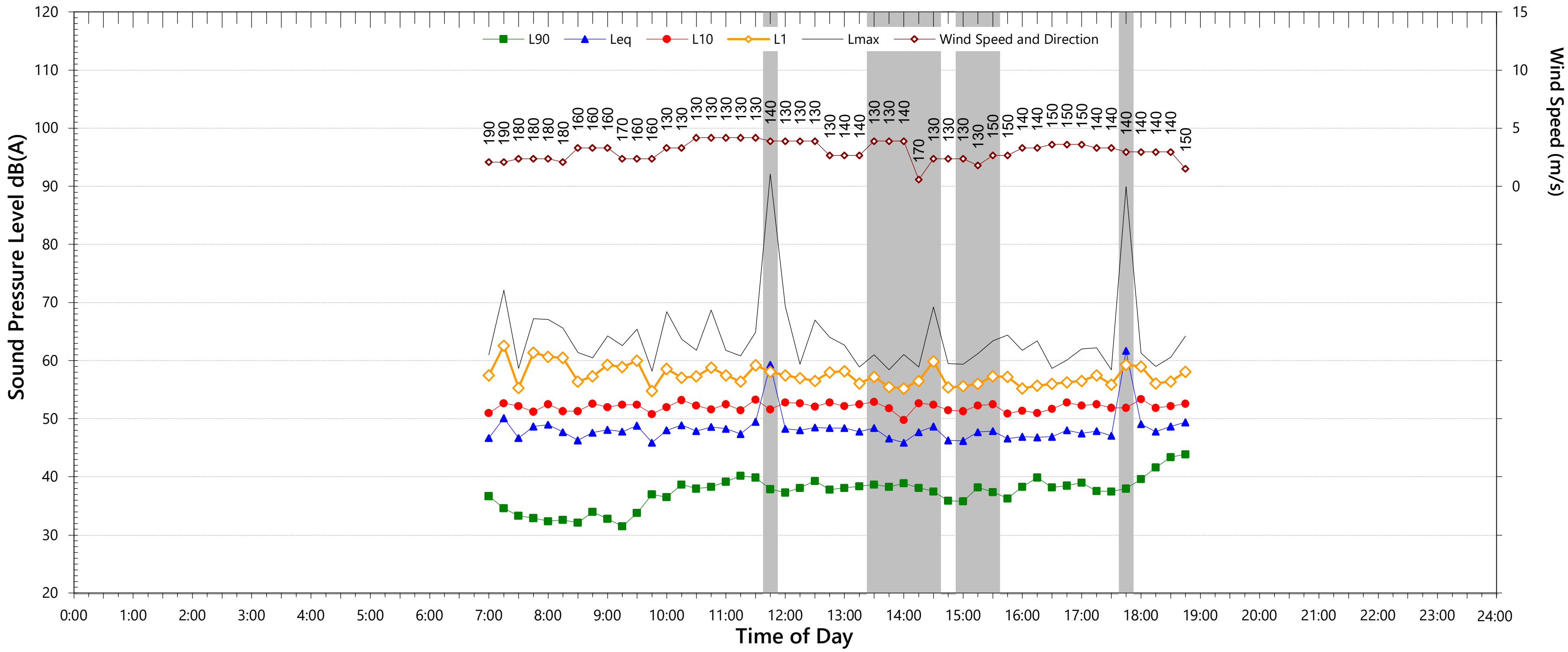


Data File: 2021-09-10_SLM_002_123_Rpt_Report.txt QC416-01S02 Logger Graphs (r2) QTE-26 Logger Graphs Program (r38)

Unattended Noise Monitoring Results

Location L1 [Easting: 335859mE, Northing: 8176159mS]

Saturday, 11 September 2021



Data File: 2021-09-10_SLM_002_123_Rpt_Report.txt

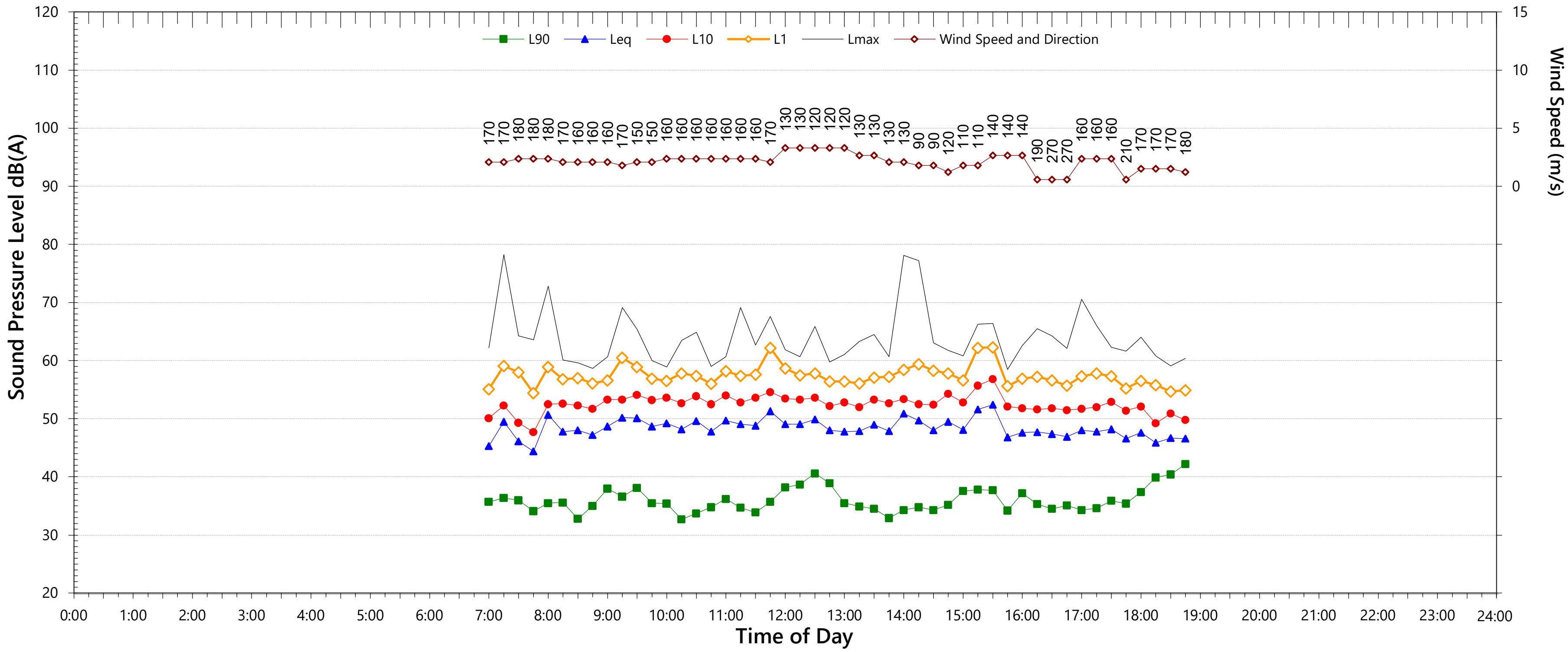
QC416-01S02 Logger Graphs (r2)

QTE-26 Logger Graphs Program (r38)

Unattended Noise Monitoring Results

Location L1 [Easting: 335859mE, Northing: 8176159mS]

Sunday, 12 September 2021



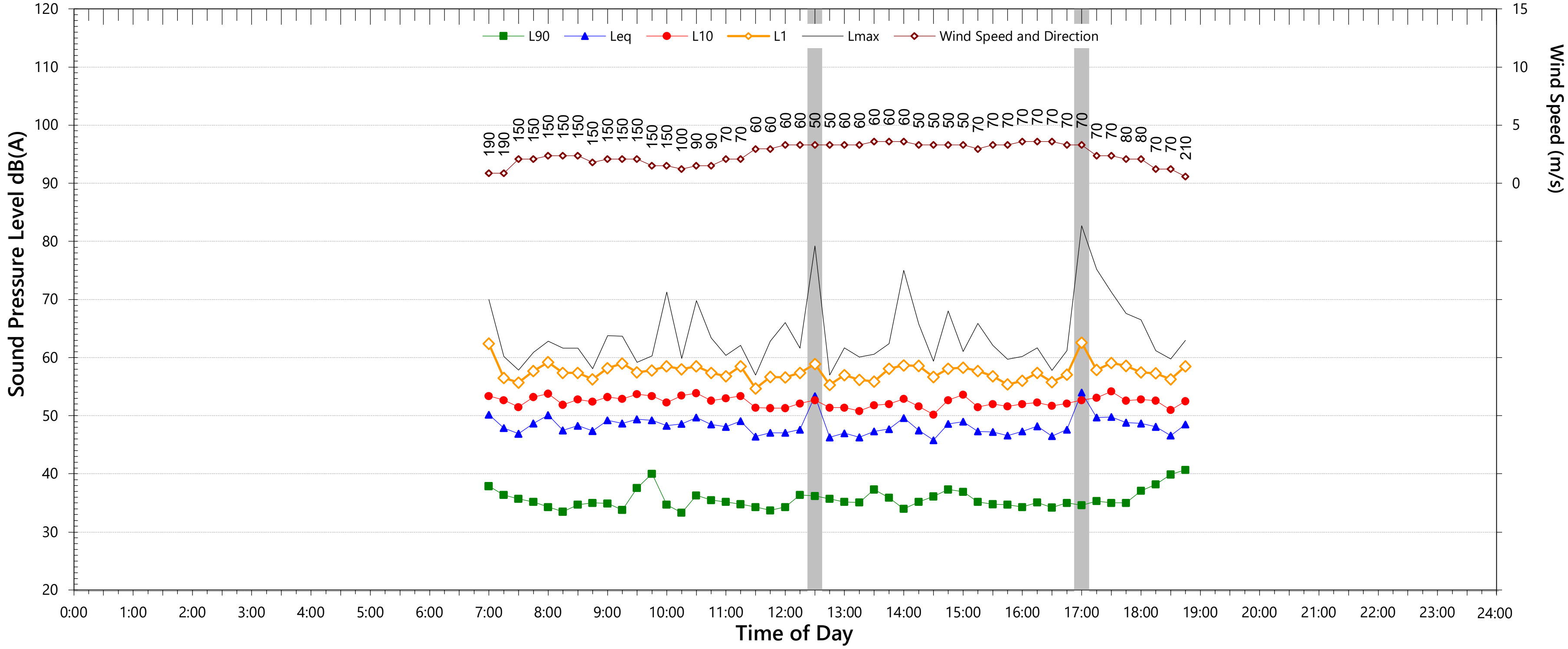
Data File: 2021-09-10_SLM_002_123_Rpt_Report.txt

QC416-01S02 Logger Graphs (r2)

QTE-26 Logger Graphs Program (r38)

Unattended Noise Monitoring Results

Location L1 [Easting: 335859mE, Northing: 8176159mS] **Monday, 13 September 2021**



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Unattended Noise Monitoring Results

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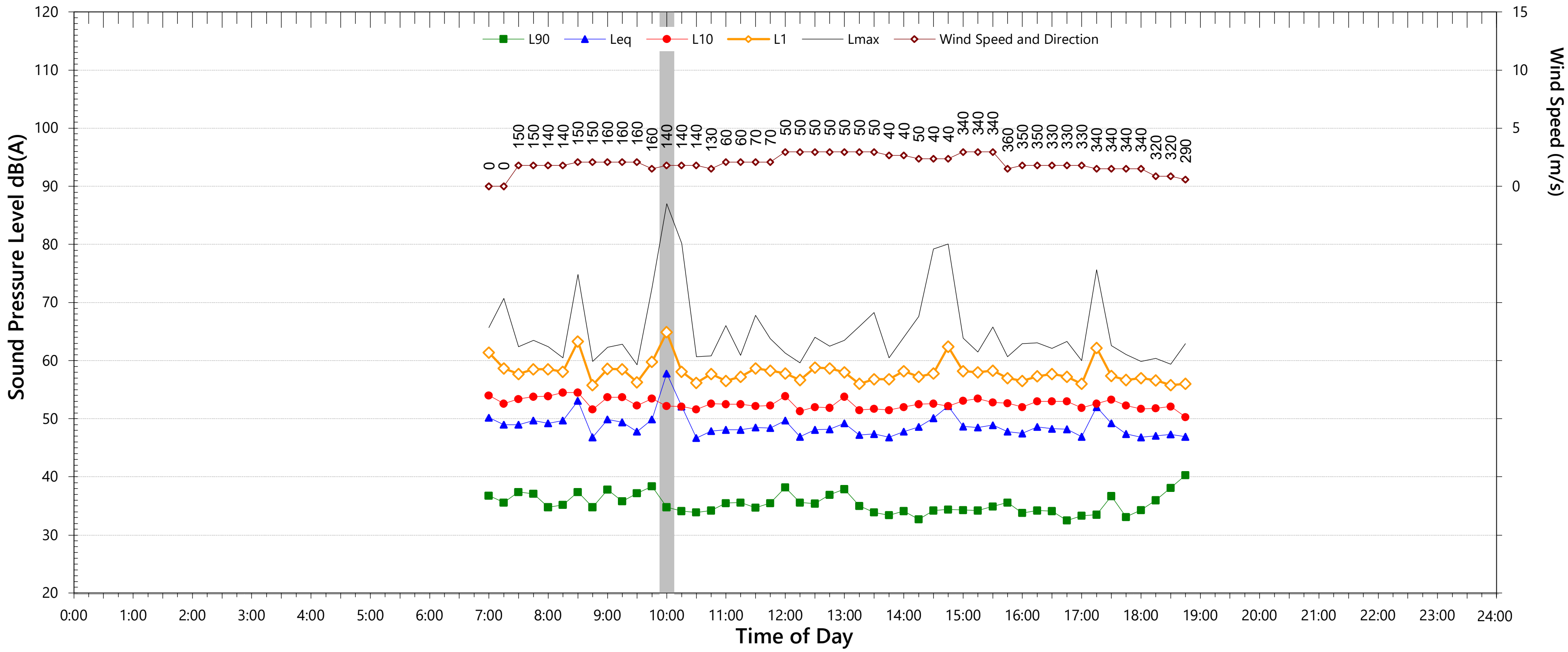

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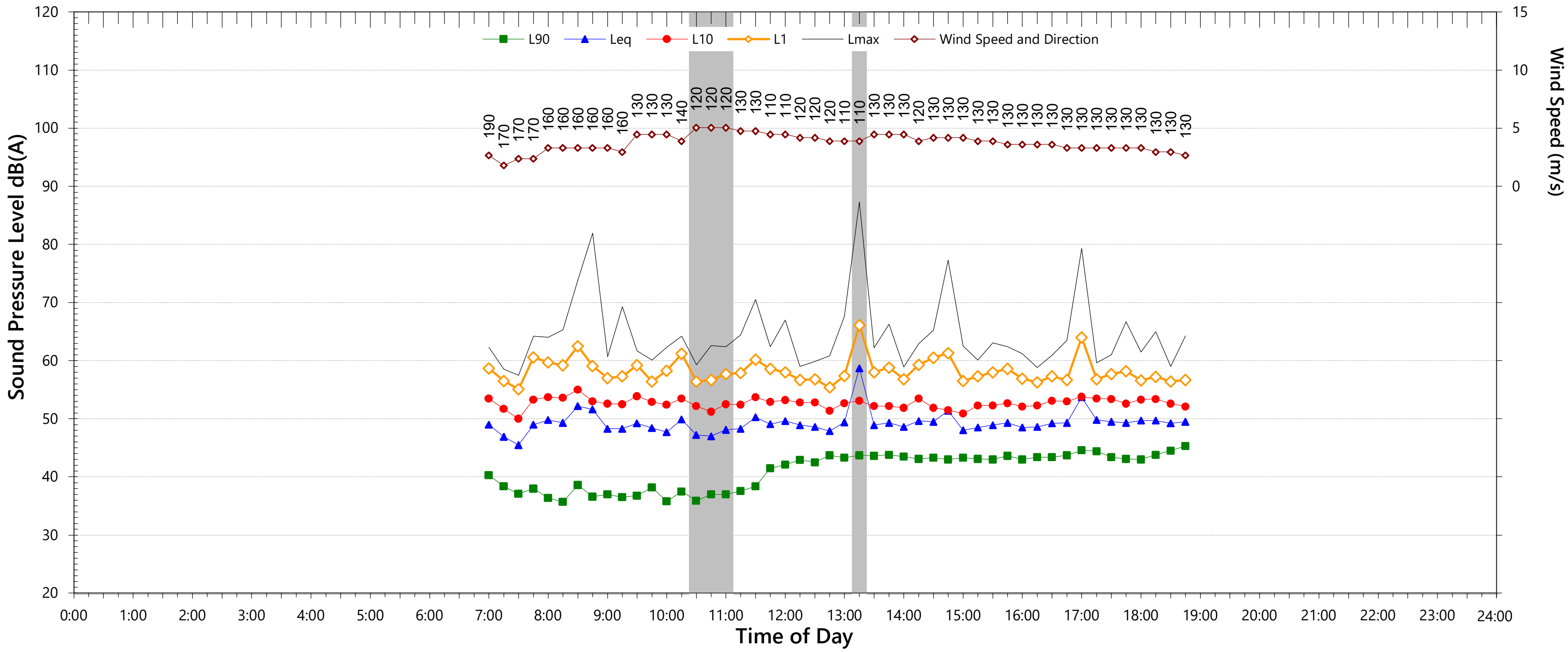
Unattended Noise Monitoring Results

Location L1 [Easting: 335859mE, Northing: 8176159mS]

Wednesday, 15 September 2021



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QC416-01S02 Logger Graphs (r2)

QTE-26 Logger Graphs Program (r38)

Unattended Noise Monitoring Results

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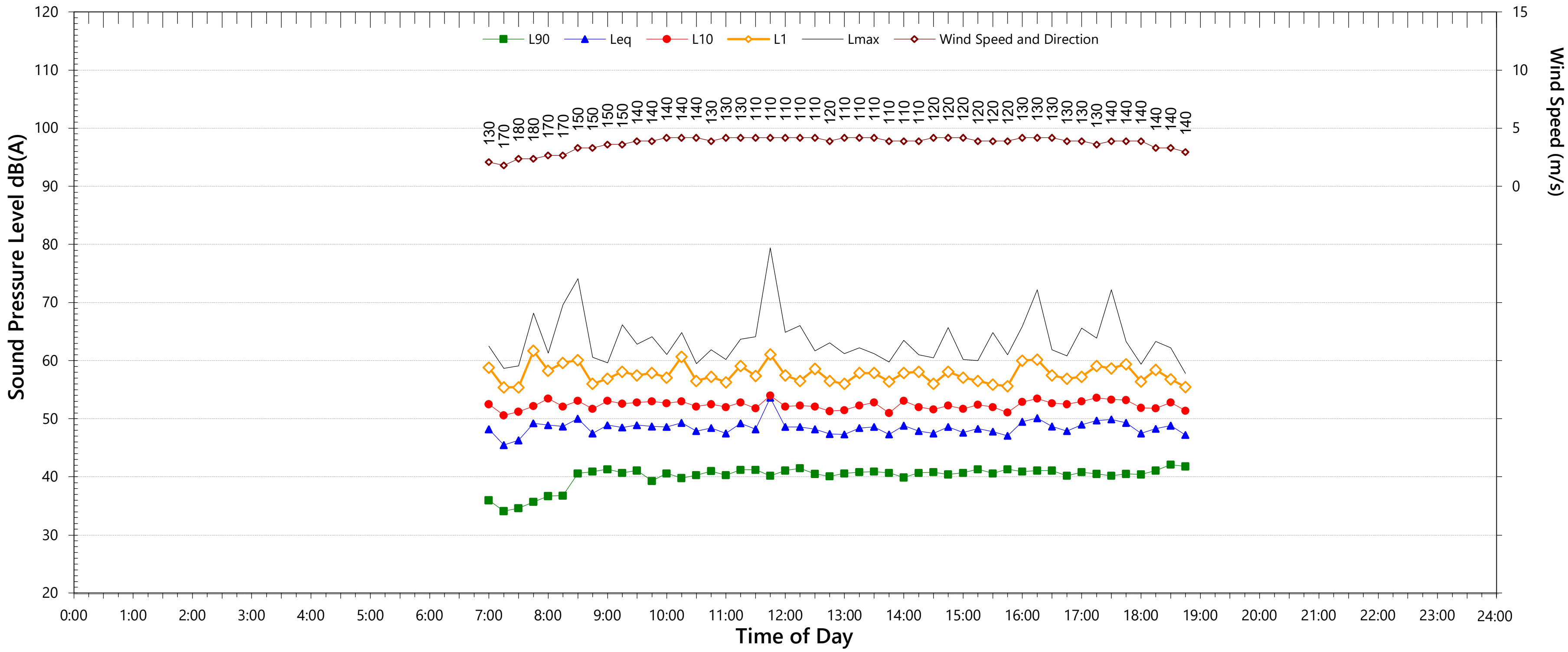

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Unattended Noise Monitoring Results

Location L1 [Easting: 335859mE, Northing: 8176159mS]

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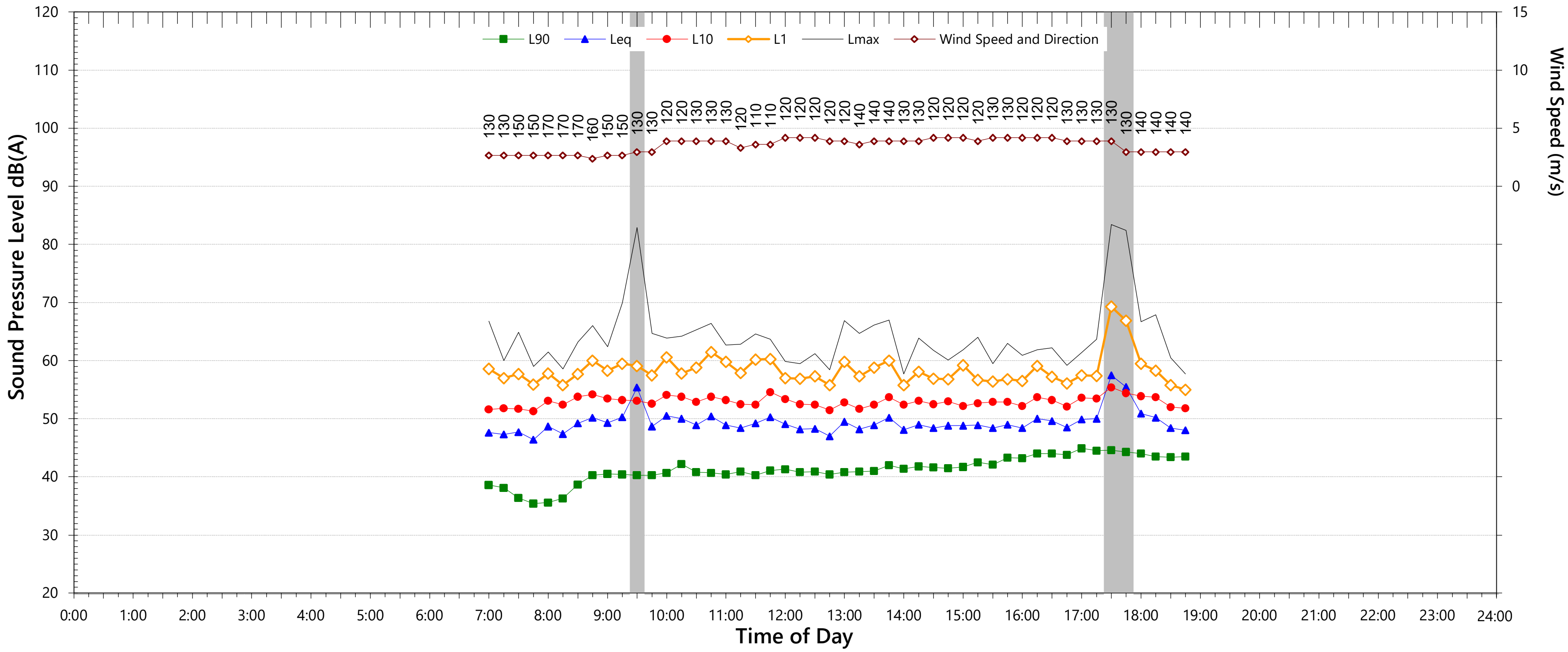

Data File: 2021-09-10_SLM_002_123_Rpt_Report.txt

QC416-01S02 Logger Graphs (r2)

QTE-26 Logger Graphs Program (r38)

Unattended Noise Monitoring Results

Location L1 [Easting: 335859mE, Northing: 8176159mS]

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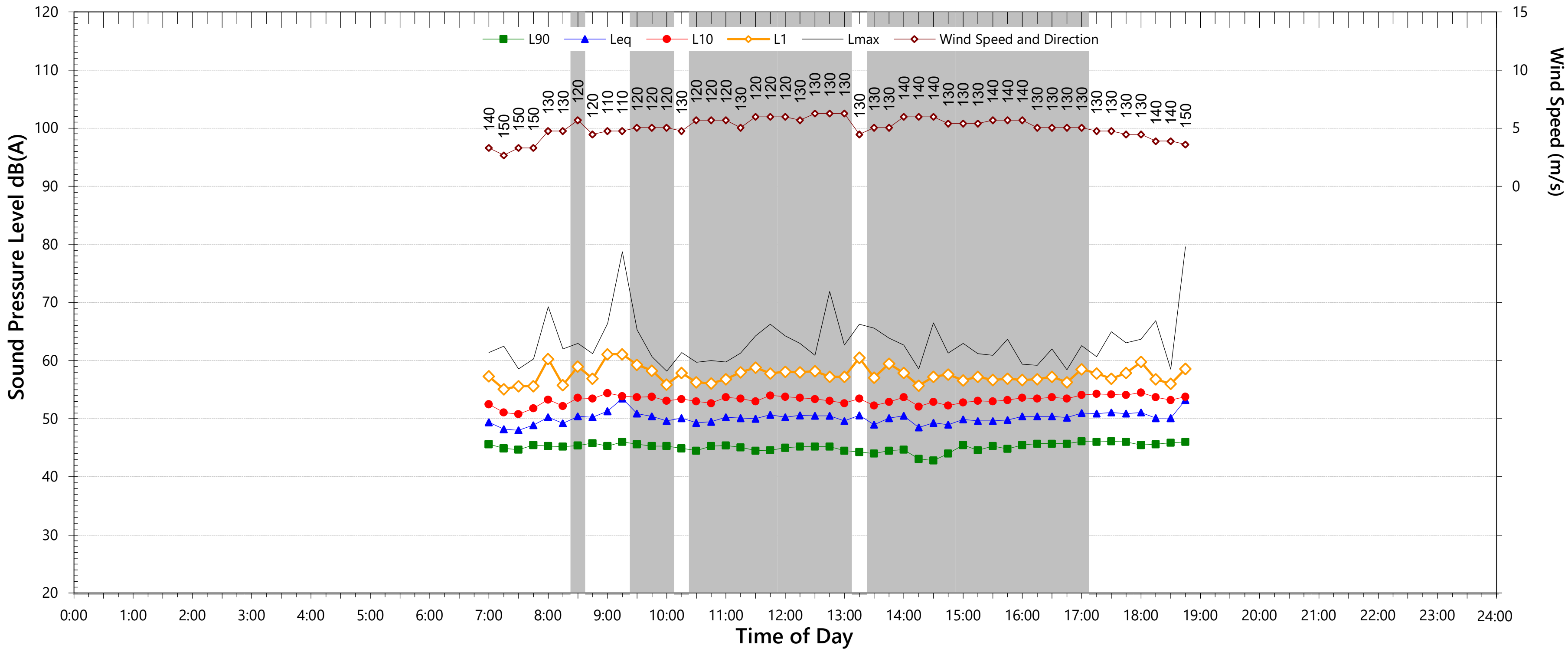


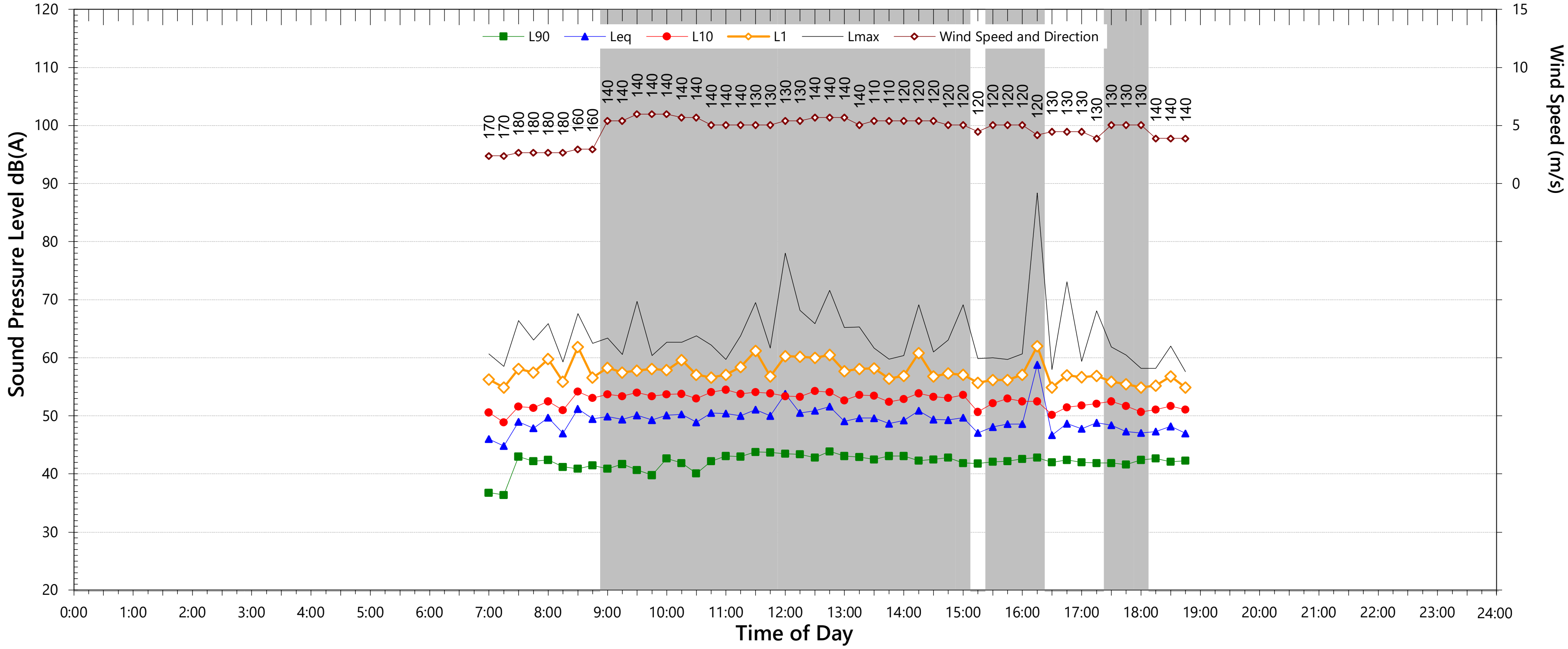
Data File: 2021-09-10_SLM_002_123_Rpt_Report.txt

QC416-01S02 Logger Graphs (r2)

QTE-26 Logger Graphs Program (r38)

Unattended Noise Monitoring Results

Location L1 [Easting: 335859mE, Northing: 8176159mS] **Sunday, 19 September 2021**



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Unattended Noise Monitoring Results

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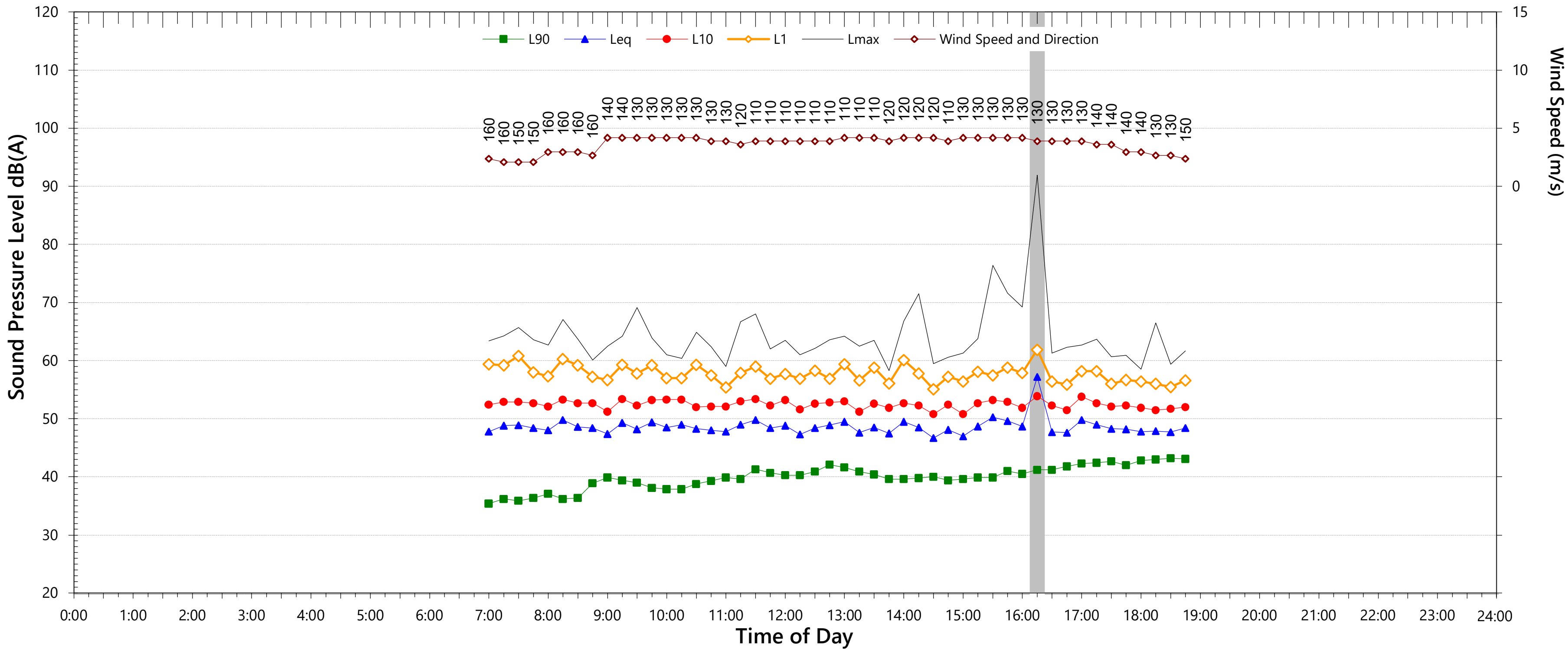

Unattended Noise Monitoring Results

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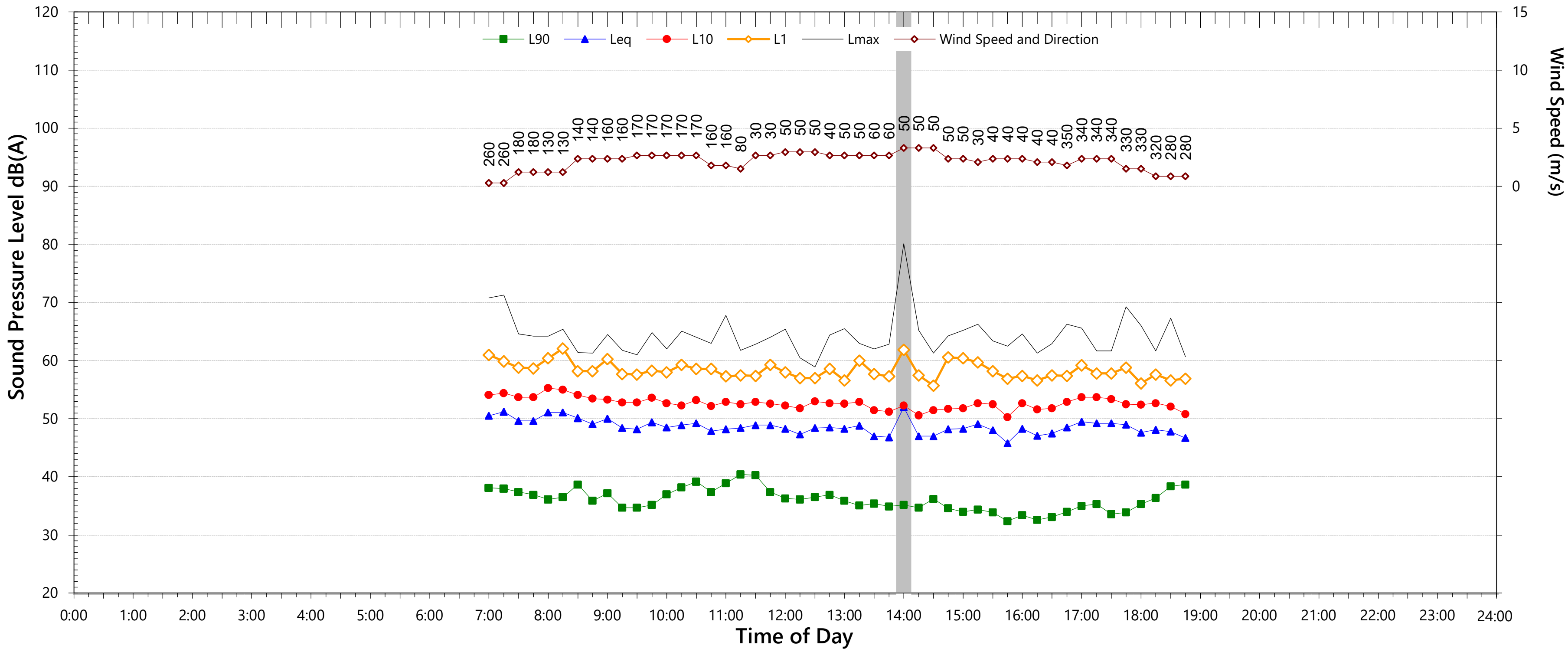

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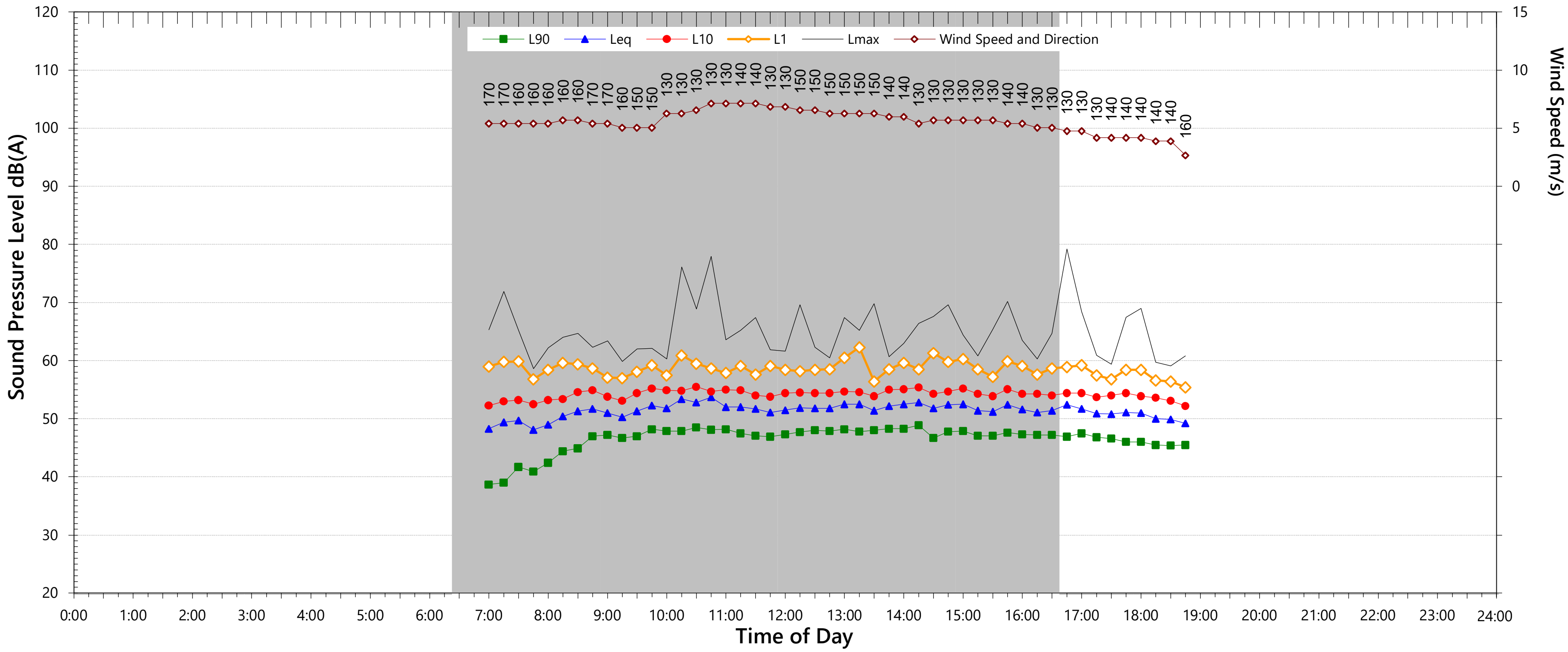
Unattended Noise Monitoring Results

Location L1 [Easting: 335859mE, Northing: 8176159mS] **Wednesday, 22 September 2021**



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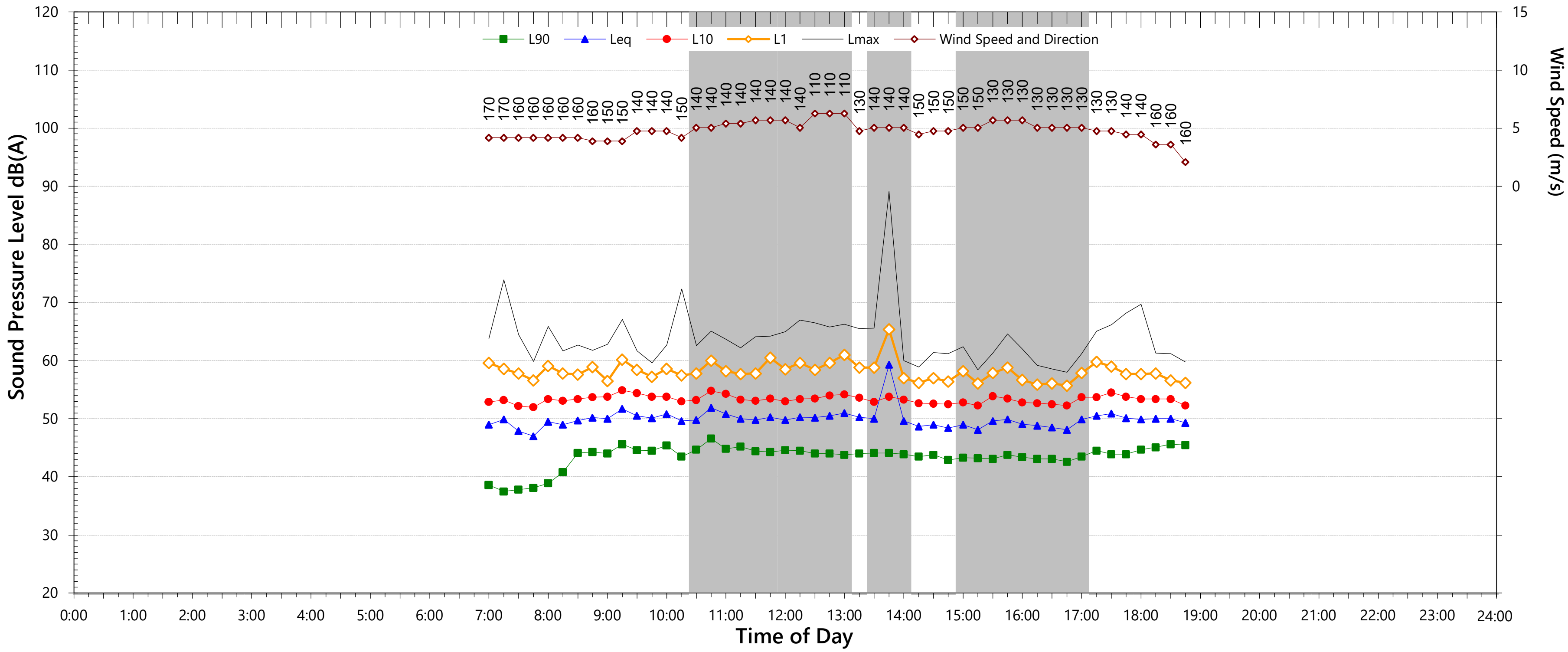
Unattended Noise Monitoring Results

Location L1 [Easting: 335859mE, Northing: 8176159mS] **Thursday, 23 September 2021**



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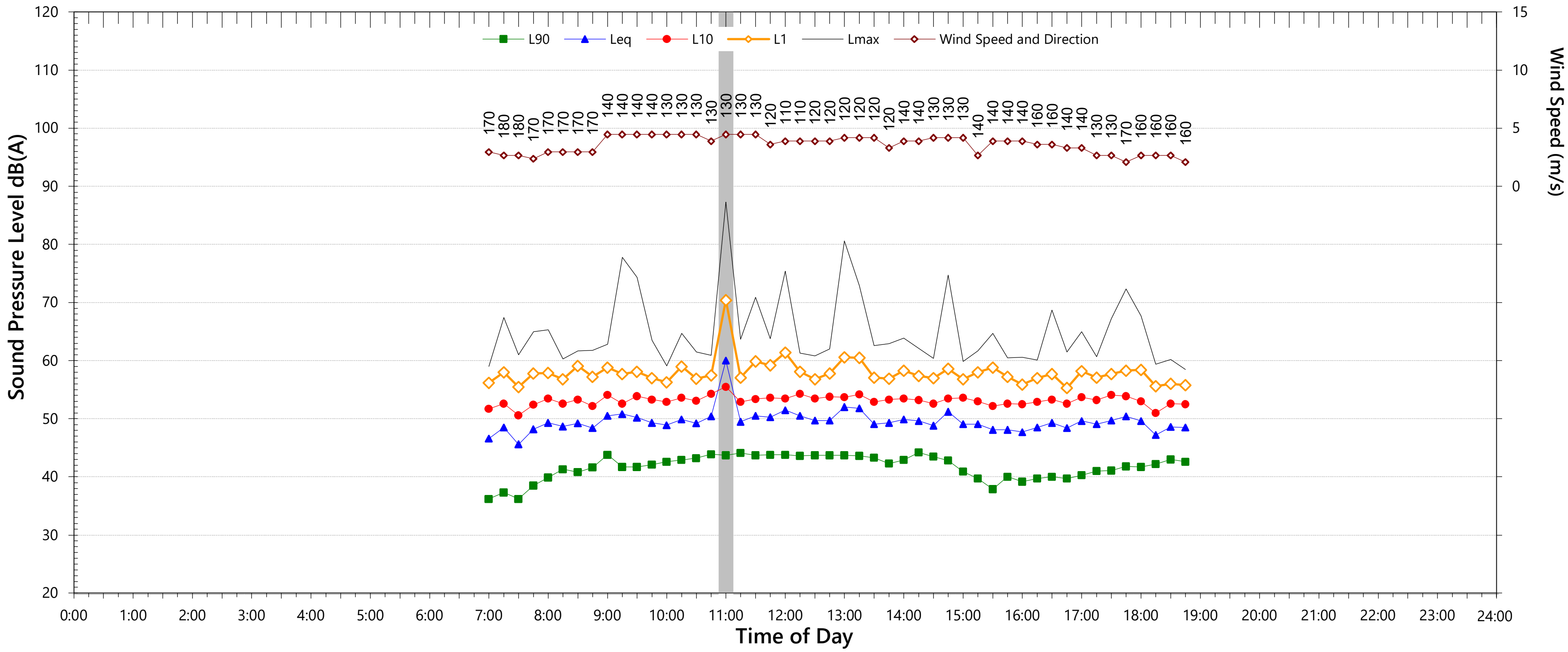
Unattended Noise Monitoring Results

Location L1 [Easting: 335859mE, Northing: 8176159mS]

Friday, 24 September 2021



Data File: 2021-09-10_SLM_002_123_Rpt_Report.txt

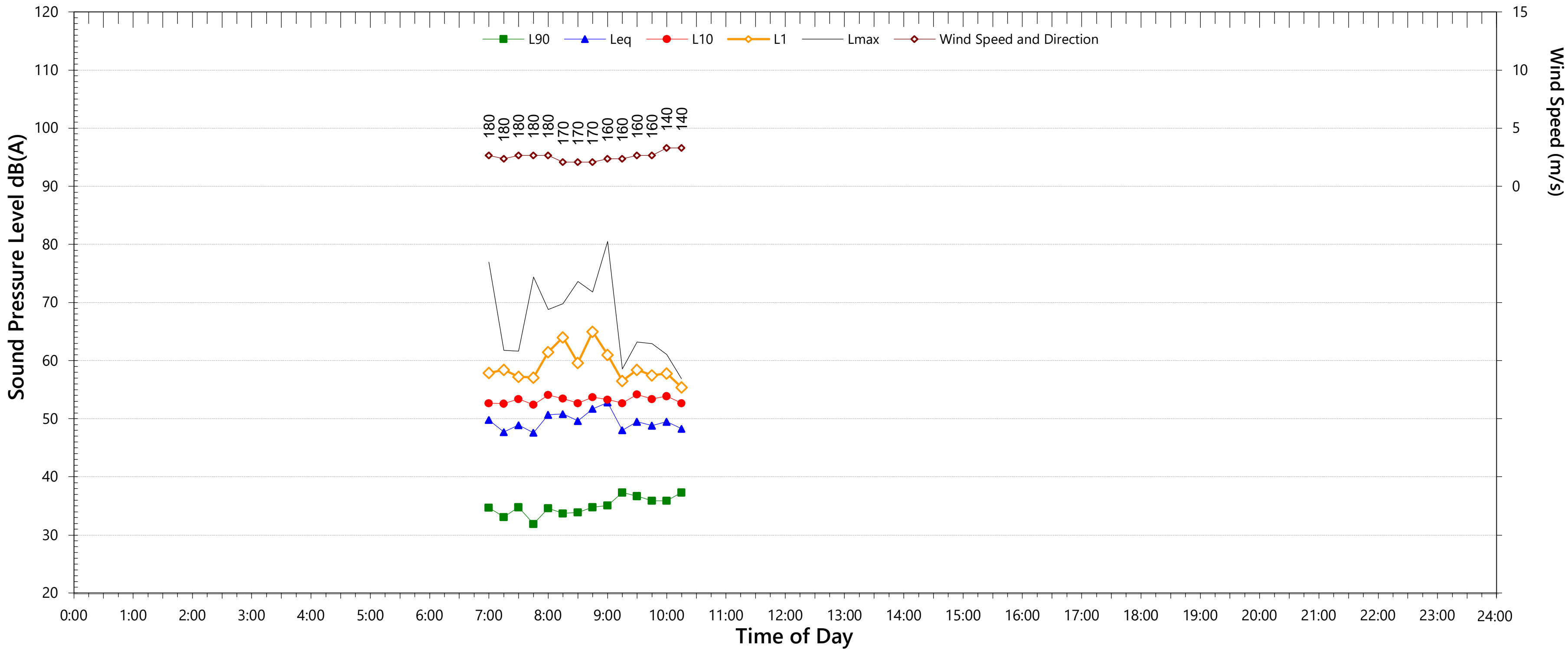
QC416-01S02 Logger Graphs (r2)

QTE-26 Logger Graphs Program (r38)

Unattended Noise Monitoring Results

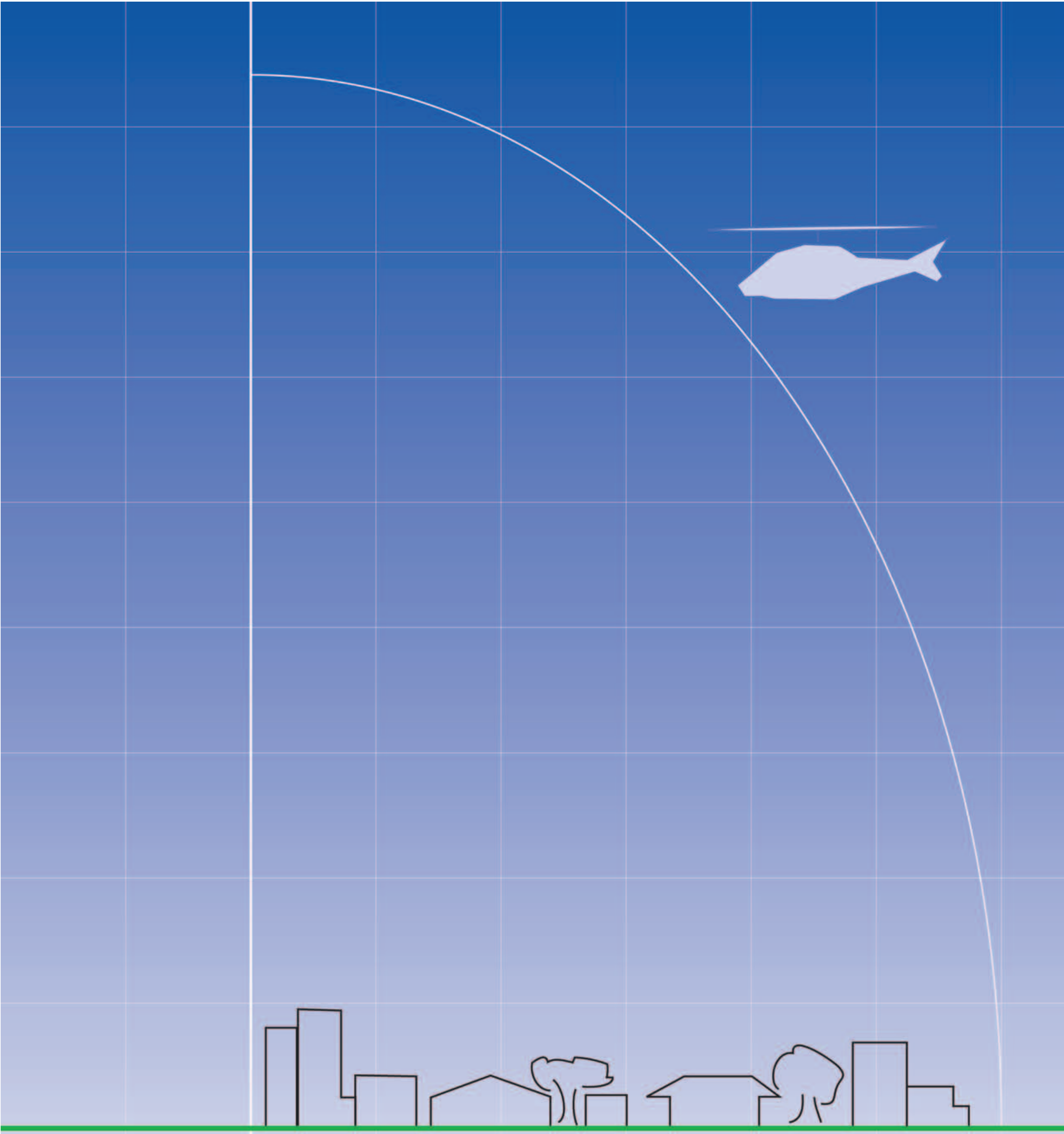
Location L1 [Easting: 335859mE, Northing: 8176159mS]

Saturday, 25 September 2021



Data File: 2021-09-10_SLM_002_123_Rpt_Report.txt QC416-01S02 Logger Graphs (r2) QTE-26 Logger Graphs Program (r38)

APPENDIX D Fly Neighborly Guide



Fly Neighborly Guide

produced by the **Helicopter Association International** Fly Neighborly Committee

Preface

This is the third edition of the Helicopter Association International (HAI) *Fly Neighborly Guide*. The initial guide was issued in 1981 and again with a change to the title page in 1983. A second edition was issued in 1993. This guide is based on the second edition and was edited and revised by Charles Cox and Dr. John Leverton on behalf of the HAI Fly Neighborly Committee.

The Fly Neighborly Program is a voluntary noise abatement program developed by the HAI Fly Neighborly Committee. The program is designed to be implemented world-wide by large and small individual helicopter operators. This program applies to all types of civil, military and governmental helicopter operations.

Fly Neighborly Noise Abatement procedures for specific helicopter models are available on the HAI Web site www.rotor.com.

Additional pilot training information, discussion of helicopter noise sources, noise propagation and general information on how to operate helicopters to minimize the noise impact is also available on an associated interactive Noise Abatement Training CD developed for pilots by the HAI Manufacturers Committee. Copies of this CD can be obtained from HAI .

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Foreword

In the late 1970s, concern was being expressed about helicopter noise by the general public and national authorities in a number of nations, including the USA. As a result, a number of Helicopter Association International (HAI) committees, including the Heliport and Airways Committee (now known as the Heliports Committee), started to research how this concern should be addressed. At the same time, the International Civil Aviation Organization (ICAO), with active support of the United States Federal Aviation Administration (FAA) and most European nations, established a working group to develop helicopter noise certification standards. In addition, the FAA issued a Notice of Proposed Rulemaking (NPRM) outlining proposed noise certification procedures and limits.

The industry, and HAI in particular, felt that a better approach would be for the industry to develop voluntary guidelines to control the noise impact by operational means. After a number of FAA/industry meetings, the FAA, in the fall of 1981, agreed to withdraw its initial NPRM related to helicopter noise certification while additional technical data were acquired. This was done with the understanding that the helicopter industry would develop new technology - creating quieter, more advanced equipment, and implement a voluntary noise abatement program. This resulted in the establishment of the HAI Fly Neighborly Program based on an earlier program developed by Bell Helicopter Textron.

ICAO initially issued international noise standards in 1981, as a part of the International Standards and Recommended Practices, ◎Environmental Protection,◎Annex 16 to the Convention on International Civil Aviation. These were not adopted by many nations before they were relaxed in 1985. Since that time, the standards have been amended a number of times. The FAA subsequently issued helicopter noise certification standards in 1988. These have been revised over the years. They are defined in 14 CFR Part 36. The Fly Neighborly Program offers the technical information necessary for helicopter operators to fly both current and new advanced helicopters as quietly as practical, and to make helicopter operations compatible with nearly all land uses. The program also discusses how to communicate to the public the gains from using such procedures. In addition, the program provides general information related to helicopter noise and public acceptance.

1 General Information

1.1 Background

HAI's Heliports and Airways Committee (HAC) originally organized the Fly Neighborly Program through its Fly Neighborly Steering Committee. This committee was composed of members of HAI and governmental representatives, including the FAA, members of the military and other associations. Officially launched by HAI in February 1982, the program gained U.S. and international acceptance. Subsequently, the work related to the Fly Neighborly Program was considered sufficiently important by HAI that a separate Fly Neighborly Committee was formed to promote the program and ensure that the *Fly Neighborly Guide* and associated material are updated as appropriate.

In the U.S., the program has gained the full support of helicopter operators, regional associations, manufacturers, pilots and communities throughout the country. Federal, state and local government agencies have embraced the program, and taken an active part in sponsoring Fly Neighborly presentations in conjunction with safety seminars and other activities. Worldwide, the helicopter industry and its related communities are kept informed on the Fly Neighborly Program. Companion programs have been developed in a number of countries including Germany, France, and the United Kingdom.

1.2 Objectives

The Fly Neighborly Program addresses noise abatement and public acceptance objectives with guidelines in the following areas:

- pilot and operator awareness
- pilot training and education
- flight operations planning
- public acceptance and safety
- sensitivity to the concerns of the community

1.3 About This Guide

The *Fly Neighborly Guide* is published under the auspices of HAI to promote helicopter noise abatement operations. It addresses general issues only and is, by no means, comprehensive.

1.4 Purpose

These guidelines are intended to assist pilots, operators, managers, and designated Fly Neighborly officers to establish an effective Fly Neighborly Program. The concepts and flight operations outlined, herein, must be further tailored to suit local needs, and to ensure local or regional organizations cooperate to develop a strong, well-organized and disciplined approach to achieving Fly Neighborly objectives.

1.5 Organization

This guide is divided into seven main sections. Section One covers general information. Section Two addresses helicopter sound generation. Section Three gives guidance for noise abatement operations. Section Four discusses how to operate helicopters quietly. Section Five covers pilot training. Section Six describes the operator program which provides a broad outline of the possible actions helicopter operators can take, including flight operations planning. Section Seven deals with community concerns and issues of public acceptance and Section Eight answers the question of what the Fly Neighborly Program can achieve. Three appendices present a comparison of sounds, the Advisory Circular (AC) 91.36D, and an example of a public heliport noise abatement program. In addition, a glossary is provided to help define the acronyms used or referred to in this Guide.

1.6 Administration

HAI solicits new ideas, comments, and recommendations to improve the program. HAI's Fly Neighborly, Safety and Heliport Committees are focal points for the development of new technical material in their respective areas. Additional guides can be obtained from HAI.

The Fly Neighborly Committee monitors the Fly Neighborly Program, and distributes new information to participants. Individuals, operators, or agencies desiring additional information should contact the HAI Fly Neighborly Program staff liaison at:

Helicopter Association International
1635 Prince Street
Alexandria, VA 22314 USA

Phone: (703) 683-4646
Fax: (703) 683-4745
Web site: www.rotor.com
Email address: flyneighborly@rotor.com

2 Helicopter Sound Generation

2.1 The Source of the Sound

The external sound produced by a helicopter is made up of acoustical sources from the main rotor, the anti-torque system (tail rotor), the engine(s), and drive systems. For turbine-powered helicopters, the main rotor and anti-torque system dominate the acoustical signature. Engine and gearing noise are generally of significance only when up close to the helicopter. The same is true for piston-powered helicopters, although muffling of the engine is usually necessary.

The most noticeable acoustical characteristic of all helicopters is the modulation of sound by the relatively slow-turning main rotor. This modulation attracts attention, much as a flashing light is more conspicuous than a steady one. The resulting modulated sound can become impulsive in character and is referred to as BVI (Blade Vortex Interaction Noise), *blade slap*, or more generally, as *impulsive noise.* In some flight conditions, the main rotor noise can become quite impulsive in character (*blade slap*, or more generally *impulsive noise*), which can increase the annoyance of the helicopter to people on the ground.

Impulsive noise occurs during high-speed forward flight as a result of blade thickness and compressible-flow on the advancing blade. This latter source causes the blade’ airloads to fluctuate rapidly. These fluctuations result in impulsive noise with shock waves that can propagate forward. High tip-speed rotor designs flown at high airspeeds are the worst offenders.

At lower airspeeds, and typically during a descent, rotor impulsive noise can occur when a blade intersects its own vortex system or that of another blade. This type of noise is referred to as Blade Slap or (BVI) noise. When this happens, the blade experiences locally high velocities and rapid angle-of-attack changes. This tends to produce a sound that is loud and very annoying in character.

There are three basic types of anti-torque systems used in current helicopters: the conventional open tail rotor, the ducted tail rotor/fan (e.g., the Fenestron), and the Coanda-effect/ blown-air system (e.g., the NOTAR). Each system has its own unique acoustical characteristics. The conventional open tail rotor generates a fluctuating low pitch whine or drone. The ducted tail rotor/fan produces a high pitch, sometimes fluctuating shrill. The blown-air, directional-vane system generates a broadband, “compressed-air”hissing.

The noise of both the open tail rotor and the ducted tail rotor/fan increases with airspeed and in high-rate climbs and turns. Interaction between the main rotor and either type of anti-torque system can, and often, exacerbates the anti-torque system’ sound output. In addition, the proximity of the vertical fin and tail boom influences the sound output of an open tail rotor. Somewhat similarly, the presence of vanes/stators and support struts, plus inflow/outflow turbulence, exacerbate the sound output of ducted tail rotor/fan systems. Turbulent flows off the pylon and fuselage also tend to increase the level and the sound fluctuations of both these types of anti-torque systems.

The Fenestron has some advantages over an open rotor at distance since it generates a higher frequency sound, which is more easily attenuated by the atmosphere. On many helicopters, the main source of noise heard at distance, particularly if a high tip-speed tail rotor is used, is associated with the tail rotor blade thickness. ©Quiet open tail rotors© tend, therefore, to use lower tip speeds, thinner blade sections and, to provide adequate thrust, an increase in the number of blades.

With regard to the noise generated, the NOTAR has advantages in many respects because it is independent of the increase associated with the other two types of anti-torque systems. The NOTAR is, however, only available at the current time on designs manufactured by one company.

The general relationship between sound level and helicopter weight, and a comparison of the sound generated by a helicopter and other common noise sources are given in Appendix 1.

2.2 Impact of Operations

For a typical small/light helicopter, the most annoying noise mechanism impulsive noise (BVI) occurs during partial power descents and in sharp/high-rate turns. For a typical medium or large/heavy helicopter, they can occur in low-speed level flight, during partial power descents, and in sharp/high-rate turns. Figures 1, 2 and 3 show the flight conditions under which you can expect main rotor impulsive noise to occur.

The impulsive noise boundary for your particular helicopter may be somewhat larger than that shown in Figures 1 and 2 because the main rotor may generate impulsiveness intermittently when it encounters wind gusts, or during a rapid transition from one flight condition to another. Although the sound produced at these descent rates is not extremely loud to crewmembers inside the helicopter, they can, in most cases, recognize it and, thereby, define the impulsive noise boundaries for their particular helicopter. However, in some cases, the impulsive BVI noise cannot be detected in the cockpit. Of course, people on the ground hear impulsive noise grow more intense as the helicopter descends.

Figure 1

High-Noise Flight Operations – Small/Light Helicopter

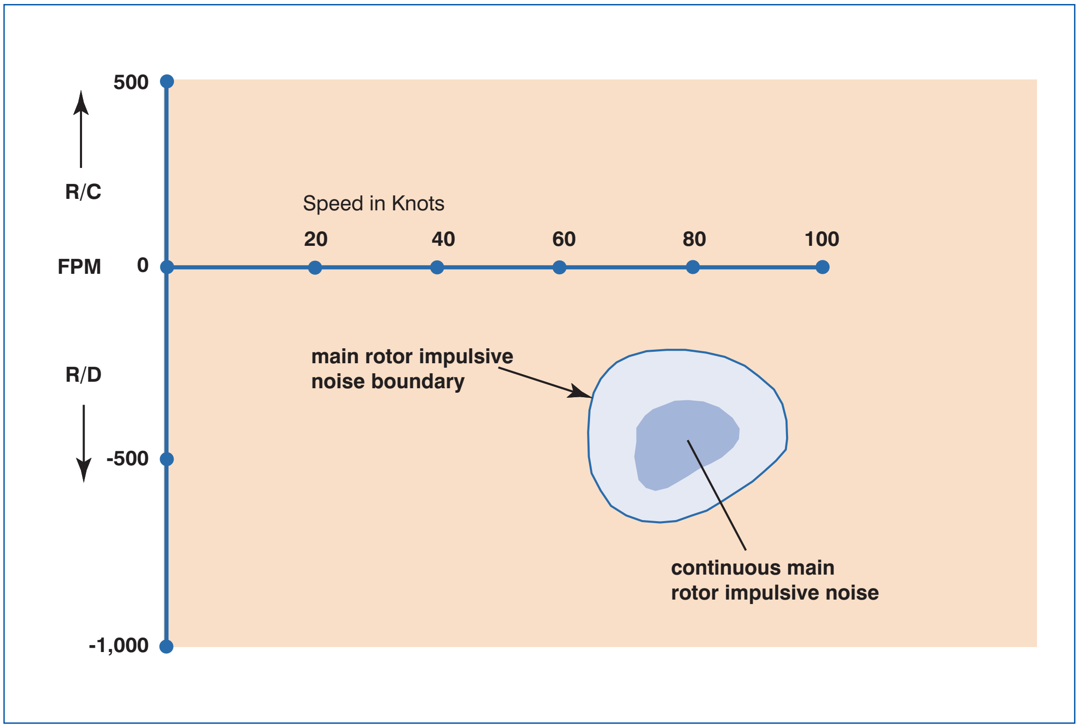
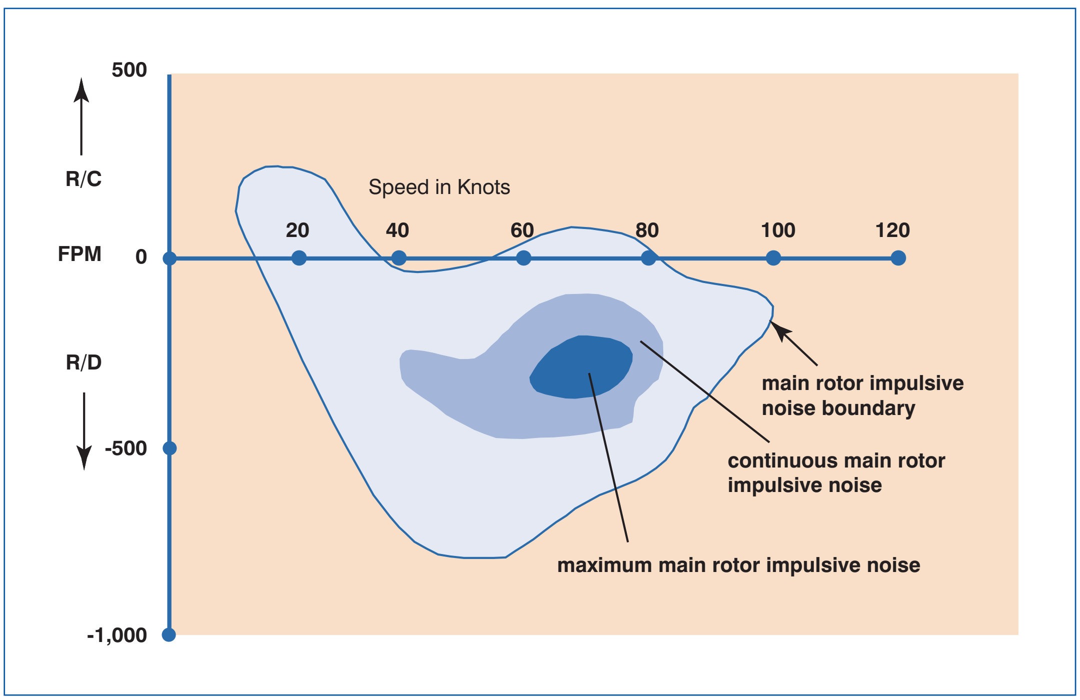


Figure 2

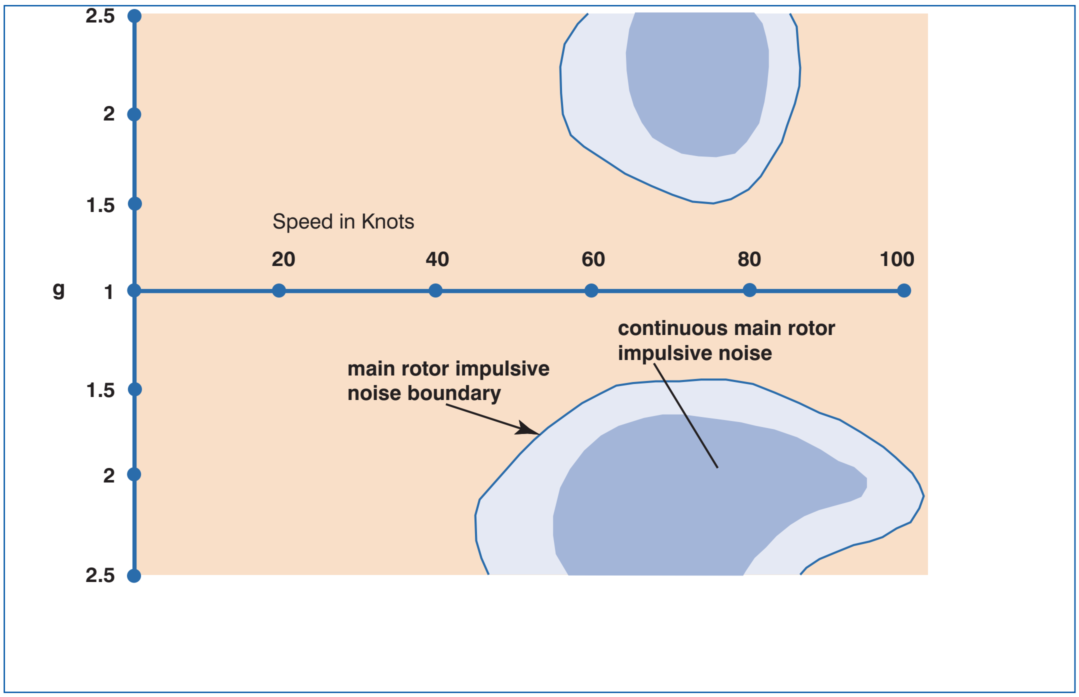
High-Noise Flight Operations – Medium/Heavy Helicopters



Main rotor impulsive noise also occurs during maneuvers (i.e. in constant speed turns, if turn rates are too high. Here, the main rotor blade and wake interact in much the same manner as in partial power descents. As Figure 3 shows, for a medium helicopter with a two-bladed main rotor, main rotor impulsive noise occurs in turns that exceed 1.5g, with airspeeds between 50 and 90 knots in a left turn, and between 40 and 100 knots in a right turn. There is little difference in the intensity of the noise in right or left turns once the “critical g” is reached. The crew can normally hear this impulsiveness. These characteristics also generally apply to other helicopters. Unfortunately, specific information on the increase in the level of impulsive noise, in terms of “g” or bank angle, is not generally available.

Figure 3

High-Noise Maneuvers – Medium Helicopters



In addition to the general characteristics discussed above, it should be noted that the various sound sources exhibit specific directivity characteristics. These are not discussed in detail in this document, but it is worth noting that, in general, the main rotor sound is focused towards the front and on the advancing blade side of the helicopter. The tail rotor noise is similarly focused forward and it is also radiated downward under the helicopter. As a result, the sound – in particular from the main rotor impulsive sources - is generally detected well in advance of the helicopter flying over. Fortunately, these aspects are normally taken into account when noise abatement procedures are developed by the manufacturer. Even so, they should not be ignored when planning flight operations.

3 General Guidelines for Noise Abatement Operations

This section offers a number of noise abatement techniques for use in daily operations. A few general guidelines are given below.

- Avoid noise-sensitive areas altogether, when possible. Follow:
    - high ambient noise routes such as highways, or
    - unpopulated routes such as waterways.

If it is necessary to fly near noise-sensitive areas:

- maintain an altitude as high as possible in line with the HAI *Fly Higher Chart* (Fig. 4)
- fly normal cruising speed or slower
- observe low-noise speed and descent recommendations
- avoid sharp maneuvers
- use steep takeoff and descent profiles, and
- vary the route, since repetition contributes to annoyance

Flights conducted over roads (particularly interstates), railways and rivers in noise-sensitive areas are less likely to generate complaints than routes that acoustically and visually intrude on peoples’ privacy, such as those that cross, or can be heard from, residential backyards.

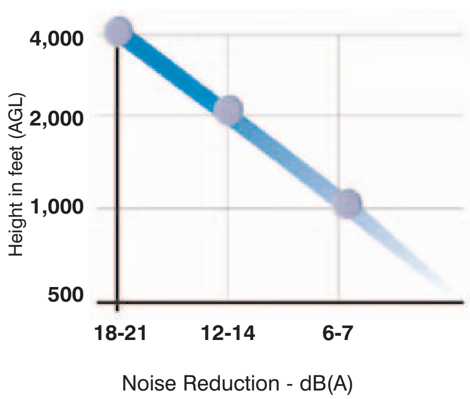
3.1 Flyover Height

Maintaining an altitude as high as possible above the ground and flying at airspeeds consistent with minimum noise output, flight safety and ATC constraints is essential. Height and distance have a major impact on the noise level observed under the helicopter, as illustrated in the HAI *Fly Higher Chart*, shown in Figure 4. It shows the relationship of flyover height and noise exposure at ground level for different-sized helicopters. A doubling of height or distance reduces the level by six to seven dB(A). If the height/distance is increased by a factor of three, the maximum level is decreased by approximately 10 dB(A), which is equivalent to reducing the loudness by half. The chart can be used to decide what height should be flown so that the helicopter’s noise output is compatible with community noise exposure criteria. For example, to be compatible with the generally accepted criterion of 65 dB(A) max2 for flyover of noise-sensitive areas, light/small helicopters should fly at altitudes no less than 1,000 feet AGL. For medium helicopters, the recommended height is 2,000 feet AGL, and, for heavy/large helicopters, 4,000 ft AGL.

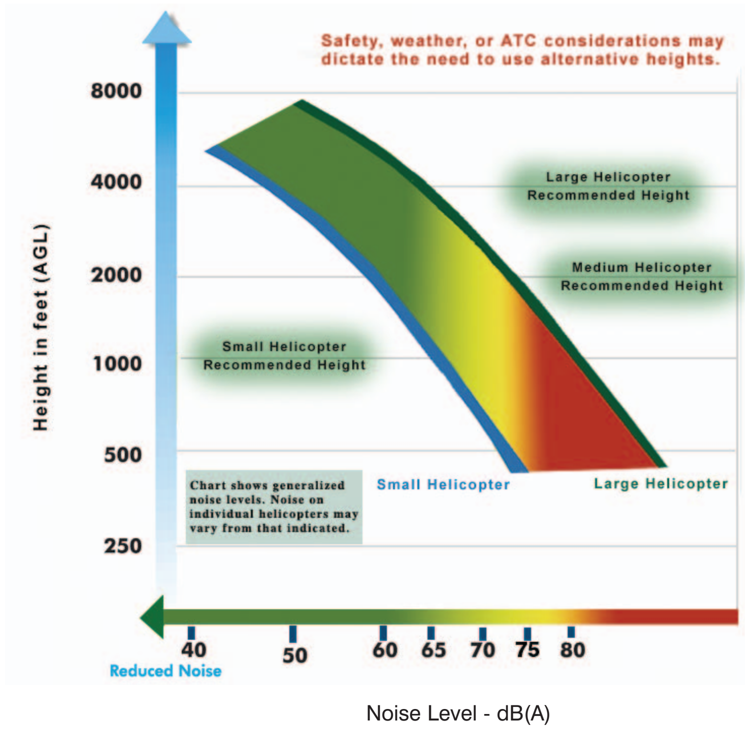
Figure 4

Fly Higher Chart

dB Reduction vs. Height



Variation of Noise Levels with Flyover Height



3.2 FAA Guidance - VFR Flight Near Noise Sensitive Areas

The FAA has published guidance when flying near noise-sensitive areas for a number of years. It was updated in 2004 and issued as Advisory Circular AC91.36D. A copy of this document is reproduced in Appendix 2. This voluntary practice recommends:

- the avoidance of flights over noise sensitive areas, if practical.
- When not possible, pilots flying VFR flights over noise-sensitive areas should make every effort to fly at not less than 2,000 feet above the surface, weather permitting, even though flight at a lower level may be consistent with the provisions of FAR 91.79, Minimum Safe Altitudes.

Typical of noise-sensitive areas in this Advisory Circular are defined as: outdoor assemblies of persons, churches, hospitals, schools, nursing homes, residential areas designated as noise-sensitive by airports or by an airport noise compatibility plan or program, and National Park Areas (including Parks, Forest, Primitive Areas, Wilderness Areas, Recreation Areas, National Seashores, National Monuments, National Lakeshores, and National Wildlife Refuge and Range Areas). It is also recommended that, during departure from, or arrival at an airport, climb after takeoff and descent for landing should be made so as to avoid prolonged flight at low altitudes near noise sensitive areas. It should be mentioned, however, that such procedures should not apply where it would conflict with ATC clearances or instructions, or where an altitude of less than 2,000 feet is considered necessary by a pilot in order to adequately exercise his or her primary responsibility for safe flight.

It should be noted that FAA guidance recommends a height of 2,000 ft AGL be used for general over flight of noise-sensitive areas. This is somewhat different than the guidance developed by HAI's Fly Neighborly Committee, discussed previously and illustrated in Figure 4, which recommends 1,000 ft for small helicopters. For medium helicopters, HAI recommends 2,000 ft, the same as the FAA, but for large helicopters, HAI recommends 4,000 ft. Although FAA guidance should be followed when practical, HAI considers use of the heights in Figure 4 will ensure acceptable noise disturbance to persons on the ground.

3.3 Flyover Speed

The airspeed of the helicopter has an important effect on both noise exposure impact and the impulsive character of your helicopter. Generally, it is best to fly at, or somewhat below, normal cruise speeds when over-flying noise-sensitive areas. Airspeeds above normal cruise can dramatically increase your helicopter's noise levels and the impulsive character to the extent that, even if you maintain the suggested minimum flight altitudes, your over-flight is no longer compatible with generally accepted noise exposure criteria.

4 How to Operate Helicopters Quietly

In this section, general information is presented on how to fly a helicopter more quietly. Such information applies to the operation of all helicopters. The flight techniques given in this section are also general in nature and vary somewhat according to the actual helicopter being flown. Manufacturers have developed recommended noise abatement procedures for specific models and, when available, these should be followed. The information on HAI® Web site, www.rotor.com, represents data currently available from the manufacturers. As new data becomes available, HAI will periodically update the Web site. In some cases, the noise abatement information is also available in the specific *Rotorcraft Flight Manual*. When noise abatement information is not available for a specific helicopter model, the flight techniques in the following sections should be followed. This information is also helpful to supplement the information supplied by a manufacturer.

4.1 General

Increasing the distance/separation from noise-sensitive areas is the most effective means of noise abatement.

4.2 Ground Operations

Although startup and shutdown procedures are relatively quiet and are usually shielded from noise-sensitive areas, it is good practice to reduce the amount of time spent on the ground with the rotor turning. This reduces the noise exposure to ground handling crews and heliport/airport personnel.

Minimize the duration of warm-up or cool-down periods (typically two to three minutes, although, on some engines it can be as short as 30 seconds). Do not idle at the heliport for extended periods of time.

When feasible, park with the rotors running with the nose of the helicopter directed into the wind to minimize noise. If the wind speed is above 5 knots, avoid parking with the nose 15 degrees or more from the approaching wind. This will minimize tail rotor noise.

4.3 Hover / Hover Taxi /Ground Taxi

When hover turning, make the turn in the direction of the main rotor rotation. This minimizes the anti-torque thrust required and, therefore, minimizes the level of noise generated by the anti-torque system. Keep the turn rate to as low as practical.

4.4 Takeoff and Climb (Departure)

Takeoffs are reasonably quiet operations, but you can limit the total ground area exposed to helicopter sound by using a high rate-of-climb and making a smooth transition to forward flight. The departure route should be over areas that are least sensitive to noise.

4.5 Enroute and Cruise Flyover

- Fly at least at the heights recommended in the *Fly Higher Chart* (Figure 4).
- Fly at the highest practical altitude when approaching metropolitan areas.

- Select a route into the landing area over the least populated area.
- Follow major thoroughfares or railway tracks.
- Avoid flying low over residential and other densely populated areas.
- If flight over noise-sensitive areas is necessary, maintain a low to moderate airspeed.
- Select the final approach route with due regard to the type of neighborhood surrounding the landing area, and the neighborhood's sensitivity to noise. Assess this sensitivity beforehand for each landing area. Some guidelines are:
  - Keep the landing area between the helicopter and the most noise-sensitive building or area on approach.
  - If the landing area is surrounded by noise-sensitive areas, approach using the recommended noise abatement approach procedure or at the steepest practical glideslope.
  - Avoid flying directly over hospitals, nursing homes, schools, and other highly noise-sensitive facilities.

4.6 Turns (Maneuvers)

As a general rule, avoid rapid, "high g"/high bank angle turns. When the flight operation requires turns, perform control movements smoothly.

4.7 Descent/Approach and Landing

The approach techniques presented below are designed to avoid the impulsive (BVI) noise generated by the main rotor. These techniques typically use a glideslope that is a few degrees steeper than a normal approach. In addition to avoiding high BVI regimes, steep approaches ensure a greater height over the noise-sensitive area. Once the transition from cruise to the approach glideslope has been made, the airspeed and rate of descent can be "tailored" to fit local conditions, avoid unsafe regimes, and still guarantee minimum noise.

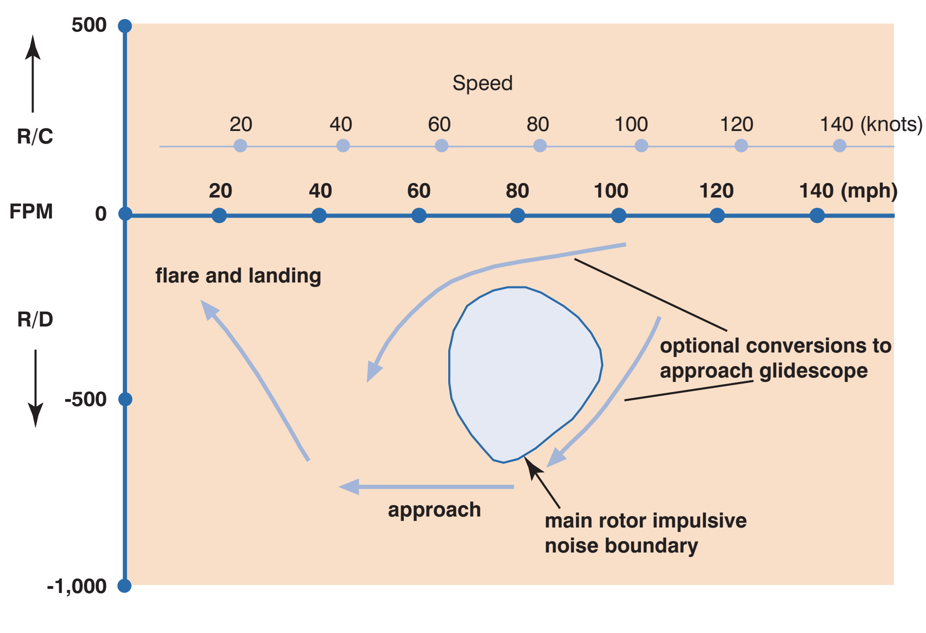
4.7.1 Small/light helicopters

Follow one of the noise abatement flight techniques given below and illustrated in Figure 5.

- When commencing approach, first establish a rate-of-descent of at least 500 fpm, then reduce airspeed while increasing the rate-of-descent to 700-800 fpm.
  - Hold the rate-of-descent to less than 200 fpm while reducing airspeed to 50-60 knots/60-70 mph, then increase the rate-of-descent to 700-800 fpm.
- At a convenient airspeed between 45 and 60 knots/50-70 mph, set up an approach glideslope while maintaining the 700-800 fpm or greater rate-of-descent.
- Increase the rate-of-descent if main rotor BVI noise is heard, or if a steeper glideslope is required.
- Just prior to the "flare," reduce the airspeed below 50 knots/60 mph before decreasing the rate-of descent.
- Execute a normal flare and landing, decreasing the rate-of-descent and airspeed appropriately.

Figure 5

Noise Abatement Approach Techniques for Small/Light Helicopters



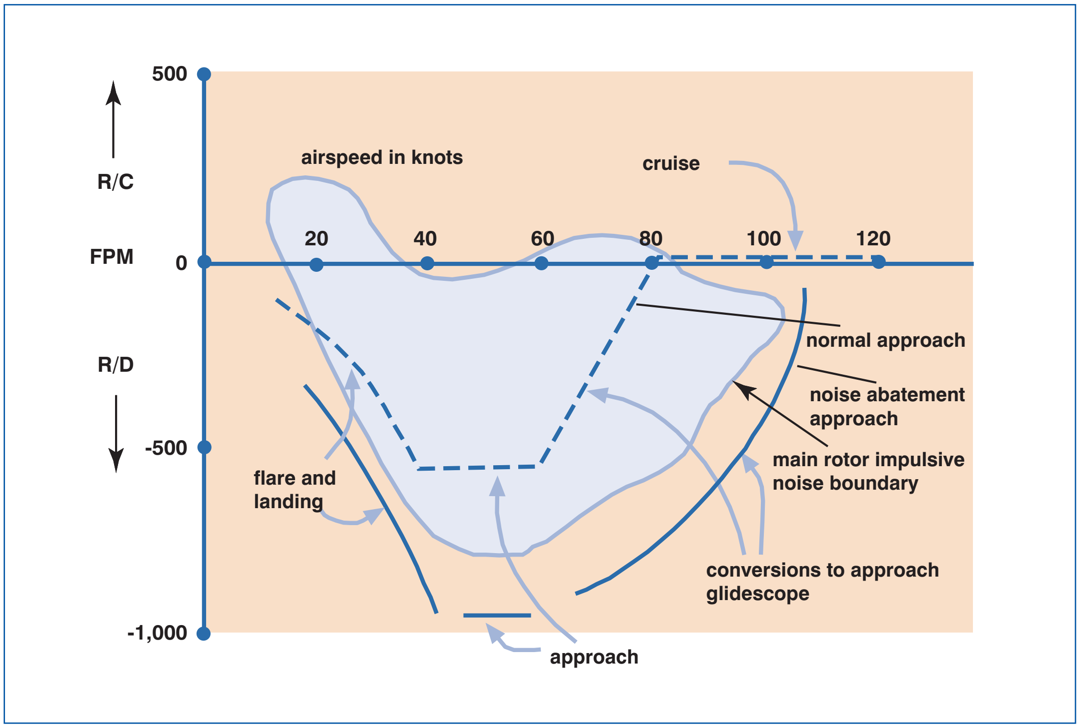
4.7.2 Medium and heavy helicopters.

Follow the noise abatement flight technique given below and illustrated in Figure 6.

- When commencing approach, begin descent at a rate of at least 200 fpm before reducing airspeed, then reduce airspeed while increasing the rate of descent to 800-1000 fpm.
- At a convenient airspeed between 50 and 80 knots, set up an approach glideslope while maintaining the 800-1000 fpm rate of descent.
- Increase the rate-of-descent if main rotor BVI noise is heard, or a steeper glides-lope is required.
- Just prior to the approach to the ©flare,® reduce the airspeed to below 50 knots before decreasing the rate-of-descent.
- Execute a normal flare and landing, decreasing the rate of descent and airspeed appropriately.

Figure 6

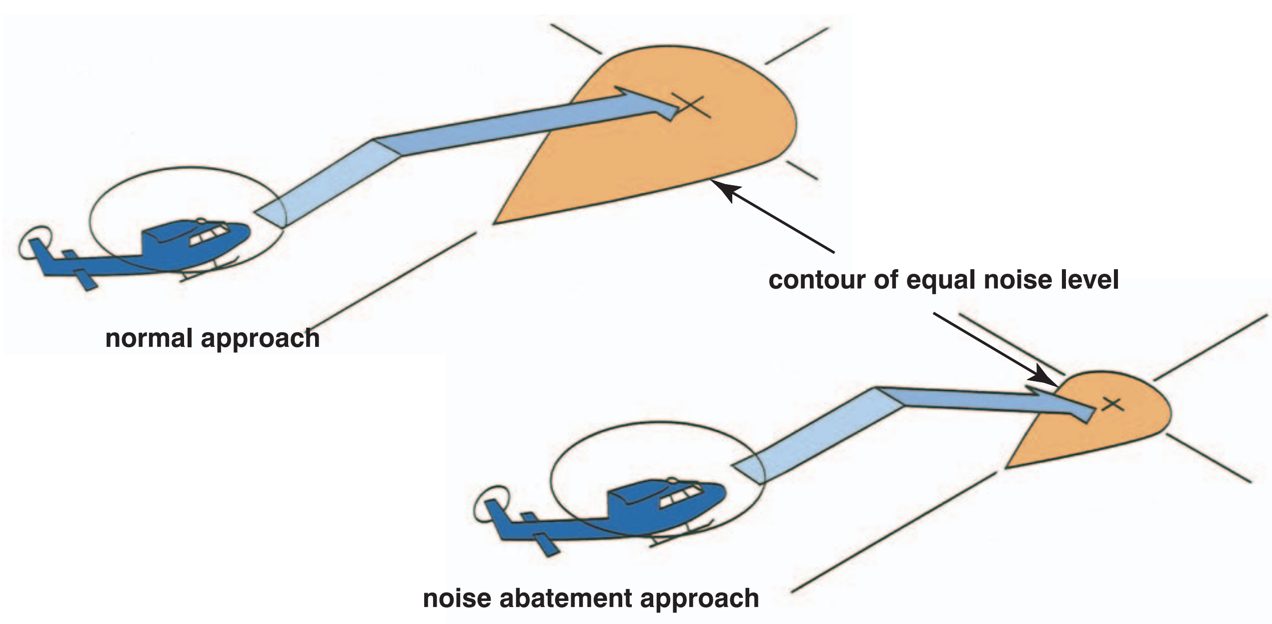
Noise Abatement Approach Technique for Medium and Heavy Helicopters



The noise abatement flight techniques discussed above for small/light and medium helicopters reduce the ground area exposed to a given noise level by as much as 80 percent. Figure 7 illustrates the potential noise benefits when compared to a normal approach.

Figure 7

Ground Noise Exposure Footprint



4.8 Other Factors to be Considered

It is important to mention that the sound environment on the ground and weather have much to do with how offensive helicopter sound is judged. The background noise of residential areas reaches its lowest level between late evening and early morning. In warm weather, people are apt to be relaxing outdoors in the evening and on weekends. At these times, they are most conscious and resentful of noise intrusion. Therefore, flight over or near residential areas should be avoided, if possible.

Although the weather cannot be controlled, it may be possible to adapt the planned flight schedule to take advantage of meteorological conditions to help minimize noise. The two weather factors most useful in this respect are wind and temperature. They are helpful because they affect the propagation of sound, and vary throughout the day, in a more or less predictable manner.

Wind carries sound in the direction towards which it is blowing, and it makes a background noise of its own that, in high winds, tends to reduce the intrusion of helicopter sound. In inland areas, surface winds are generally stronger during the day, reaching a maximum in mid-afternoon and weaker at night. In coastal regions, land and sea breezes give a different diurnal pattern, beginning to blow shortly after sunrise (sea breeze) and sunset (land breeze). These winds can be used to increase the acceptability of the helicopter by flying downwind of densely populated areas and by scheduling the majority of flights after noon near especially noise-sensitive areas.

Temperature has two effects upon sound. One is the tendency of warm air to be more turbulent than cold air, and, therefore, to disperse sound and decrease its nuisance effect. The other is temperature gradient - the change in temperature with altitude. The normal gradient is negative: temperature decreases with altitude. A negative gradient reaches a maximum in the late morning or just after noon, and is more intense during summer months. This means that it is of some value to schedule flights to and from noise-sensitive areas during the warmer parts of the day. Also, lower temperatures lead to higher advancing main rotor and tail rotor tip speeds which increase the magnitude of the impulsive noise.

At certain times, however, there may be an inversion in the atmosphere - a layer of air from a few hundred to a few thousand feet thick in which the temperature increases with altitude. The inversion reverses the normal curvature of sound propagation, turning an abnormally high portion of the sound energy back toward the ground. The most severe inversions usually occur at night and in the early morning. These, then, are times when the sound of the helicopter will have the most adverse effect upon people on the ground.

In terms of helicopter noise, the worst possible combination of atmospheric conditions is a windless, cold, overcast morning. At such times, it is important that even more emphasis is placed on using noise abatement procedures.

NOTE: *The noise abatement flight techniques described above and detailed on the HAI Web site permit flight crews to fly helicopters in the quietest manner possible. They are to be construed as advisory guidelines only. If flying according to these noise abatement flight techniques conflicts with operating the aircraft in a safe manner, then all safety-related procedures take precedence.*

5 Pilot Training

The basic scope of the recommended pilot training program and an outline of the requirements for such a program are outlined in this section. The information embodied in other sections of the Guide is also relevant. In addition, HAI has issued an interactive Noise Abatement Training CD for Pilots which covers all the aspects a pilot should be aware of. This CD, developed by the HAI Manufacturers Committee, and initially issued in 2006, is available from HAI. It is recommended that this CD be used as a part of any pilot noise abatement training program.

5.1 Scope

The scope of a pilot training program should include:

- initial and recurrent flight training for pilots
- preparing and distributing recommended noise abatement procedures
- organizing and holding operator and manufacturer seminars
- providing environmental and supervisory personnel training courses.

5.2 Basic Guidelines for Pilot Training

Public acceptance for helicopter operations can be obtained in several ways. One is noise abatement. Crew training to ensure that pilots are fully familiar with the noise abatement procedures is, therefore, vital. The following guidelines for noise abatement training are suggested:

- Select training teams for ground and flight training, usually two or three people who have extensive metropolitan operations experience.
- Standardize presentations.
- Maintain complete files of all persons trained.
- Circulate comment sheets at all meetings or training sessions, and stress that all suggestions, ideas and comments will be taken into consideration.
- Make the necessary changes in training and publications that result from the feedback.
- Maintain an open-door policy to all participants, flight crews and the public.
- Determine the effect of this training on the public. Has it been positive or negative?
- Record all complaints and include all relevant details, such as the time, date, location, altitude, and weather.
- Follow up with proficiency training every six months. Emphasize the importance of public contacts, and the necessity of good community relations.
- Expand the guidelines given in this document to cover local needs.

6 Operator Program

When operating a helicopter in a new area, a new spectrum of sound is added to the usual noise environment. If that area is a municipality, thousands of people will hear the new sounds and know a helicopter is operating. How they react depends not only on the noise you generate but upon physical, economic, and psychological factors. One thing is certain: they will react strongly, adversely, and actively if the sound is too irritating, if it represents something that seems to threaten their safety and well-being, or if they cannot see how the noisemaker (the helicopter) benefits them. Although it is up to operators to educate the public about the safety and usefulness of the helicopter, pilots can make the public less hostile to the helicopter (and to the operator's arguments about its safety and community service) by flying in such a way as to make the sound of the aircraft as non-intrusive as possible.

6.1 Introduction

The Fly Neighborly Program attacks the problem of helicopter noise on three fronts: pilot training, flight operations planning, and public education and acceptance. These three areas are interrelated. Planning flight operations with an eye to noise abatement can have a major positive impact on both the pilot training program and public acceptance.

The information presented in this section provides only a broad outline of the possible actions helicopter operators can take. Operators are encouraged to expand this outline by applying knowledge of their own geographical area of operations, the nature of their businesses, and the local climate of opinion with regard to helicopter operations.

6.2 Company Policy

Implement a company policy aimed at reducing the sound levels produced by the operation of your aircraft or other equipment. As part of this policy, implement a broad-based complaint prevention program. Such a voluntary program is necessary to preclude the eventual implementation of restrictive and mandatory federal, state or local laws, regulations, or ordinances.

To formulate this policy, identify and evaluate current and anticipated problems. To assure its acceptance and success, make your commitment to your policy clear, in order to generate such change as may be necessary in the attitudes of pilots and other personnel. In order for company policy to have any meaning, companies should formulate and implement specific guidelines.

6.2.1 Formulate Guidelines

Guidelines are intended to assist flight crews and flight operations personnel to formulate responsible mission profiles without infringing on operational reality. They are not, however, provided as a substitute for good judgment on the part of the pilot. They must also not conflict with federal aviation regulations, air traffic control instructions, or aircraft operating limitations. The noise abatement procedures outlined by these guidelines should be used when consistent with prudent and necessary mission requirements. The safe conduct of flight and ground operations remains the primary responsibility.

- Enroute operations:
  - Maintain a height above the ground consistent with the HAI *Fly Higher Chart* (see Figure 4), or higher, when possible. Complaints are significantly reduced when operating above these altitudes. The reverse is also true.
  - Vary routes in order to disperse the aircraft sound.
- Heliport (Terminal) operations:
  - Restrict hours or frequency of operations as appropriate. Minimize early or late flights, especially on holidays and weekends.
  - Limit ground idling in noise-sensitive areas.
  - Minimize flashing landing lights in residential areas at night.
- Establish procedures for each sensitive route or terminal.
- Provide flight crews with noise abatement procedures for each model of aircraft.

6.2 Implement Guidelines

- Publish all guidelines and procedures in a flight operations manual or similar document.
- Train flight crews and flight operations personnel as appropriate:
  - Educate regarding basic attitudes in ground school.
  - Train in noise abatement procedures for each model of aircraft to be flown.
  - Emphasize awareness and recognition of sensitive routes and terminals.
  - Establish a requirement that noise abatement procedures must be considered in recurrent company flight checks.
- Assign responsibility and authority for the company program to an appropriate person.

6.2.3 Review and Revise

- Establish periodic reviews of company policy and programs to respond to changes in the regulatory climate or operational conditions.
- Revise your policy and programs as necessary.

7 Managing Public Acceptance

7.1 Scope

The scope of the public acceptance program includes:

- engendering media support
- promoting positive public relations
- enacting a program to prevent or resolve complaints from the public

7.2 Media Support

The purposes of engendering media support are to:

- develop favorable and active helicopter-related media coverage
- provide valid information concerning helicopter operations as necessary

Media sometimes concerned with news of helicopter-related activities include general circulation newspapers, television and radio news, trade journals, and the magazines or newsletters of international, national, state, and regional helicopter associations.

To engender awareness and support in these media, a number of actions can be taken:

- Provide press releases to trade journals and local newspaper, radio, and television news editors concerning any Fly Neighborly seminars that may be sponsored by the local helicopter operator association.
- Support a continuing campaign with the trade journals to keep the rotary-wing community aware of the Fly Neighborly Program.
- Support a continuing campaign with the general press to make the public aware of the Fly Neighborly Program, and the benefits of helicopter transport.
- Stage demonstrations and press conferences addressing specific local issues such as heliports, high-rise evacuation, police services, search and rescue services, emergency medical evacuation, fire-fighting, and the benefits of helicopter transportation to the general public.

7.3 Public Relations

The purposes of engaging in public relations activities are to:

- Develop awareness in the community of the benefits of helicopter transportation
- Develop awareness of the Fly Neighborly Program
- Develop support for the voluntary Fly Neighborly Program, as administered by the helicopter community, in lieu of governmental regulation

In order of their general importance and effectiveness, public relations activities can be undertaken in conjunction with:

- governmental agencies concerned with aviation such as federal, state, or local agencies, the FAA, or state aeronautics commissions
- other governmental agencies not particularly concerned with aviation, such as regional planning commissions, economic development commissions, the National League of Cities, or the U.S. Council of Mayors

- local civic and professional organizations such as Rotary or Kiwanis Clubs, the National Association of Aviation Officials, the Airport Operators Council International, or the National Fire Protection Association. Provide speakers for their local meetings. Solicit their sponsorship of heliports based on the Fly Neighborly Program as a civic project to promote public service.
- nongovernmental economic development agencies such as chambers of commerce, regional economic development councils, or merchant associations. Demonstrate to economic development agencies how helicopter transportation benefits the community, and present data to show the economic viability of helicopter transportation.
- direct public contact
- environmental organizations such as Greenpeace, the Sierra Club, or federal or state environmental protection agencies. Provide information. Do not immediately assume they are hostile to the planned operations. Instead, emphasize the positive environmental aspects of helicopter operations, such as the fact that they are involved in search and rescue operations for hikers or workers injured in remote areas, and that they provide access to such areas without the need to pave over ground for landing strips.

Public relations can be improved by influencing government agencies concerned with aviation in the following ways:

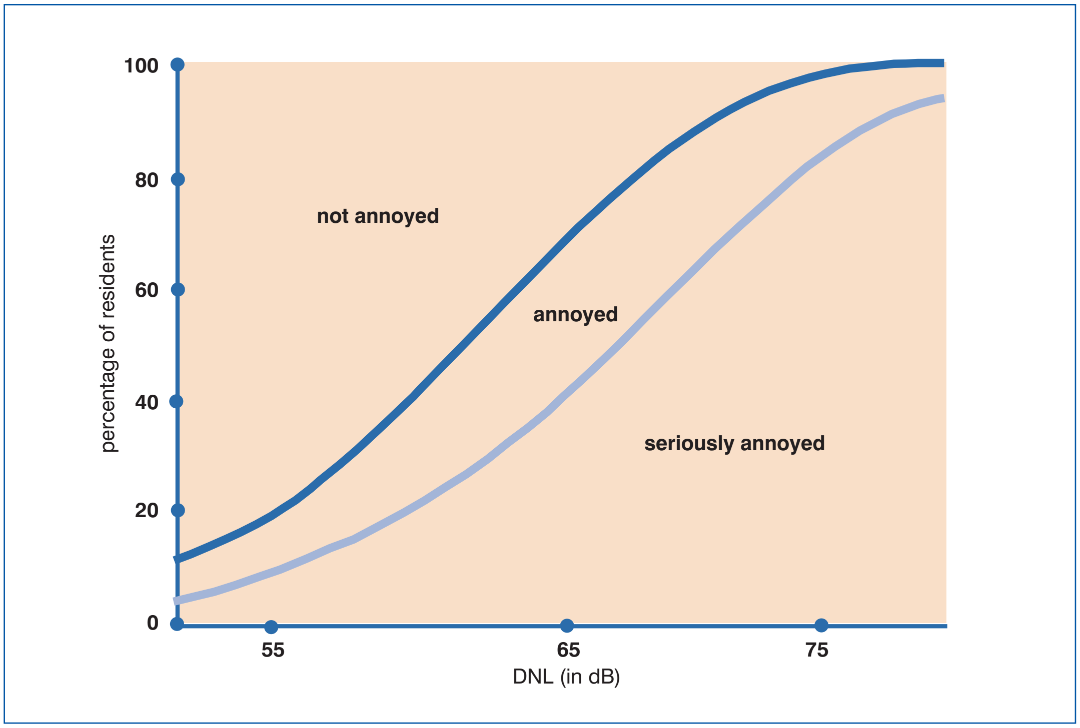
- Participate in public hearings
- Provide professional testimony as appropriate
- Conduct flight demonstrations
- Conduct one-on-one campaigns
- Submit petitions and letters

7.4 Preventing and Responding to Complaints

Helicopter operations are undeniably noisy, and this guide is concerned with a program designed to minimize the problem. Figure 8 shows the relationship between the amount of noise people are exposed to, and how annoyed they are likely to get. In the figure, the amount of noise exposure is expressed as DNL (day-night sound level).

Figure 8

Relationship between Noise Exposure and Annoyance



7.4.1 Complaint Prevention

A significant number of noise-related complaints can be prevented in the first place, given a certain degree of sensitivity, foresight, and commitment. Prevent complaints by assessing the environmental compatibility of potential landing facilities. Select those most suitable from a safety, operational, and environmental point of view.

Implement a public acceptance program.

- When contemplating site licensing, identify, contact, and try to influence potential sources of opposition before the hearing.
- Initiate or support presentations, seminars, or displays to educate the public about the value of helicopter transport.

Educate customers about noise abatement procedures, in order to prevent or minimize conflicts between their expectations and company policy.

Coordinate operations personnel and flight crews, so that flights that would unnecessarily violate company policy are not assigned.

7.4.2 Handling Noise Complaints

Although earlier sections of this guide offer information concerning noise abatement techniques, it is unlikely all noise complaints can be avoided. Since some complaints are inevitable, how they are handled is also important to the success of the Fly Neighborly Program.

The resulting problem is not simple. A helicopter can annoy people simply by being over, or too near, certain noise-sensitive areas. If someone calls the FAA, or a state agency, and offers routine information such as the aircraft registration number, colors, or type, it is likely that he or she will be told the aircraft was not in violation of any regulation, and that, therefore, nothing can be done. The result can be an angry, frustrated member of the community who will probably not be particularly supportive of any current or future helicopter or heliport related issue.

The helicopter user community has a real interest in assuring all complaints are appropriately addressed. Conventional channels for complaints are demonstrably insufficient. Therefore, a number of regional helicopter associations have started to operate their own complaint lines. These lines offer state, federal and local agencies another option when they receive complaint calls about legal and proper operations. The agencies can pass the complaint along to the regional association, or provide the complainant with the telephone number of the complaint line.

Such programs offer a number of benefits:

- Regional associations can often identify an aircraft with much less information than other agencies require.
- Associations can ensure that each issue is addressed and, when possible, satisfy the complainant.

When a complaint is received, how should it be addressed?

- The most effective way to deal with the complaint is to contact the complaining party personally. When you do, avoid being defensive, argumentative, or opinionated. Sincerely try to understand the other person's point of view, and avoid hostile confrontations. Sometimes merely listening politely can improve the situation.
- Furthermore, evaluate the problem thoroughly, and follow through. Was the pilot aware of the problem? Was there something the pilot could have done to avoid it? Is it likely to recur? Contact the pilot or the operator to determine the facts. Consult this guide, and other sources of noise abatement information, to determine how to improve the situation.
- Finally, respond to the caller. Tell him or her what has been learned, and what is being done to prevent the situation from recurring.

Of course, the best way to handle complaints is to avoid them in the first place. If a problem with a certain operation can be anticipated, contact the likely complainant, or members of the public to be impacted, before the operation begins. Explain to him or her, the purpose, timing, and duration of the operation, and its likely impact upon the area. People like to feel they have some control over their lives. Often, just a simple courtesy call in the beginning can save hours of trouble and nuisance later.

An example is given in Appendix 3 of a noise abatement program established at a heliport in a downtown area. The noise abatement program that was put into effect to solve the situation is described.

8 Fly Neighborly Program– What Can be Achieved?

The Fly Neighborly Program outlined in this guide, together with the information on HAI's Noise Abatement Training CD for Pilots, and use of the noise abatement procedures which are available on HAI's Web site, provide the basis for lowering the noise generated by helicopters in day-to-day operations. In addition, the noise abatement procedures offer a way of reducing the impulsive noise characteristic of helicopters which occur during normal operations and often cause complaints. By adopting and following the Fly Neighborly Program, a high level of public acceptance can be obtained.

It should also be noted that current public acceptance of helicopters is, in general, poor and, unless the program outlined in this guide is adopted, further international, national, and local regulations will be enacted to limit helicopter operations. Therefore, HAI strongly recommends that its members introduce a Fly Neighborly Program as outlined in this guide.

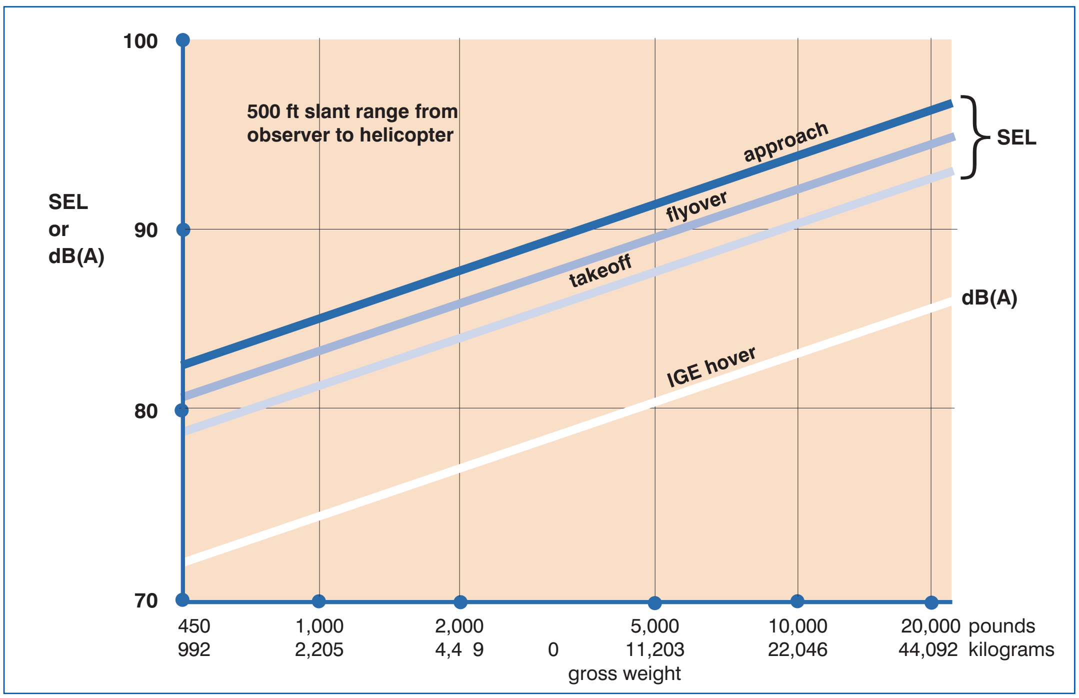
If the procedures given in this guide are followed, public acceptance will be improved and the rotorcraft segment of the aviation industry will be able to flourish and grow, without being restricted by the burden of new noise regulations and operational restrictions.

Sound Comparisons

The general relationship between sound level and helicopter weight is shown in Figure A1 reproduced from the HAI Helicopter Noise Prediction Method. Smaller helicopters are generally quieter than larger ones and sound levels tend to increase approximately three decibels per doubling of helicopter weight.

Figure A1

Relationship between Sound Level and Helicopter Weight



What do these sound levels mean? Table A1 provides sound levels for illustrative noise sources heard both outdoors and indoors. Human judgment of the relative loudness (relative to a reference level of 70 dB(A) of different sound levels is also given.

Table A1

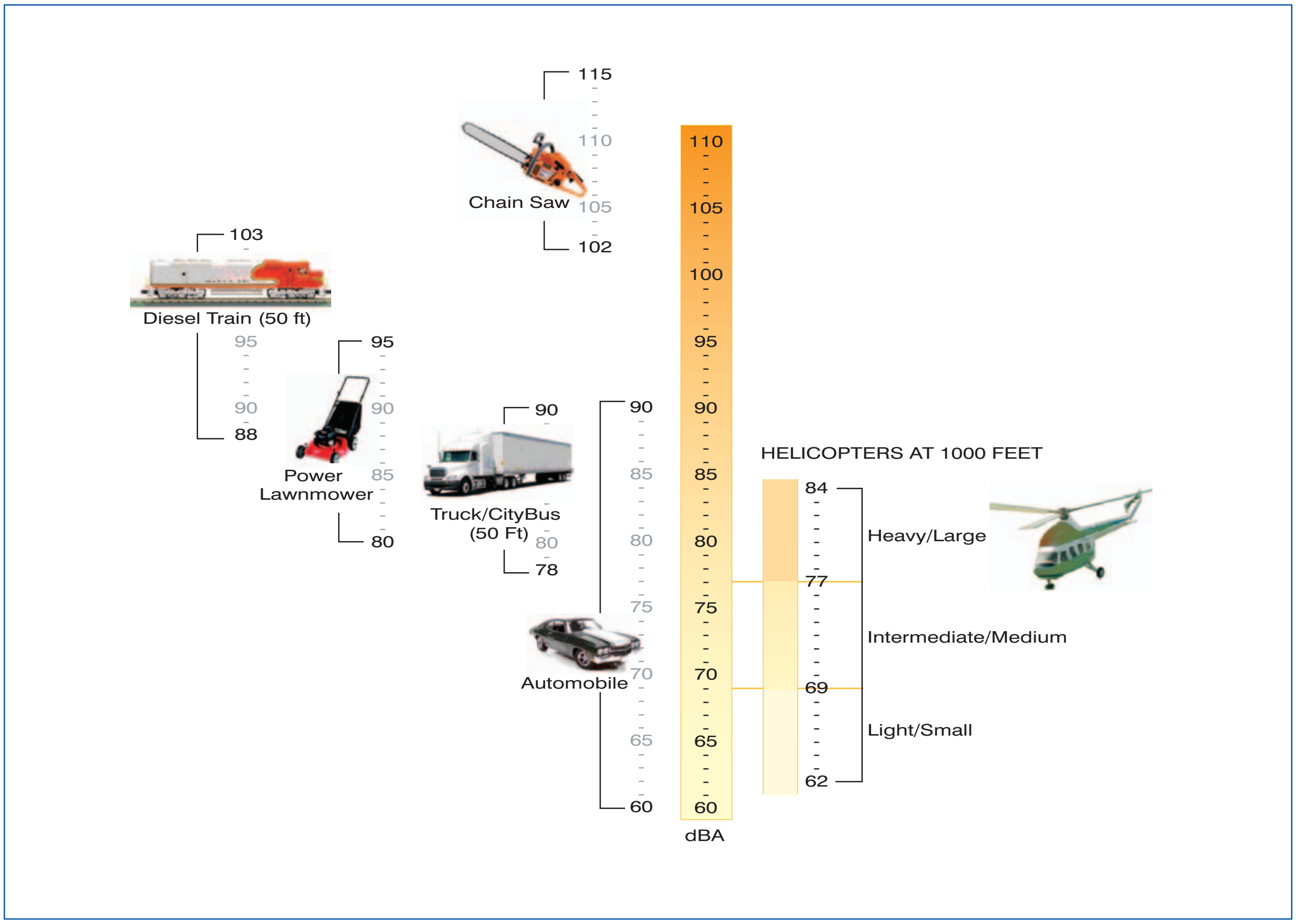
Illustrative Noises

dB(A)	Overall Level	Community (Outdoors)	Home or Industry (Indoors)	Human Judgment of Loudness
130	uncomfortably loud	military jet takeoff from aircraft carrier at 50ft (130)		
120			Oxygen Torch (121)	120dB(A) 32 times as loud
110	very loud	turbofan aircraft takeoff at 200ft (118)	riveting machine (110) rock-and-roll band (108-114)	110 dB(A) 16 times as loud
100		Jet flyover at 1,000 ft (103)		100dB(A) 8 times as loud
90		Power mower (95)	newspaper press (97)	90dB(A) 4 times as loud
80	moderately loud	car wash at 20 ft (89) diesel truck at 40mph at 50ft (84) high urban ambient sound (80)	food blender (88) milling machine (85) garbage disposal (80)	80dB(A) twice as loud
70		car at 65mph at 25ft (77)	living room music (76) TV audio, vacuum cleaner (70)	70dB(A)[reference]
60		A/C unit at 100ft (60)	electric typewriter at 10ft (64) dishwasher (rinse) at 10ft (60) conversation (60)	60dB(A) half as loud
50	quiet	large transformer at 100ft (50)		50 dB(A) 1/4 as loud
40		bird calls (44) lower limit of urban ambient sound (40)		40dB(A) 1/8 as loud
10	just audible			
0	threshold of hearing			

Figure A2 provides some basis for comparing helicopter sound levels to other familiar sounds. Comparisons are made at representative distances from each sound source.

Figure A2

Comparison of Sounds



The sound level is, however, only one of the aspects to be considered since the character of the sound - or the impulsive character of the sound - can be equally important. Fortunately, the impulsive character of the sound, as well as the actual level, can be controlled by using noise abatement procedures.

FAA Advisory Circular AC 91.36D

Date: September 17, 2004 AC No: 91-36D

Subject: VISUAL FLIGHT RULES (VFR) FLIGHT NEAR NOISE-SENSITIVE AREAS Initiated by: ATO-R

1. PURPOSE. This Advisory Circular (AC) encourages pilots making VFR flights near noisesensitive areas to fly at altitudes higher than the minimum permitted by regulation and on flight paths that will reduce aircraft noise in such areas.

2. EFFECTIVE DATE. This advisory circular is effective on September 17, 2004.

3. CANCELLATION. Advisory Circular 91-36C, Visual Flight Rules (VFR) Flight Near Noise Sensitive Areas, dated October 19, 1984, is cancelled.

4. AUTHORITY. The FAA has authority to formulate policy regarding use of the navigable airspace (Title 49 United States Code, Section 40103).

5. EXPLANATION OF CHANGES. This AC has been updated to include a definition of "noisesensitive" area and add references to Public Law 100-91; the FAA Noise Policy for Management of Airspace Over Federally Managed Lands, dated November 1996; and the National Parks Air Tour Management Act of 2000, with other minor wording changes.

6. BACKGROUND.

a. Excessive aircraft noise can result in annoyance, inconvenience, or interference with the uses and enjoyment of property, and can adversely affect wildlife. It is particularly undesirable in areas where it interferes with normal activities associated with the area's use, including residential, educational, health, and religious structures and sites, and parks, recreational areas (including areas with wilderness characteristics), wildlife refuges, and cultural and historical sites where a quiet setting is a generally recognized feature or attribute. Moreover, the FAA recognizes that there are locations in National Parks and other federally managed areas that have unique noise-sensitive values. The Noise Policy for Management of Airspace Over Federally Managed Areas, issued November 8, 1996, states that it is the policy of the FAA in its management of the navigable airspace over these locations to exercise leadership in achieving an appropriate balance between efficiency, technological practicability, and environmental concerns, while maintaining the highest level of safety.

b. The Federal Aviation Administration (FAA) receives complaints concerning low flying aircraft over noise sensitive areas such as National Parks, National Wildlife Refuges, Waterfowl Production Areas and Wilderness Areas. Congress addressed aircraft flights over Grand Canyon National Park in Public Law 100-91 and commercial air tour operations over other units of the National Park System (and tribal lands within or abutting such units) in the National Parks Air Tour Management Act of 2000.

c. Increased emphasis on improving the quality of the environment requires a continuing effort to provide relief and protection from low flying aircraft noise.

d. Potential noise impacts to noise-sensitive areas from low altitude aircraft flights can also be addressed through application of the voluntary practices set forth in this AC. Adherence to these practices is a practical indication of pilot concern for the environment, which will build support for aviation and alleviate the need for any additional statutory or regulatory actions.

7. DEFINITION. For the purposes of this AC, an area is "noise-sensitive" if noise interferes with normal activities associated with the area's use. Examples of noise-sensitive areas include residential, educational, health, and religious structures and sites, and parks, recreational areas (including areas with wilderness characteristics), wildlife refuges, and cultural and historical sites where a quiet setting is a generally recognized feature or attribute.

8. VOLUNTARY PRACTICES.

a. Avoidance of noise-sensitive areas, if practical, is preferable to overflight at relatively low altitudes.

b. Pilots operating noise producing aircraft (fixed-wing, rotary-wing and hot air balloons) over noisesensitive areas should make every effort to fly not less than 2,000 feet above ground level (AGL), weather permitting. For the purpose of this AC, the ground level of noise-sensitive areas is defined to include the highest terrain within 2,000 feet AGL laterally of the route of flight, or the uppermost rim of a canyon or valley. The intent of the 2,000 feet AGL recommendation is to reduce potential interference with wildlife and complaints of noise disturbances caused by low flying aircraft over noise-sensitive areas.

c. Departure from or arrival to an airport, climb after take-off, and descent for landing should be made so as to avoid prolonged flight at low altitudes near noise-sensitive areas.

d. This advisory does not apply where it would conflict with Federal Aviation Regulations, air traffic control clearances or instructions, or where an altitude of less than 2,000 feet AGL is considered necessary by a pilot to operate safely.

9. COOPERATIVE ACTIONS. Aircraft operators, aviation associations, airport managers, and others are asked to assist in voluntary compliance with this AC by publicizing it and distributing information regarding known noise-sensitive areas.

Signed

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Sabra W. Kaulia

The Portland Public Heliport Noise Abatement Program

In 1989, the city of Portland, Oregon and the Northwest Rotorcraft Association decided to build a heliport to provide direct air access to downtown Portland. During hearings to approve the facility, concern was expressed about the resulting noise increase in the area surrounding the heliport. In response to this concern, the following noise abatement program was put into effect:

Noise Abatement

Pilots are requested to utilize the following noise abatement procedures, whenever possible. Of course, it is the pilot©s responsibility on each flight to determine the actual piloting techniques necessary to maintain safe flight operations.

1. *Flight Paths:* Maintain approach and departure paths over rivers and freeways. Avoid residential neighborhoods, the McCormick Pier Apartments, the convention center towers, and the piers for the Steel Bridge. Approach and depart over the Morrison, Broadway, and Grand Avenue bridges. [A map is provided with those features marked.]

2. *Steep Departure:* Depart at Vy (best rate of climb) when possible.

3. *Steep Approach:* Use steep approach angle when possible (PLASI is set for a 10ë approach).

4. *Night Operations:* Avoid night approach from the north, as it passes near the McCormick Pier Apartments.

5. *Minimize Ground Operations:* Minimize the duration of warm-up or cool-down periods (typically two to three minutes). Do not idle at the heliport for prolonged periods.

6. *Avoid High Noise Regime:* Most helicopters have a high noise regime near a descent profile of 70 knots at 300 fpm. Pilots can avoid descending through this area by initiating the descent at a higher speed than normal.

7. *Gradual and Smooth Control Inputs:* Gradual and smooth control inputs result in reduced noise impact.

8. *Avoid Steep Turns:* Avoidance of steep turns result in reduced noise impact.

9. *Enroute Altitude:* Whenever possible, maintain 2,000 feet above ground level over residential neighborhoods and other noise-sensitive properties, as per FAA AC 91-36 "VFR Flight Near Noise-Sensitive Areas."

10. *Fly Neighborly:* Refer to the HAI Fly Neighborly Program for additional information on how to minimize helicopter noise impact.

Citizen concerns about helicopter noise emanating from the Portland Heliport should be brought to the attention of the Northwest Rotorcraft Association by calling 503-286-0927. All noise complaint calls will be logged. If the caller can identify the helicopter involved, follow-up calls will be made to the involved helicopter pilot and then back to the concerned citizen.

The Bureau of General Services maintains a Portland Heliport Noise Abatement Committee. When noise issues at the heliport cannot be easily resolved, the committee will be convened to assist in the resolution process, and the logs reviewed for pertinent information.

As concerns noise abatement of helicopter traffic in other parts of the city, it is noted that the Port of Portland has developed a plan of preferred helicopter flight routes for use in the greater Portland metropolitan area, especially as concerns helicopter traffic to and from Portland International Airport and Portland Hillsboro Airport. This program has been very successful and the heliport is still operating today.

The acronyms used in this Guide are defined below.

AGL Above Ground Level

BVI Blade-Vortex Interaction

dB Decibels, the basic unit for measuring the level of sounds.

dB(A) A-weighted sound level. A sound pressure level that has been weighted to approximate human hearing response to sound of different frequencies. Weighted sound pressure levels, such as the “A” weighting, are currently used for noise certification of light helicopters and small propeller-driven aircraft. In FAA Advisory Circular 36-3C, they are used as the basis for airport access restrictions that discriminate solely on the basis of noise level.

DNL Day-night sound level. A single-number measure of community noise exposure (expressed in the unit Ldn), introduced to help predict the effects on a population of the average long-term exposure to environmental noise. It is based on the equivalent sound level (Leq), but corrects for night-time noise intrusion. A ten-decibel correction is applied to noises heard between 10 P.M. and 7 A.M. to account for the increased annoyance of noises heard at night.

DNL uses the same energy equivalent concept as Leq. The specified time integration period is 24 hours. For assessing long-term exposure, the yearly average DNL is the specified metric in the FAA 14 CFR Part 150 noise compatibility planning process.

EPNL Effective perceived noise level. A measure of complex aircraft noise, expressed in decibels, that approximates human annoyance responses. It corrects for the duration of the noise event and the presence of audible pure tones and discrete frequencies such as the whine of a jet aircraft. The EPNL is used by the FAA as the noise certification metric for large transport and turbojet airplanes, as well as for helicopters.

fpm Feet per minute. A measure of speed used for the rate-of-climb or rate-of-descent of an aircraft.

KIAS Knots indicated airspeed. A measure of the speed of an aircraft.
[1 knot = 1.69 ft/sec =101.3 ft/min = 1.15 mile/hour]

Leq Equivalent sound level expressed in decibels. The energy average noise level (usually A-weighted) integrated over some specified time. The purpose of Leq is to provide a single-number measure of noise level averaged over a specific period of time. When use for assessing community noise, Leq is normally defined over a 16 or 24 hour period.

mph Miles per hour. A measure of speed. [1 mph = 0.87 Knots]

PNL Perceived noise level. A rating of noisiness used in assessing aircraft noise, expressed in decibels. PNL is computed from sound pressure levels measured in octave or one-third octave frequency bands. An increase of ten decibels in PNL is equivalent to doubling the perceived noisiness. Currently, this measure is used by the FAA and foreign governmental agencies in the noise certification process for all turbojet-powered aircraft, and large propeller-driven transports.

R/C Rate of climb. The speed at which an aircraft is ascending.

R/D Rate of descent. The speed at which an aircraft is descending.

RPM Rotor revolutions per minute. The rotational speed at which an aircraft rotor is turning.

SEL Sound exposure level. A measure, expressed in decibels, of the effect of duration and magnitude for a single event. In typical aircraft noise model calculations, SEL is used in computing aircraft acoustical contribution to the equivalent sound level (Leq) and the day-night sound level (DNL).

Fly Neighborly Guide

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