APPENDIX 5

NOISE IMPACT ASSESSMENT FOR THE PROPOSED CAPE WINELANDS AIRPORT EXPANSION

JULY 2025

NOISE IMPACT ASSESSMENT FOR THE PROPOSED CAPE WINELANDS AIRPORT EXPANSION

Final Report

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Submitted to:

PHS Consulting

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DECLARATION OF INDEPENDENCE

The specialist appointed in terms of the Regulations_

I, Demos Dracoulides , declare that—

General declaration:

I act as the independent specialist in this application;

I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;

I declare that there are no circumstances that may compromise my objectivity in performing such work;

I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;

I will comply with the Act, regulations and all other applicable legislation;

I have no, and will not engage in, conflicting interests in the undertaking of the activity;

I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;

All the particulars furnished by me in this form are true and correct; and

I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

DDA Environmental Engineers

Name of company (if applicable):

Date: 17/06/2025

DETAILS OF SPECIALIST

Demos Dracoulides has 25 years of consulting experience specialising in air quality and noise pollution. He is the Director of DDA Environmental Engineers.

Over the past years, Demos Dracoulides has been involved in the development of industry-specific emission inventories, establishing the impacts on air quality in a great number and variety of projects, including AEL applications, emissions testing reporting to the NAEIS system, etc. These include projects for petrochemical and chemical industries, minerals processing and mining, the ceramic industry, power generation, landfill facilities, incineration operations, wastewater treatment plants, airport facilities, etc.

He has also been active in the noise and vibration fields. He has been involved in the development of industry-specific noise and vibration models, including power stations and transformer stations. He has participated in teams for the design, technical specifications and noise minimisation for projects such as the Gautrain, the Cape Town International Airport Realignment, the Ankerlig and the Gourikwa CCGT Power Stations, as well as the proposed Pebble Bed Modular Reactor Demonstration Power Plant in South Africa.

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Terminology, Acronyms and Definitions

AEDT	Aviation Environmental Design Tool
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
A-weighted sound level:	A frequency weighting filter used for the measurement of sound pressure levels designed to reflect the acuity of the human ear, which does not respond equally to all frequencies.
ATNS	Air Traffic navigation Services
Day-Night noise level, DNL, L_{dn}	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 22:00 and 06:00.
dB(A):	Unit of sound level. The weighted sound pressure level by the use of the A metering characteristic and weighting specified in the American National Standards Institute (ANSI) Specifications for Sound Level Meter.
deciBel (dB)	A measure of sound. It is equal to 10 times the logarithm (base 10) of the ratio of a given sound pressure to a reference sound pressure. The reference sound pressure used is 20 micropascals, which is the lowest audible sound.
DNL	Day Night Level
EAP	Environmental Assessment Practitioner
EPNL	Effective Perceived Noise Level
Equivalent A-weighted sound level (L_{Aeq}):	A-weighted sound pressure level in decibels of continuous steady sound that within a specified interval has the same sound pressure as a sound that varies with time. This is an average sound level that would produce the same energy equivalence as the fluctuating sound level actually occurring.
Equivalent continuous rating level ($L_{Req,T}$):	The equivalent continuous A-weighted sound level ($L_{Aeq,T}$), measured or calculated during a specified time interval T, to which adjustments are added for tonal character, impulsiveness of the sound and the time of day.
FAA	Federal Aviation Administration
ICAO	International Civil Aviation Organization
Impulse time weighting	A standard time constant weighting applied by the Sound Level Meter.
Integrating averaging sound level meter	A Sound Level Meter which accumulates the total sound energy over a measurement period and calculates an average.
L_{A10}	The noise level exceeded 10% of the measurement period with 'A' frequency weighting calculated by statistical analysis. It represents the higher noise levels during the measurement interval. It is generally utilized for traffic noise impacts.
L_{A50}	The noise level exceeded 50% of the measurement period with 'A' frequency weighting calculated by statistical analysis.
L_{A90}	The noise level exceeded 90% of the measurement period with 'A' frequency weighting calculated by statistical analysis. It gives an indication of the underlying noise level, or the level that is almost always there in between intermittent noisy events. It is generally utilized for the determination of background noise, i.e. the noise levels without the influence of the main sources.
L_{AE}	Sound exposure level
L_{eq}	Equivalent continuous sound pressure level of a steady state sound that has the same sound energy as that contained in the actual time-varying sound being measured over a specific time, referenced to the sound pressure level of $2*10^{-5}$ Pa.

L_{pA}	Sound pressure level with 'A' frequency weighting.
$L_{pA\ max}$	Maximum sound pressure level with 'A' frequency weighting.
L_{Rdn}	Equivalent continuous Day-Night rating level
L_{WA}	Sound power level in dB(A), referenced to the sound power of 10^{-12} Watt.
NSR	Noise-Sensitive Receivers.
PWL	Power level in dB(A).
Residual noise	Sound in a given situation at a given time that excludes the noise under investigation but encompasses all other sound sources, both near and far.
SABS	South African Bureau of Standards
SANS	South African National Standard.
SEL	Sound Exposure Level
TNIP	Transparent Noise Information Package
WHO	World Health Organisation

1 INTRODUCTION

The Cape Winelands Airport (CWA) (formerly Fisantekraal Airfield) is an ex-South African Air Force airfield built around 1943 and was acquired by Cape Winelands Airport Limited in November 2020. The CWA is 150 ha in size and is located approximately 13 km northeast of Durbanville and 25 km northeast of the Cape Town International Airport.

The CWA currently serves as a general flying airfield and is used for flight training. In addition, the airfield offers aircraft maintenance, private charter flights, hangarage for private plane owners, as well as the sale of aviation fuel.

It has been proposed that the existing airfield and adjacent plots of land be developed into a commercial and aviation hub, supporting flight operations domestically, regionally, as well as internationally.

PHS Consulting (Pty) Ltd has been appointed to undertake the Environmental Impact Assessment (EIA) for the proposed project. DDA Environmental Engineers (DDA) was appointed by PHS Consulting to undertake a noise impact assessment for the proposed development. The present report describes the baseline noise measurements, the noise modelling and the noise impact assessment for the project.

1.1 Terms of Reference

The proposed terms of reference for the noise impact assessment were:

- Define and describe the baseline noise conditions around the airport;
- Provide an overview of relevant legislation, standards, guidelines and policies, including international standards and policies (such as the ICAO), regarding the reduction of aircraft noise at source, the noise surrounding airports, compatible land use planning and limitations on land use and requirements for noise mitigation, including aircraft noise abatement procedures, and compensation;
- Identify the noise-sensitive receptors, such as schools, hospitals, places of worship, etc. in the area that may be affected;
- Use the Integrated Noise Model or its successor, which was developed by the Federal Aviation Administration, as defined in SANS 10117, to determine and map the future noise contours (representing the average and maximum noise levels) associated with the proposed project;
- Assess the impacts of the noise on surrounding communities and the environment, using the prescribed impact assessment methodology;
- Identify and describe potential cumulative impacts resulting from the proposed project in relation to proposed and existing developments in the surrounding area;
- Recommend mitigation measures to minimise/reduce impacts and enhance benefits. Assess the effectiveness of proposed mitigation measures using the prescribed impact assessment methodology;
- Recommend and draft a monitoring campaign to ensure the correct implementation and adequacy of recommenced mitigation and management measures, if applicable; and
- Assist the Environmental Assessment Practitioner (EAP) in addressing any relevant comments raised by stakeholders.

1.2 Study Area

The CWA is located approximately 13 km northeast of Durbanville and 25 km northeast of Cape Town International Airport. The location of the CWA can be seen in Figure 1-1 below and is accessible via the R304 and R312.

The communities close to the CWA include Klipheuwel, which is approximately 5 km to the north and Fisantekraal, which is approximately 3 km to the southwest of the CWA. The Durbanville residential suburb is located more than 6 km away, towards the southwest of the project site.

There are two proposed developments in the vicinity of the airport. The first is the Bella Riva Lifestyle & Country Estate, which is situated between the CWA and the railway line to the west. This development will be a mixed residential and lifestyle golf estate. The second is the Greenville Garden City development, which is located south of the CWA and the R312. The Greenville Garden City will be a residential development.

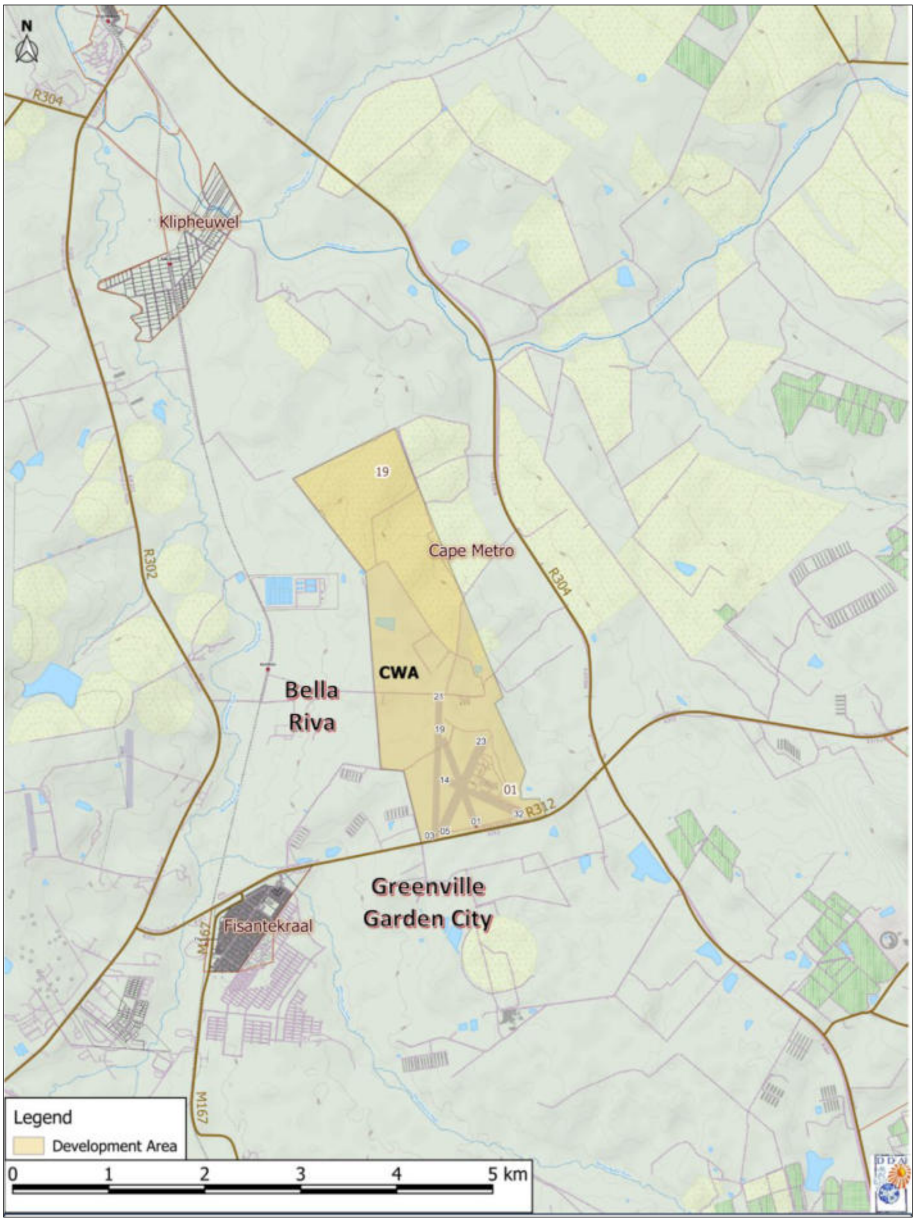

Figure 1-1. CWA Locality Map

1.3 Methodology Overview

For the aircraft noise calculations, the Aviation Environmental Design Tool (AEDT) from the US Federal Aviation Administration (FAA) was utilised. AEDT is a software system that models aircraft performance in space and time for the estimation of fuel consumption, emissions, noise and air quality consequences. AEDT consolidates the modelling of these environmental impacts in a single tool and is used for assessing each of these specific environmental impacts. AEDT is designed to model individual studies, ranging in scope from a single flight at an airport to scenarios at the regional, national, and global levels.

The AEDT is the successor of the INM model, which is specified in the SANS 10117-2008 Code for the calculation of aircraft noise in South Africa.

The AEDT model utilizes flight track information, aircraft fleet mix, standard and user-defined aircraft profiles and terrain as inputs. The AEDT model produces equivalent continuous Day-Night rating level L_{Rdn} exposure contours that are used for land use compatibility maps. The AEDT includes built-in tools for comparing contours and utilities that facilitate easy export to commercial Geographic Information Systems. The model also calculates predicted noise at specific sites, such as hospitals, schools or other sensitive locations.

The flight paths' input into the AEDT model was provided by Royal HaskoningDHV (Pty) Ltd, operating as NACO, in terms of the current annual hourly aircraft traffic movements (ATM), as well as the future predicted aircraft movements on busy days for the future scenarios of the existing airport and the new runway (see Section 1.4).

The following SANS codes relating to noise were taken into consideration for the noise impact assessment:

- SANS 10103 (for land use planning, annoyance and speech communication);
- SANS 10328 (for the methods for environmental noise impact assessment).

1.4 Operational Scenarios

For the noise impact assessment three operational scenarios were selected, covering the current airport runways under full utilisation, as well as the new runway during its operational year and under full capacity.

The current runway alignments (RNW 01/19, 03/21, 05/23 and 14/32) and the new runway orientation (RNW 01/19) can be seen in Figure 1-2.

The operational scenarios modelled in the study were:

Scenario 1: Existing runways at full capacity;

Scenario 2: New runway during its operational year[a]; and

Scenario 3: New runway at full capacity.

For the assessment of the existing runways (RNW 01/19, 03/21, 05/23 and 14/32), the typical busy day at full utilisation was used, which is expected to generate a total of 301 air traffic movements (ATM).

[a] Assuming no other limitations or constraints.

In order to evaluate the immediate effects of the change to the new runway from the existing, the ATM for the operational year were used, which were estimated to be 29 per day.

The maximum capacity of 208 ATM per busy day for the new runway was used for the assessment of the maximum impact of the new runway.

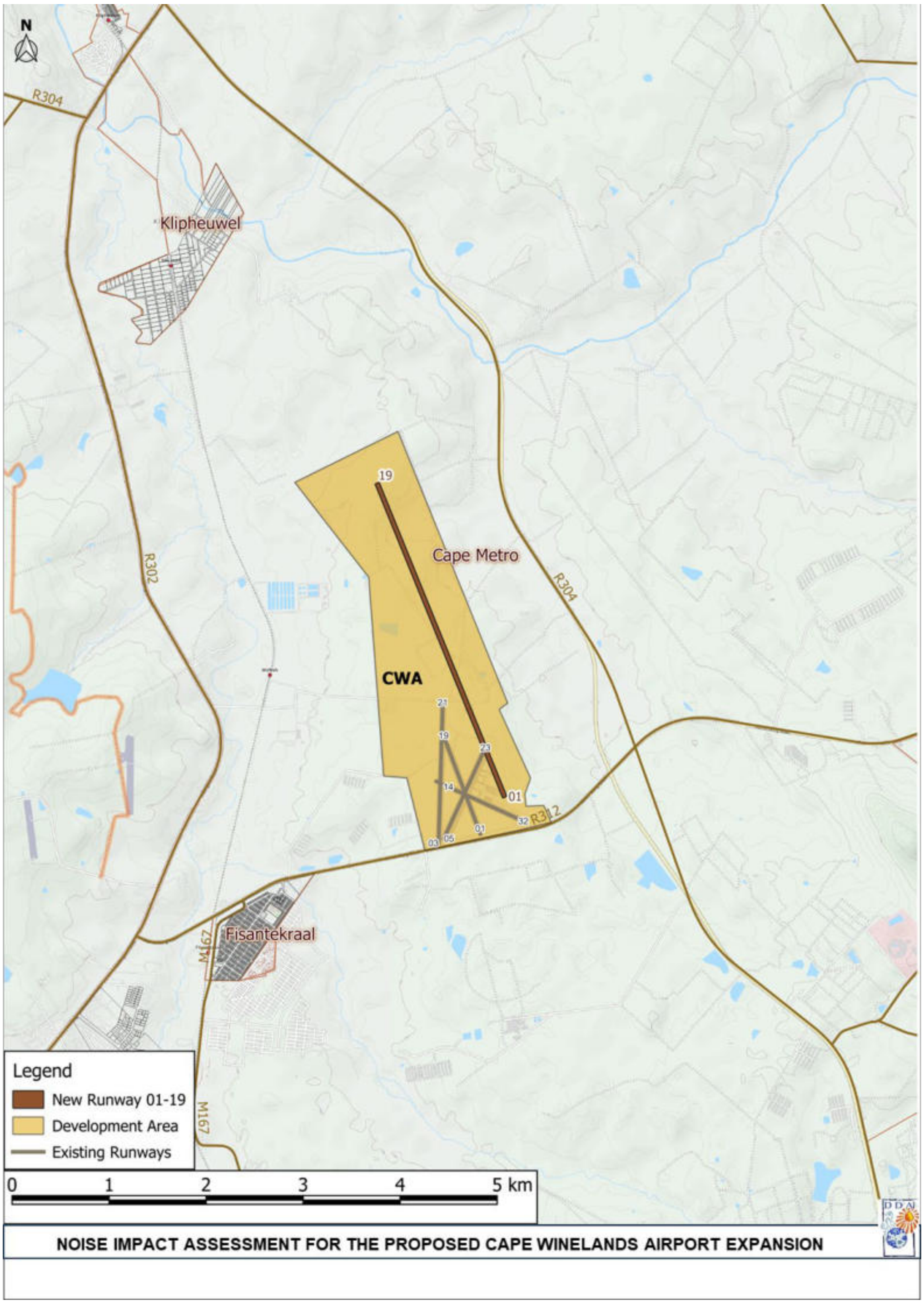

Figure 1-2. CWA Current and New Runway Layouts

2 NOISE BASICS, GUIDELINES AND LEGAL REQUIREMENTS

2.1 Noise Basics

Sound is created when an object vibrates and radiates part of that energy as acoustic pressure or waves through a medium, such as air, water or a solid. Sound and noise are measured in units of decibels (dB). The dB scale is not linear but logarithmic. This means, for example, that if two identical noise sources, each producing 60 dB, operate simultaneously they will generate 63 dB. Similarly, a 10-decibel increase in sound levels represents ten times as much sound energy.

The human ear can accommodate a wide range of sound energy levels, including pressure fluctuations that increase by more than a million times. The human ear is not equally receptive to all frequencies of sound. The A-weighting of sound levels is a method used to approximate how the human ear would perceive a sound, mostly by reducing the contribution from lower frequencies by a specified amount. The unit for the A-weighted sound levels is dB(A).

Small changes in ambient sound levels will not be detectable by the human ear. Most people will not notice a difference in loudness of sound levels of less than 3 dB(A), which is a two-fold change in the sound energy. A 10-dB(A) change in sound levels would be perceived as doubling of sound loudness.

The level of ambient sound usually varies continuously with time. A human's subjective response to varying sounds is primarily governed by the total sound energy received. The total sound energy is the average level of the fluctuating sound, occurring over a period of time, multiplied by the total time period.

In order to compare the effects of different fluctuating sounds, one compares the average sound level over the time period with the constant level of a steady, non-varying sound that will produce the same energy during the same time period. The average of the fluctuating noise levels over the time period is termed L_{eq}, and it represents the constant noise level that would produce the same sound energy over the time period as the fluctuating noise level.

Percentile parameters (L_n) are also useful descriptors of noise. The L_n value is the noise level exceeded for "n" percent of the measurement period. The L_n value can be anywhere between 0 and 100. The two most common ones are L_{10} and the L_{90}, which are the levels exceeded for 10 and 90 percent of the time respectively. The L_{90} has been adopted as a good indicator of the "background" noise level. The L_{10} has been shown to give a good indication of people's subjective response to noise.

Sound levels diminish with distance from the source because of dispersion, and for point noise sources the calculated sound pressure is:

$L_{p2} = L_{p1} - 20 \log(r_2/r_1)$

Where: L_{p2} = sound pressure level in dB at distance r_2 in meters, and

L_{p1} = sound pressure level in dB at distance r_1 in meters.

In the case of a line source (e.g. conveyor belt, road, etc.) the sound pressure is:

$L_{p2} = L_{p1} - 10 \log(r_2/r_1)$

In simple terms, for point sources, the distance attenuation would be approximately 6 dB(A) per doubling of distance from the source. For line sources the same attenuation is approximately 3 dB(A).

The atmospheric conditions, interference from other objects and ground effects also play an important role in the resulting noise levels. For example, "hard" ground, such as asphalt or cement transmits sound differently than "soft" ground, such as grass. The first ground type promotes transmission of sound, thus producing louder sound levels farther from the source. In general terms, the above effects increase with distance, and the magnitude of the effect depends upon the frequency of the sound. The effects tend to be greater at high frequencies and less at low frequencies.

Typical noise levels for various environments are shown in the following figure.

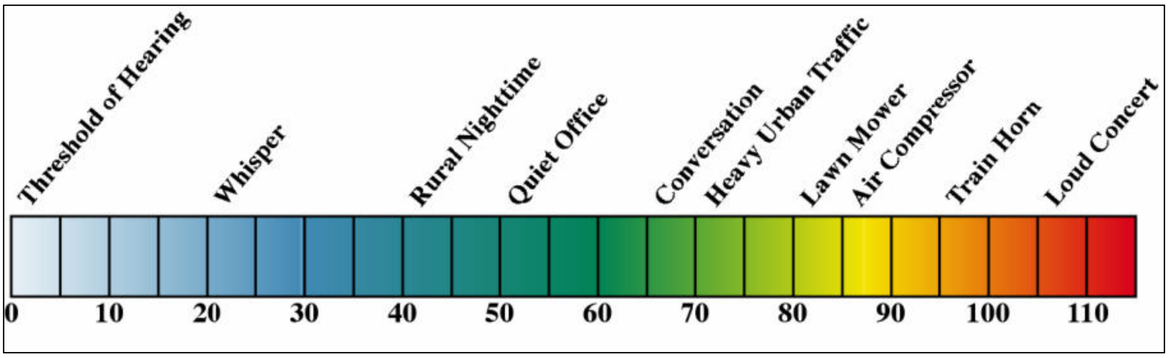

Figure 2-1. Typical Sound Levels (dB(A))

2.2 Noise Metrics

Noise metrics can be categorized as single-event metrics and energy-averaged cumulative metrics. Single-event metrics describe the noise from individual events, such as an aircraft flyover. Cumulative metrics describe the noise in terms of the total noise exposure throughout the day.

Several classes of noise metrics exist for quantifying noise exposure. However, only a limited set of these are used in noise health studies and most are based on average energy of the sound that the person is being exposed to. In sleep studies, researchers also use Maximum A-weighted level or A-weighted Sound Exposure Level.

In many studies, the metrics used are time-averaged frequency-weighted sound pressure levels, where the averaging time may vary from fractions of seconds, (as is the case when assessing maximum levels) to a year. The shorter time averaging is used in metrics that quantify the impact of single events, where the energy in the time period immediately adjacent to the peak level is thought to be important. The most popular weighting is A-weighting, which is derived from an equal loudness contour (tones at different frequencies deemed equally loud to a 40 dB tone at 1000 Hz.).

For land use planning purposes it is international practice to express aircraft noise in terms of an integrated, or energy-averaged, noise level over a period of 24 hours.

The noise metrics typically used for aircraft noise quantification are:

- L_{Aeq16}, which indicates noise exposure over a 16 hour daytime period usually 07:00-23:00. This same time period is also sometimes represented by L_{DAY}, which indicates noise exposure over a 12 hour day-time period, usually 07:00-19:00 and $L_{EVENING}$, which indicates noise exposure during 4 hours of the evening, typically 19:00-23:00.
- L_{NIGHT}, which indicates noise exposure at night, usually 23:00-07:00.
- L_{den} (day-evening-night level), which combines the L_{DAY}, $L_{EVENING}$ and L_{NIGHT} values to indicate average noise exposure over the 24 hour period, with a 5 dB penalty added to the evening

noise measure and a 10 dB penalty added to the night-time noise measure to account for the greater sensitivity of people to evening and nocturnal noise exposure. This metric is used in the European Union's Environmental Noise Directive Metrics (END) (Directive 2002/49/EC, 2002).

- L_{DN} (day-night level (DNL)), which is frequently used in airport noise studies internationally and primarily in the USA. It indicates the average noise exposure over a 24-hour period, with a 10 dB penalty added to the night-time. The exact hours defined as night-time vary somewhat between countries and may run between 23:00 and 07:00 or 22:00 and 06:00.

- L_{Rdn} (equivalent continuous day-night rating level), which is applicable to South Africa is similar to the L_{DN}, the only difference being the definition of day (06:00 to 22:00) and night (22:00 to 06:00). The weighting of 10 dB is applied to the sound levels during the night period.

- L_{Amax} is the maximum (A-weighted) sound level experienced in a given period of time, measured on a fast setting on a sound level meter, and is often used in sleep disturbance studies to quantify the impact of a single event on sleep.

- SEL (sound exposure level) is also often used to quantify single noise events. It is the total (weighted) energy of the noise within some time interval of the peak reading or over a defined event. This event definition is sometimes given as all energy exposure, while the waveform is within e.g. 10 dB of the peak level. It is typically based on A-weighted sound pressure levels. A-weighted SELs are typically used to describe indoor levels in sleep disturbance studies.

- Number Above (N), which was established by the Australian Department of Infrastructure and Transport, devised a metric based on *the number* of noise events (aircraft movements) that reach or exceed a certain dB(A) threshold within a given time period. This metric is also called Number Above or N contours (or, in Europe, Frequency contours). Typically, these contours are produced showing N70 values, i.e. the number of events that have a maximum external level of 70 dB(A) or more. Any other dB(A) level can be also selected for plotting. This metric may be more easily understood by the public than L_{Aeq} or the L_{Rdn}.

- Effective Perceived Noise Level (EPNL), defined as the Perceived Noise Level (PNL) adjusted to account for the tone components in aircraft broad band noise, as well as the duration of the noise. It is measured in EPNdB and is generally used by the United States Federal Aviation Administration in aircraft certification.

For aircraft flyovers, the value of an SEL of an event is always higher than the corresponding LAmax. As a rule of thumb, the numerical difference between SEL and LAmax for aircraft on departure is 10 dB(A); and on arrival 8 dB(A).

The U.S. Environmental Protection Agency identified DNL (which is the equivalent to the South African L_{Rdn}) as the most appropriate measure of evaluating airport noise based on the following considerations:

- It is applicable to the evaluation of pervasive long-term noise in various defined areas and under various conditions over long periods of time.

- It correlates well with known effects of noise on individuals and the public.

- It is simple, practical and accurate. In principle, it is useful for planning as well as for enforcement or monitoring purposes.

- The required measurement equipment with standard characteristics is commercially available.

- It is closely related to existing methods currently in use.

Basner (2008) found that integrated A-weighted energy-based metrics were not the most accurate predictors of sleeplessness resulting from a night of aircraft noise. This result is not surprising, in that with these measurements many very quiet events unlikely to disturb sleep are evaluated as being equal to very few, very loud events where the likelihood of waking is very high. For sleep disturbance, noise inside the bedroom is clearly important, so outdoor noise measures or predictions, even if single event-focused, may not be reflective of community sleep disturbance.

A few recent studies have also examined exposure to maximum noise levels (e.g. L_{Amax}), as in pathophysiological terms it is not known whether the overall 'dose' of noise exposure is important in determining effects on health or whether peak sound pressure events or the number of noise events might be important. This issue is of increasing importance, given that the number of noise events for aircraft noise are increasing, while noise emission levels per event are falling.

The Australian Standard AS2021[1] specifies the single event level of 60 dB(A) as "the indoor design sound level for normal domestic areas in dwellings", since this is the level at which "a noise event is likely to interfere with conversation or with listening to the radio or the television". Given that a house with partially open windows provides around 10 dB(A) attenuation of external noise sources, this leads to the rationale of selecting the 70 dB(A) L_{Amax} as the single event noise threshold. The noise events above 70 dB(A) L_{Amax}, i.e. N70, may be used to describe the number of single events above this threshold.

The Australian Department of Transport and Regional Services (DOTARS) chose the 70 dB threshold as a level that is likely to minimize interference with conversation or listening to radio or television indoors. Based on the above, the main supplemental noise metric they implemented is the Number-of-Events that exceed and outdoor noise level of L_{max} 70 dB, which they labelled as the "N70" metric.

For the present study the N70 was selected for the supplemental noise metric calculations.

The night-time N60 events were also calculated in this study, as the level of 60 dB(A) chosen in this case corresponds to the sleep disturbance level of 50 dB(A) specified in AS2021, allowing for 10 dB attenuation by the fabric of a building.

These supplemental noise metrics were selected in the present study, as there is an international tendency to utilise them in sleep disturbance and population disturbance studies, since the human response to noise relates to both the maximum level of noise, as well as its duration. In general, people are disturbed by the number of aircraft noise events, and their sense of annoyance increases with the number of events, especially when those occur late at night.

Secondly, the Australian climate is very similar to the South African one, and thus the noise reduction due to the fabric of a dwelling with open windows is expected to be similarly around 10 dB.

Thirdly, based on the SANS 10103 speech interference level of 65 dB(A) within a building, the N70 provides the number of events that exceed this limit by 5 dB, assuming a 10 dB reduction due to a building or dwelling with open windows.

[1] Australian Standard AS2021-2015 Acoustics – Aircraft noise intrusion – Building siting and construction.

2.3 Health Effects of Aircraft Noise

The effects of aircraft noise upon people are numerous but the most common is annoyance. This is evident from the complaints from communities situated near airports throughout the world. Noise annoyance is defined by the US EPA as any negative subjective reaction on the part of an individual or group. Noise and the way it is experienced is very subjective, and while the overall community attitude about a noise level is usually what is reported, some individuals will be much more, and others much less sensitive to the sound in question.

Research into the effects of noise have been extended beyond auditory effects to include non-auditory health consequences such as birth defects, low birth weight, psychological illness, cancer, stroke, hypertension, sudden cardiac death, myocardial infarction, and cardiac arrhythmias. Hypertension is the most biologically plausible effect of noise exposure and noise seems to cause a number of the biochemical and physiological reactions, including temporary elevation of blood pressure, which can be associated with other environmental stresses.

Cause-effect relationships are complex and much research has indicated that non-auditory health effects of long-term noise exposure will generally not be found at levels below those recommended to protect against noise- induced hearing loss. Many studies attempting to clarify such health effects have found that noise exposure levels established for hearing protection will also protect against any potential non-auditory health effects, at least in workplace conditions.

Researchers have also identified many factors, which contribute to the variation in human reaction to noise. This is often due to emotional variables such as the activity being performed at the time the individual hears a noise, attitudes about environment, general sensitivity to noise, belief about the effect of noise on health and physical variables such as time of day, season, and type of neighbourhood. Over recent years there has been increasing evidence that the number of noise events is a key determinant of the extent to which a person may be annoyed by aircraft noise.

Human response to noise relates to both the maximum level of noise and its duration, so the maximum sound level alone is not sufficient to evaluate the effect of noise on people. People are bothered by the number of noise events and their sense of annoyance increases with the number of noise events, especially when those noise events occur late at night. Research has indicated that unlike individual reaction, community response is much more predictable because of the larger number of people involved.

2.4 Noise Guidelines and Regulations

In general, the standards applied by the international community are similar for different countries. Internationally, the current trends are to apply more stringent criteria due to the deteriorating noise climate.

The noise impacts due to a proposed project are generally based on the difference between the expected noise level increase and the existing noise levels in the area, as well as on comparisons against area-specific noise guidelines.

The available international guidelines are presented in the sections below and have taken into consideration the following adverse effects of noise:

- Annoyance.
- Speech intelligibility and communication interference.
- Disturbance of information extraction.
- Sleep disturbance.

- Hearing impairment.

2.4.1 WHO and World Bank/IFC Guidelines

The WHO together with the Organisation for Economic Co-ordination and Development (OECD) have developed their own guidelines based on the effects of the exposure to environmental noise. These provide recommended noise levels for different area types and time periods.

The World Health Organisation has recommended that a standard guideline value for average outdoor noise levels of 55 dB(A) be applied during normal daytime, in order to prevent significant interference with the normal activities of local communities. The relevant night-time noise level is 45 dB(A). The WHO further recommends that, during the night, the maximum level of any single event should not exceed 60 dB(A). This limit is to protect against sleep disruption. In addition, ambient noise levels have been specified for various environments. These levels are presented in the table below.

Table 2-1. WHO Guidelines for Ambient Sound Levels

Environments	Ambient Sound Level L_{Aeq} (dB(A))			
	Daytime		Night-time	
	Indoor	Outdoor	Indoor	Outdoor
Dwellings	50	55	-	-
Bedrooms	-	-	30	45
Schools	35	55	-	-

The WHO specifies that an environmental noise impact analysis is required before implementing any project that would significantly increase the level of environmental noise in a community (WHO, 1999). Significant increase is considered a noise level increase of greater than 5 dB.

The German National Aeronautics and Space Research Centre ‘Strain’ study has identified significant changes in sleep stages caused by aircraft noise, which over the long-term could lead to adverse health effects, even though the noise levels are insufficient to cause awakenings (DLR Institute for Aerospace Medicine). As a result, WHO Europe issued new guidelines on night noise in 2009, for the long-term protection of public health (WHO, 2009).

WHO Europe guidance sets an interim maximum target for noise levels of 55 dB(A) L_{NIGHT}, and a long-term maximum target of 40 dB(A) L_{NIGHT}. In the first round of mapping of night noise under the Environmental Noise Directive (2002/49/EC), it was estimated that 60,000 people were exposed to more than 55 dB(A) L_{NIGHT} due to Heathrow airport (CAA, 2007). To achieve even the WHO Europe interim target in London would essentially require a near complete closure of the transport system between 23:00 and 07:00.

The 2019 update of the WHO Europe Environmental Noise Guidelines introduced a significant strengthening of recommendations, particularly regarding aircraft noise, when compared to the 2009 version. The main differences focus on the health impacts of noise exposure and the recommended threshold levels for reducing these effects.

The 2019 guidelines recommend stricter thresholds for both daytime and nighttime noise. For aircraft noise exposure averaged across the day, evening, and night (L_{den}), the new threshold is set at 45 dBA, down from the previous level of 55 dBA. For night-time noise (L_{night}), the updated guideline recommends reducing levels below 40 dBA, which is more stringent than the 2009 version that suggested higher levels.

The World Bank Group (WBG) International Finance Corporation (IFC) has developed a program in pollution management so as to ensure that the projects they finance in developing countries are environmentally sound. Noise is one of the pollutants covered by their policy. It specifies that noise levels measured at noise receptors, located outside the project's property boundary, should not be 3 dB(A) greater than the background noise levels, or exceed the noise levels depicted in Table 2-2.

The WBG/IFC program also refers to the WHO Guidelines for Community Noise (WHO, 1999) for the provision of guidance to environmental health authorities and professionals trying to protect people from the harmful effects of noise in non-industrial environments.

Table 2-2. World Bank/IFC Ambient Noise Guidelines (IFC, 2007)

Receptor	Maximum Allowable Ambient Noise Levels 1-hour L_{Aeq} (dB(A))	
	Daytime 07:00 – 22:00	Night-time 22:00 – 07:00
Residential, institutional, educational	55	45
Industrial, commercial	70	70
Note: No L_{Aeq} values are stipulated for rural areas.		

The increased sensitivity to noise at night has resulted in a number of noise metrics being developed to take this into account. The day-night noise level (DNL noise level or L_{dn}) has proved to be popular in many countries, where a correction factor of 10dB is factored into the noise level to take into account the increased sensitivity to noise at night. Generally, the guidelines say that DNL levels between 55 and 65 dB indicate moderate exposure and are generally considered acceptable for residential use. Internationally the 55dB level seems to be favoured, with the United States FAA adopting a 65 dB level.

2.4.2 European Environmental Noise Directive (END) (2002/49/EC)

The European Environmental Noise Directive (END) was adopted in 2002 as part of a long-term strategy to reduce the number of people affected by noise. The latest consolidated version of the European Environmental Noise Directive (2002/49/EC) is from July 29, 2021.

The END requires Member States to monitor noise sources in their country, on a five-year rolling programme, through the production of strategic noise maps and action plans for major airports (more than 50,000 movements (ATM) per year) and agglomerations (more than 250,000 inhabitants).

Member States must inform and consult the public about noise exposure, its effects, and any measures that will be taken to address the identified noise sources. The aim is to reduce noise where necessary and maintain noise quality where it is good.

Noise maps must be produced using harmonised noise indicators L_{DEN} (day-evening-night equivalent level) and L_{NIGHT} (night equivalent level). These will be used to assess the numbers of people annoyed and sleep-disturbed due to noise throughout Europe.

Action plans will seek to manage noise issues and effects, and will include noise reduction if necessary, based on the results of the mapping process.

In England the Directive is implemented through a series of Regulations, led by the Department for Environment, Food and Rural Affairs.

Crucially, the Directive does not set any limit values, and leaves it to the discretion of the competent authorities as to whether or not to implement their action plans. For action plans relating to aviation noise sources, airport operators are the competent authorities. Additionally, the Directive refers to 'reduction' of noise, whereas the UK regulations refer to 'management' of noise.

2.4.3 Noise Control Regulations

In South Africa, the national Noise Control Regulations were promulgated in terms Section 25 of the Environmental Conservation Act (GN R154 in Government Gazette No. 13717 dated 10 January 1992). The responsibility of the administration of the Noise Control Regulations is at provincial level. Western Cape Noise Control Regulations were published in Provincial Gazette Number 7141 of 20 June 2013.

The disturbing noise and noise nuisance definitions have also changed in the new regulations:

''Disturbing noise'' means a noise, excluding the unamplified human voice, which—

a) exceeds the rating level[2] by 7 dBA;
b) exceeds the residual[3] noise level where the residual noise level is higher than the rating level;
c) exceeds the residual noise level by 3 dBA where the residual noise level is lower than the rating level; or
d) in the case of a low-frequency noise, exceeds the level specified in Annex B of SANS 10103;

''Noise nuisance'' means any sound which impairs or may impair the convenience or peace of a reasonable person.

In Schedule 2 of the Noise Control Regulations, 2013, it is stipulated that a person may not:

a) cause a disturbing noise; or
b) allow a disturbing noise to be caused by any person, animal, machine, device, apparatus, vehicle, vessel or model aircraft, or any combination thereof.

In Schedule 3, regarding causing of a noise nuisance, a person may not:

- build, make, construct, repair, rebuild, modify, operate or test a vehicle, vessel, aircraft, model aircraft or any other object, or allow it to be built, made, constructed, repaired, rebuilt, modified, operated or tested, in or near a residential area;

In terms of Schedule 4 (1) of the Noise Control Regulations:

The local authority, or any other authority responsible for considering an application for a building plan approval, business license approval, planning approval or environmental authorization, may instruct the applicant to conduct and submit, as part of the application, a noise impact assessment in accordance with SANS 10328 to establish whether the noise impact rating of the proposed land use or activity exceeds the appropriate rating level for a particular district as indicated in SANS 10103, or

[2] The equivalent continuous level that Includes corrections for tonal character, impulsiveness of the noise and the time of day. These rating levels are indicated in columns 2 and 5 of Table 2 in SANS 10103 (see also Table 2-3).

[3] The totally encompassing sound in a given situation at a given time, usually composed of sound from many sources, both near and far, excluding the noise under investigation.

where the noise level measurements cannot be determined, an assessment, to the satisfaction of the local authority, of the noise level of the proposed land use or activity.

In terms of Schedule 4 (3) of the Noise Control Regulations:

Where the results of an assessment undertaken in terms of sub regulation (1) indicate that the applicable noise rating levels referred to in that sub regulation will likely be exceeded, or will not be exceeded but will likely exceed the existing residual noise levels by 5 dBA or more, the applicant must provide a noise management plan, clearly specifying appropriate mitigation measures to the satisfaction of the local authority, before the application is decided; and implementation of those mitigation measures may be imposed as a condition of approval of the application.

In terms of Clause 4(4) of the Noise Control Regulations:

Where an applicant has not implemented the noise management plan as contemplated in sub regulation (3), the local authority may instruct the applicant in writing to cease any activity that does not comply with that plan, or reduce the noise levels to an acceptable level to the satisfaction of the local authority.

2.4.4 SANS Codes of Practice and Guidelines

The SANS 10103 Code of Practice provides typical ambient noise rating levels ($L_{Req,T}$) in various districts. The outdoor ambient noise levels recommended for the districts are shown in Table 2-3 below.

It is probable that the noise is annoying or otherwise intrusive to the community or to a group of persons if the rating level of the ambient noise under investigation exceeds the applicable rating level of the residual noise (determined in the absence of the specific noise under investigation), or the typical rating level for the ambient noise for the applicable environment given in Table 2-3 (Table 2 of SANS 10103).

The expected response from the local community to the noise impact, i.e. the exceedance of the noise over the acceptable rating level for the appropriate district, is primarily based on Table 5 of SANS Code of Practice 10103 (SANS 10103, 2008), but expressed in terms of the effects of impact, on a scale of NONE to VERY HIGH (see Table 2-4 below).

The noise monitoring of the baseline conditions within and around the site will provide the rating level of the residual noise. The noise impact during construction and operation will be determined by comparing:

- the ambient noise under investigation with the measured rating level of the residual noise (background noise levels); and
- the ambient noise under investigation with the typical rating level for the ambient noise for the applicable environment given in Table 2-3.

Table 2-3. Typical Rating Levels for Ambient Noise

Type of district	Equivalent continuous rating level ($L_{Req.T}$) for noise (dB(A))					
	Outdoors			Indoors, with open windows		
	Day-Night $L_{R,dn}$ 1)	Day-time $L_{Req,d}$ 2)	Night-time $L_{Req,n}$ 2)	Day-Night $L_{R,dn}$ 1)	Day-time $L_{Req,d}$ 2)	Night-time $L_{Req,n}$ 2)
a) Rural districts	45	45	35	35	35	25
b) Suburban districts with little road traffic	50	50	40	40	40	30
c) Urban districts	55	55	45	45	45	35
d) Urban districts with one or more of the following: workshops; business premises; and main roads	60	60	50	50	50	40
e) Central business districts	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50

Table 2-4. Response Intensity and Noise Impact for Increases of the Ambient Noise

Increase (dB)	Response Intensity	Remarks	Noise Impact
0	None	Change not discernible by a person	None
3	None to little	Change just discernible	Very low
3 ≤ 5	Little	Change easily discernible	Low
5 ≤ 7	Little	Sporadic complaints	Moderate
7	Little	Defined by South African National Noise Regulations as being 'disturbing'	Moderate
7 ≤ 10	Little - medium	Sporadic complaints	High
10 ≤ 15	Medium	Change of 10dB perceived as 'twice as loud', leading to widespread complaints	Very high
15 ≤ 20	Strong	Threats of community/group action	Very high

2.4.5 Civil Aviation Policy

The White Paper on Aircraft Noise and Environment Policy of 2017 contains the draft policy on aircraft operations and the environment (National Department of Transport, 2017). In Section 12.2.3 of the white paper several factors for effective noise management and environmental protection are outlined:

- Implementation of Noise Abatement Procedures: Operational changes to flight paths for the reduction of noise impacts.
- Encouraging Quieter Aircraft: Incentivizing airlines to adopt newer, quieter models.

- Land-Use Planning: Promoting compatible land uses around airports to minimize noise impact.
- Community Engagement and Monitoring: Actively monitoring noise levels and involving local communities.

These elements are in accordance with the International Civil Aviation Organisation (ICAO) balanced approach to aircraft noise management (ICAO, 2013).

For the noise contours and long-term planning of land-uses around airports the white paper specifies that the calculation of noise contours for an airport should be in accordance with:

- SANS 10117 Calculation and Prediction of Aircraft Noise Around Airports for Land Use Planning, and;
- ICAO (Doc 9911) Recommended Method for Computing Noise Contours Around Airports.

The latest version of the SANS 10117 of 2008 was used for the calculations and assessments in the present study. In the above-mentioned code, it is indicated that the recommended noise model for the calculation of the noise contours around an airport is the Integrated Noise Model (INM), which is updated by the Federal Aviation Administration on an ongoing basis, and that the user should ensure that the latest available version is used.

In the present study the latest version of the AEDT model was utilised, which is the FAA successor of the INM model.

2.4.6 Occupational Health and Safety

In South Africa, any operation that has the potential to generate noise should have a noise survey done, in terms of the Noise Induced Hearing Loss Regulations of the Occupational Health and Safety Act 85 of 1993.

The regulations require an Approved Inspection Authority to conduct the surveys in accordance with SANS 10083 and submit a report. All people exposed to an equivalent noise level of 85 dB(A) or more must be subjected to audiometric testing. It is required that all records of surveys and audiometric testing must be kept for 40 years.

The sound pressure threshold limits within workshops and plants that could affect employees' health, quality of life and quality of work are:

- Alert threshold 80 dB(A).
- Danger threshold 85 dB(A).

Site locations are required to meet the following levels of performance at all points accessible by the employees on a regular basis:

- For workshop circulated areas, the maximum levels must not exceed 85 dB(A).
- For work equipment, the maximum levels must not exceed 80 dB(A) at one meter from the equipment and at 1.60 m high.

Exceptions may be considered for areas that should not be accessed on a regular basis. Personal Protective Equipment (PPE) will be required to access those areas, and the noise levels outside should comply with the above-mentioned thresholds.

The employer has a legal duty under the current Occupational Health Regulations (SA) to reduce the risk of damage to his/her employees' hearing. The main requirements apply, where employees' noise exposure is likely to be at or above the danger threshold limit of 85 dB(A). It should be noted that there is an international tendency to regard 80 dB(A) as an informal warning level.

The action level is the value of 'daily personal exposure to noise' ($L_{EP,d}$). This depends on the noise level in the working area and how long people are exposed to the noise. The values take account of an 8-hour noise exposure over the whole working day or shift.

3 AMBIENT NOISE MEASUREMENTS

Ambient noise measurements were performed, in order to establish the existing ambient noise levels in the surrounding areas. The measurements were conducted using two 01DB DUO sound level meters (SLM) at five selected measurement points (MP). The measurements were carried out in April 2022.

3.1 Monitoring Equipment and Measurement Methodology

The measurements were performed via two 01dB DUOs, which are Type 1 Data-logging Precision Impulse Integrating Sound Level Meters (see Table 3-1). The Sound Level Meters were calibrated before and after the measurement session with a 01dB Type 1, 94dB, 1 kHz field calibrator. The above-mentioned equipment, i.e. sound level meters and calibrator, have valid calibration certificates from the testing laboratories of the De Beer Calibration Services and the manufacturer, and comply with the following international standards:

- IEC 651 & 804 – Integrating sound level meters.
- IEC 942 – Sound calibrators.

Table 3-1. Sound Level Measurement Instrumentation

Instrument	Type	Serial No.
1. Precision Integrating Sound Level Meter	01dB DUO	10372
2. Precision Integrating Sound Level Meter	01dB DUO	10373
3. Field Calibrator 01dB Cal01	CAL01	11243

Sound measurements of the continuous A-weighted equivalent sound pressure level (L_{Aeq}) at the five selected positions were performed, following the SANS 10103:2008 guidelines.

In addition, the 1/3rd octave bands, the highest and the lowest values measured, represented by L_{max} and L_{min}, and the various percentile levels (L_n) were also determined. The L_n is the sound pressure level exceeded for n% of the measurement time. Commonly used percentile values of L_n include L_{10}, L_{50} and L_{90}, which represent the noise level exceeded for 10%, 50% and 90% of the measurement time respectively. These are useful descriptors: for example, L_{10} is often used to describe the road traffic noise and L_{90} is generally used as an expression of the background noise in the absence of intrusive noisy events, such as primarily road traffic and random noisy events. All noise levels in this report are A-weighted noise levels expressed in dB(A).

During the intermittent sound measurements, a portable weather meter was used for the wind speed monitoring, and the measurement was aborted when the average wind speed exceeded 5m/s or when there were wind gusts exceeding 10m/s. Abnormal disturbances, such as loud noise generation nearby or sudden noise bursts that affect the measurement, were discarded. The influence of high winds on the measured levels on the continuous monitoring point was also identified and eliminated.

All measurements were carried out in accordance with the:

- SOUTH AFRICAN NATIONAL STANDARD - Code of Practice, SANS 10103:2008, *The measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication.*

- DEPARTMENT OF ENVIRONMENTAL AFFAIRS AND TOURISM. NO. R. 154. *Noise Control Regulations in Terms of Section 25 of the Environmental Conservation Act, 1989 (Act No. 73 of 1989)*. Govt. Gaz. No. 13717, 10 January 1992.

3.2 Noise Measurement Locations

The baseline noise measurements were conducted at 5 monitoring points. These locations were selected on the following basis:

- Easy accessibility under the current conditions.
- Personal safety during the daily inspections.
- Security in terms of instrument theft and vandalism.

The one SLM was placed within the Fisantekraal community (MP04) and a continuous measurement was carried out from the 14th to the 22nd of April 2022. The second instrument was used to measure intermittently the noise levels at the remaining 4 locations, i.e. at MP01, MP02, MP03 and MP05.

The locations of the monitoring points can be seen in Figure 3-1. The coordinates of the monitoring points and the monitoring dates are presented in Table 3-2 further below. The monitoring duration ranged from 12 to 15 minutes, except for MP04, which was conducted continuously for 7 days.

The MP01 was located within the current Cape Winelands Airport site. The position of the MP02 was situated outside the County Fair Poultry Farm, which is about 1 km west of MP01. Point MP03 was placed outside the Fisantekraal High School and point MP05 at the Klipheuwel community, approximately 6.3 km north of the airport site. It should be noted that the community around the Mikpunt train station is also considered as part of the general Klipheuwel area.

Table 3-2 Monitoring Locations and Dates

No.	Monitoring Points	Location	Measurement Dates	GPS Locations
1	MP01	CWA site	17,28,29 April 2022	Latitude: -33.770491°, Longitude: 18.742614°
2	MP02	County Fair Poultry Farm	17,28,29 April 2022	Latitude: -33.774853°, Longitude: 18.735013°
3	MP03	Fisantekraal High School	17,29 April 2022	Latitude: -33.779473°, Longitude: 18.721387°
4	MP04	Fisantekraal community	14 to 22 April 2022	Latitude: -33.780760°, Longitude: 18.719803°
5	MP05	Klipheuwel community	17,28,29 April 2022	Latitude: -33.719528°, Longitude: 18.714040°.

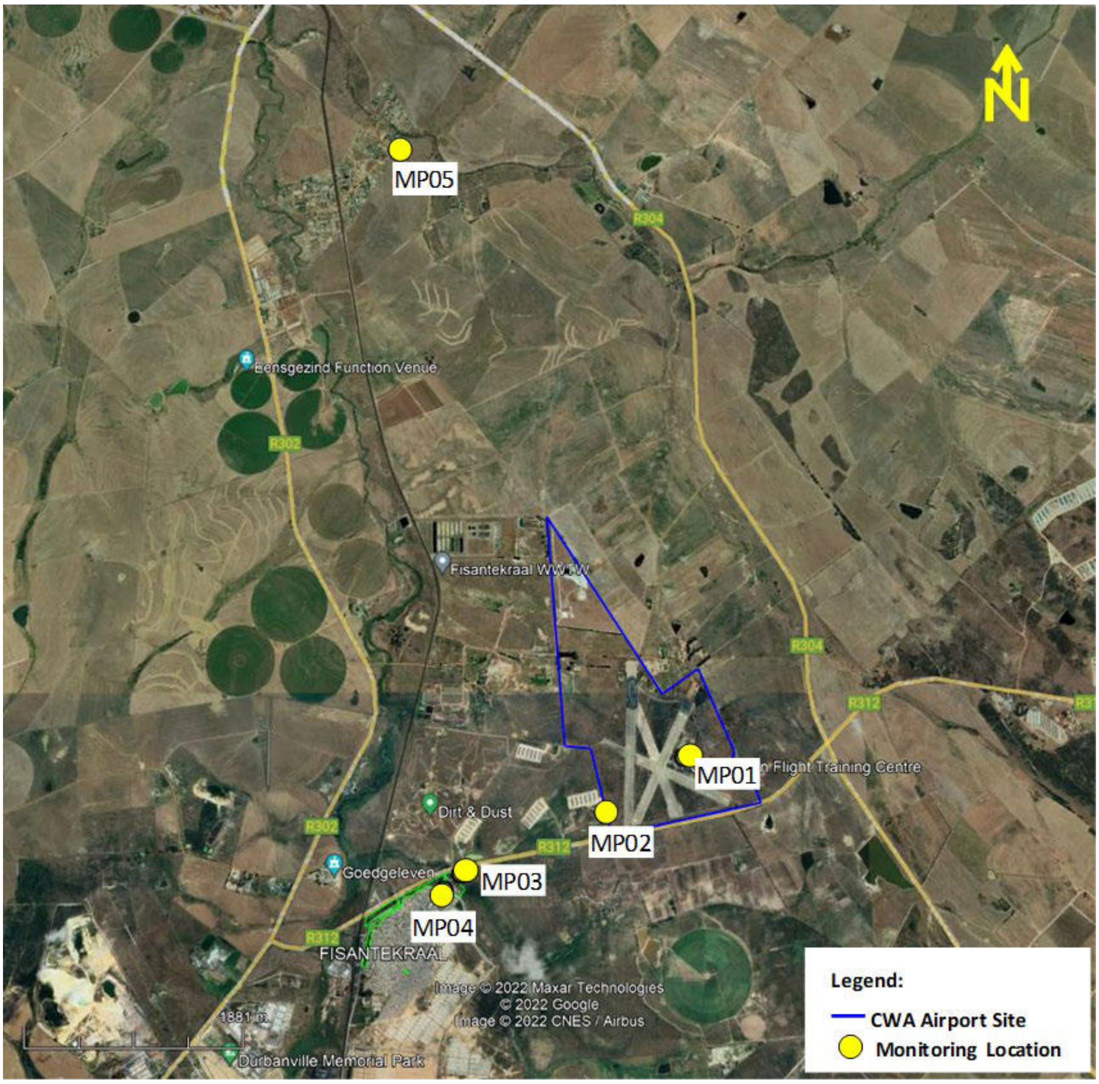

Figure 3-1. Ambient Noise Monitoring Locations

The area directly west of the existing airport is designated for industrial use in the Northern District Plan (See Figure 3-2). This area, north of Lichtenburg Road (R312), extends west from the airport to the railway line.

The areas west and south of the airport are marked for urban residential development and fall within the current Urban Development Edge.

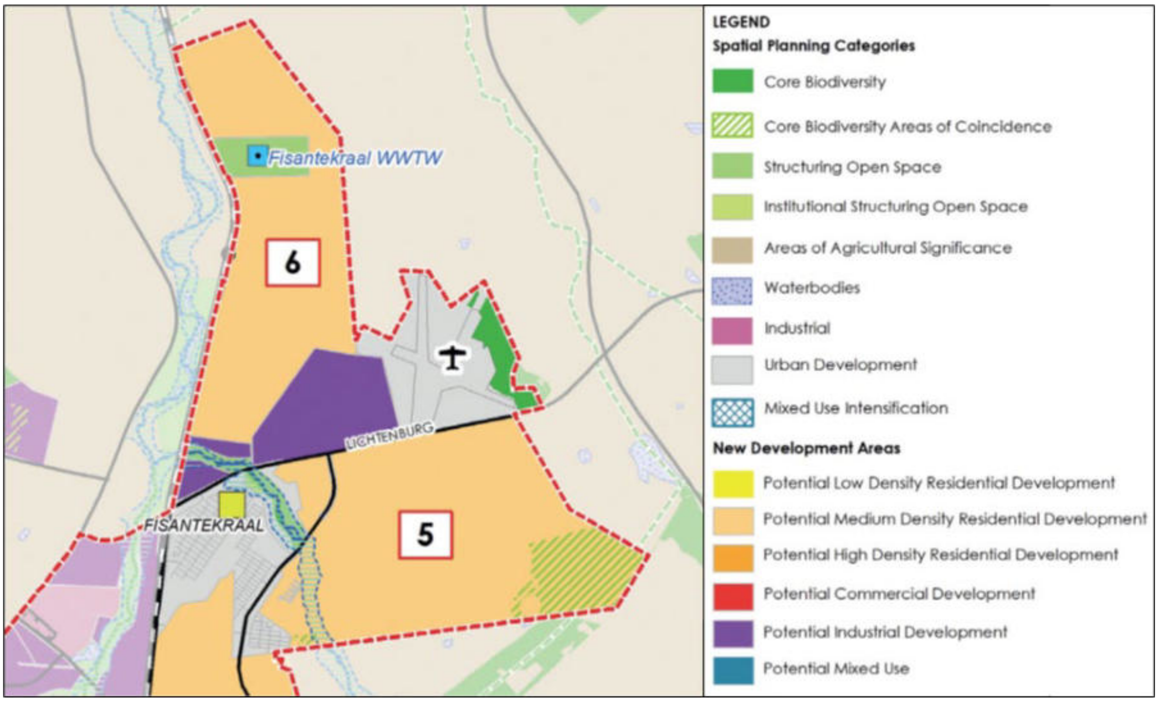

Figure 3-2. Sub-district 3 Plan in the Northern District Plan 2023

The MP01, which is located within the CWA site, is considered an Industrial District, and the area at MP02 (County Fair Poultry Farm) falls under the planned industrial zones (See Figure 3-2).

The points MP03, MP04 and MP05 were positioned within areas that are or have been marked for Urban developments.

The monitoring point MP03 was positioned at the closest school to the CWA. Similar to MP04, the area in which the school is situated is also considered an Urban Residential District, since it is located on the border of the Fisantekraal residential area and is adjacent to the Regional Route R312.

3.3 Results and Findings

The ambient noise measurement results are presented in Table 3-3. The sections below provide an overview of the measurement results and the existing noise environment at each measurement point.

3.3.1 MP01, MP02, MP03 & MP05 – Non-continuous Measurements

The measured noise levels at MP01, MP02, MP03 & MP05 can be seen in Table 3-3.

Currently at MP01, the main noise sources are the limited light aircraft flights, occasional vehicular traffic, nature sounds and limited human activities. The noise levels did not exceed 55 dB(A) during the day and only reached 40 dB(A) during the night-time (see Table 3-3).

The second noise monitoring point (MP02) was situated immediately next to the County Fair Poultry Farm, in order to collect the necessary information for the assessment of any potential impacts of the CWA on the farm operations. The main noise sources at MP02 are vehicular traffic, poultry sounds, the CWA's current aircraft operations and nature sounds. The daytime and night-time noise levels were measured to be around 55 dB(A) and 39 dB(A) respectively.

The noise sources at MP03 are mainly human activities, as well as vehicular traffic on the R312 and the Fisantekraal local road network. The daytime noise levels at the school are currently around 55 dB(A), which is also the SANS guideline for Urban Districts.

The primary noise sources at the Klipheuwel residential area (MP05) are human activities, dogs barking, nature sounds and local vehicular traffic. The noise levels at this community were low and reached only 41 dB(A) during the day and 38 dB(A) during the night, which are both below the Urban District guidelines.

Table 3-3. Measured Noise Levels at MP01, MP02, MP03 & MP05

Measurement Point	Date	Type of Area	Noise Level (dB(A))	
			Day	Night
MP01	17/04/2022	Industrial	54.4	39.9
	28/04/2022			39.8
	29/04/2022		53.1	
	Overall		**53.7**	**39.8**
MP02	17/04/2022	Urban Districts	55.7	39.7
	28/04/2022			38.5
	29/04/2022		52.6	
	Overall		**54.2**	**39.1**
MP03	17/04/2022	Urban Districts	53.9	
	29/04/2022		55.8	
	Overall		**54.8**	
MP05	17/04/2022	Urban Districts with Litte Road Traffic	39.0	40.7
	28/04/2022			35.8
	29/04/2022		43.5	
	Overall		**41.2**	**38.3**
SANS 10103 Guidelines: Suburban Districts with little road traffic: Daytime: 50 dB(A), Night-time:40 dB(A) Urban Districts: Daytime: 55 dB(A), Night-time:45 dB(A)				

3.3.2 MP04 - Continuous Measurements

The measured noise levels at the Fisantekraal community (MP04) are presented in Figure 3-3. The SLM was placed at the top of a local residence, which was situated on the north-eastern border of the Fisantekraal residential area.

It can be seen from Figure 3-3 that the daytime noise levels were maintained between 55 dB(A) and 60 dB(A), with some exceptions, primarily on Sunday the 17th of April due to increased human activities and loud music. The main noise sources at this location were identified as being primarily human activities, such as children playing, music and loud conversation, as well as local vehicular traffic. These noise levels exceeded the SANS guideline level of 55 dB(A) for Urban Residential Districts.

The night-time noise levels were found to be primarily between 45 dB(A) and 55 dB(A), which also exceeded the night-time guideline level of 45 dB(A) for Urban Districts.

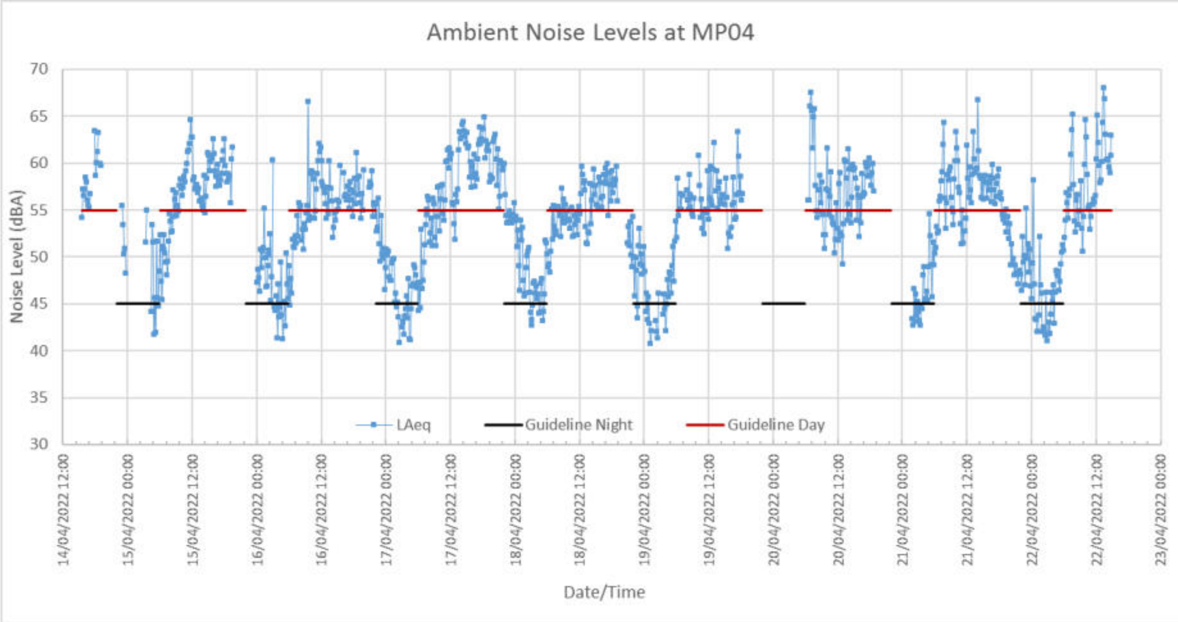

Figure 3-3. Measured Noise Levels at MP04

4 NOISE MODELLING METHODOLOGY AND RESULTS

4.1 Noise During Construction

The construction phase of the proposed development is expected to take between 2 and 3 years. During this phase, the construction of the runway (Runway 01/19) will take place, as well as the associated infrastructure and facilities. The working hours for the construction activities are expected to be from 07h00 to 18h00.

The typical construction phase will likely consist of the following:

- Establishment of the construction camp and site preparation works;
- Initiation of the main civil and electrical works;
- Major civil and electrical works;
- Commissioning of Runway 01-19.

The typical large equipment that is generally utilised during such construction will be the main contributor to the noise generation. The anticipated list of the equipment to be utilised for construction is shown below.

Table 4-1. Construction Equipment

Item	Description	Quantity
1	Bulldozer	2
2	Grader	1
3	Compactor	1
4	Water Tanker	3
5	Excavator	2
6	Articulated Dump Truck	15
7	Pickup Truck	5
8	Truck	1

In addition to the above-mentioned equipment and vehicles, trucks with a capacity of 15 m^3 are expected to be employed to transport the required fill materials to the site. The actual material quantities have not as yet been estimated.

As a worst-case scenario in the present study, it was assumed that approximately 50 truck-loads per day are to be utilised. This will result in approximately 7 trucks per hour entering and leaving the site over a period of one year. It is expected that the fill delivery trucks would approach the construction site, making use of the R312, R304 and R302, which are provincial roads designed to carry this type of traffic. This number of vehicles is considered very low compared to the average daily traffic that is currently on these roads. As such, their contribution to the ambient noise environment around these roads is considered low.

The general construction activities of the proposed runway and infrastructure are likely to increase the local noise levels temporarily during the construction period. The basis for the modelling methodology for the construction noise was the British Standard 5228-1:2009+A1:2014, titled "Code of practice for noise and vibration control on construction and open sites – Part 1: Noise."

This standard was utilised for the calculation of noise from construction and the determination of the sound level data from on-site equipment and site activities. The typical sound power levels utilised in that standard were taken from measurements at various sites, percentage on-times and power ratings for a wide range of construction plants. The airport construction equipment list in Table 4-1 was utilised for the noise modelling.

The following parameters and assumptions were used in the calculations:

- Average height of noise sources: 2 m.
- Construction operating hours: 24 hr (used as a worst-case scenario).
- No noise barriers in place.
- Construction site equipment as per Table 4-1.

It was also assumed, as a worst-case scenario, that all the equipment would be operated simultaneously at the construction site. The sound power levels of the construction equipment are shown in Table B-1 of APPENDIX B.

Based on the above-mentioned methodology, Table 4.2 below shows the noise levels of the construction activities at the CWA, as determined through the model. The noise levels further than 500 m away were found to be lower than 45 dB(A) during the day and 47 dB(A) during the night.

The closest residential area to the construction locations, Fisantekraal, is situated more than 1,000 m away, towards the south-west. As such, the daytime noise level contribution there is not expected to reach 40 dB(A) during the time that the construction activities are at their closest position to this area. If the night-time operations take place at this same closest location, their noise contribution to the closest community receptors is not expected to exceed the 43 dB(A) level, and is generally expected to be below 40 dB(A) for most of the night-time construction activities.

For receptors located at greater distances than the 1.5 km radius, the construction noise will be barely audible.

The noise levels in Table 4.2 were estimated without any barrier effects, such as from local ground elevations, temporary barriers and possible earth piles, and can thus be considered a worst-case scenario.

Table 4.2: Construction Noise at Various Distances from the Construction Face

Receptor Distance (m)	Modelled Day (dB(A))	Modelled Night (dB(A))
100	60.1	64.2
200	57.2	59.3
400	45.3	47.1
1,000	36.1	39

4.2 Operational Noise Prediction Methodology

The noise from the airport operations at the CWA were simulated with the use of the US FAA's AEDT model, which is used by the civilian aviation community for evaluating aircraft noise impacts in the vicinity of airports.

AEDT is a software system that models aircraft performance in space and time for the estimation of fuel consumption, emissions and for assessing the noise and air quality levels around airports. The AEDT consolidates the modelling of these environmental parameters in a single tool and is used for assessing each of these specific environmental impacts.

The AEDT is the successor of the INM model, which is specified as the required model for the calculation of aircraft noise contours in the SANS 10117 Code of Practice for the calculation and prediction of aircraft noise around airports for land use purposes and the draft National Policy on Airport Noise and Emissions published in March 2012. The latest AEDT version was utilised in the CWA noise contour simulations.

The AEDT requires the compilation of extensive information about how the airport operates (for existing conditions) or is expected to operate (for future conditions). The model requires the integration of an assortment of data relating to airfield geometry, weather conditions, number and type of aircraft operations, time of day of aircraft operations, aircraft fleet mix, runway use patterns, flight tracks, and other data and assumptions associated with each scenario.

The AEDT also has the capability of generating aircraft noise levels at individually defined grid points. Such information supplements the analysis provided by the noise exposure contours. This analysis provides a comprehensive list of grid points, including a set of regularly spaced points throughout the aircraft noise study area and the locations of identified non-residential noise-sensitive facilities, such as schools, places of worship, hospitals, nursing homes and libraries.

One of the improvements that the AEDT has over the INM is that it provides the capability of estimating the number of events above certain thresholds (i.e. the number of times a threshold noise level is exceeded). As such, in addition to the noise contours around the airport, the daytime and night-time events-above contours were generated for the N60 and N70 charts.

4.2.1 Airport Parameters

The latitude and longitude co-ordinates of the airport's existing and new runway were entered into the model, together with the elevation data of the surrounding areas. Table 4-3 and Table 4-4 shows the runway thresholds utilised for each runway assignment for the existing and the new runway alignments respectively.

Table 4-3 Existing Runway Co-ordinates

	Existing Airport (Scenario 1)			
	Runway 01/19		Runway 03/21	
Threshold	**01**	**19**	**03**	**21**
Latitude	-33.774975	-33.765847	-33.775836	-33.762769
Longitude	18.741758	18.737697	18.737119	18.737617
Length (m)	1,080		1,454	
	Runway 05/23		**Runway 14/32**	
Threshold	**05**	**23**	**32**	**14**
Latitude	-33.775411	-33.766975	-33.773811	-33.770611
Longitude	18.737706	18.742353	18.746556	18.738219
Length (m)	1,370		1,230	

Table 4-4 Proposed New Runway Co-ordinates

	New Runway (Scenarios 2&3)	
	Runway 01/19	
Threshold	**01**	**19**
Latitude	-33.771573	-33.742354
Longitude	18.744491	18.730384
Length (m)	3,500	

4.2.2 Flight Paths and Aircraft Operations

The Airspace Concept of Operations (CONOPS), the fight paths and busy day aircraft operations were provided by Royal HaskoningDHV (Pty) Ltd (operating as NACO), the Netherlands Airport Consultants (NLR) and the Air Traffic and Navigation Services SOC Ltd (ATNS).

The flight paths were generated utilising the Fast-Time simulation AirTOp model by NLR. Details of the methodology and assumptions for the generation of the flight paths for each scenario can be found in the relevant modelling report (NLR, 2023). The output created aircraft operations and flight path segments in INM format. These files were then converted to AEDT file format, since there is a significant change in the database system that the AEDT is based on, in comparison to the INM.

This AirTOp simulation generated the flight paths for each of the aircrafts and destinations for the AEDT busy day input and noise metric simulations. The following Table 4-5 shows the resulting arrival and departure operations for each aircraft type simulated in the AEDT model for Scenario 1, i.e. the current runway system at full capacity.

As can be seen from Table 4-5, the resulting total number of operations during a typical busy day for the current runway layout is 301 per day. The aircrafts which are predominantly utilised are the Cessna 172 and the Piper PA-28, accounting for more than 85% of the total daily movements.

Based on the operations simulation data, the aircraft movements were allocated for each hour of the day and night. The summary of the aircraft movements per hour can be seen in Table 4-6 further below. It is evident that no night-time operations are scheduled, and most of the movements take place between 09h00 and 16h00.

Based on the flight path generation with AirTOp by NLR, two INM input files were generated and converted to AEDT file format. One for the flight path segments for every arrival and departure of each aircraft and one connecting each flight path name to each aircraft operation. The resulting arrival and departure flight paths in the AEDT for the current runway system at full capacity (Scenario 1) can be seen in Figure 4-1. The same figure with satellite imagery as background can be found in APPENDIX F.

Table 4-5 Current Runway System at Full Utilisation (Scenario 1)

Aircraft ID	Aircraft Model	Operations			
		Runway 01-19, 32-14, 05-23			
		Arr.	Circ	Dep.	Total
C172	CESSNA 172R	100	0	100	157
DHC6QP	DASH 6/PT6A-27 RAISBECK QUIET PROP MOD	0	0	0	43
P28A	PIPER WARRIOR PA-28-161	0	101	0	101
Grand Total (24-hour)		100	101	100	301

Aircraft ID	Aircraft Model	Operations			
		Runway 03-21			
		Arr.	Circ.	Dep.	Total
C172	CESSNA 172R	78	0	79	157
DHC6QP	DASH 6/PT6A-27 RAISBECK QUIET PROP MOD	22	0	21	43
P28A	PIPER WARRIOR PA-28-161	0	101	0	101
Grand Total (24-hour)		100	101	100	301

Circuit: Training flights

Table 4-6 Current Runway System Operations per Hour (Scenario 1)

Hour	Operations			
	Scenario 1			
	Arrival	Circuit	Departure	Total
0	0	0	0	0
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	3	0	3	6
8	6	0	6	12
9	12	10	11	33
10	11	16	12	39
11	10	12	11	33
12	7	8	7	22
13	6	6	9	21
14	10	15	8	33
15	8	21	7	36
16	13	6	14	33
17	6	6	6	18
18	6	1	5	12
19	2	0	1	3
20	0	0	0	0
21	0	0	0	0
22	0	0	0	0
23	0	0	0	0
Grand Total (24-hour)	100	101	100	301

Note: Hour values are rounded to the closest integer.

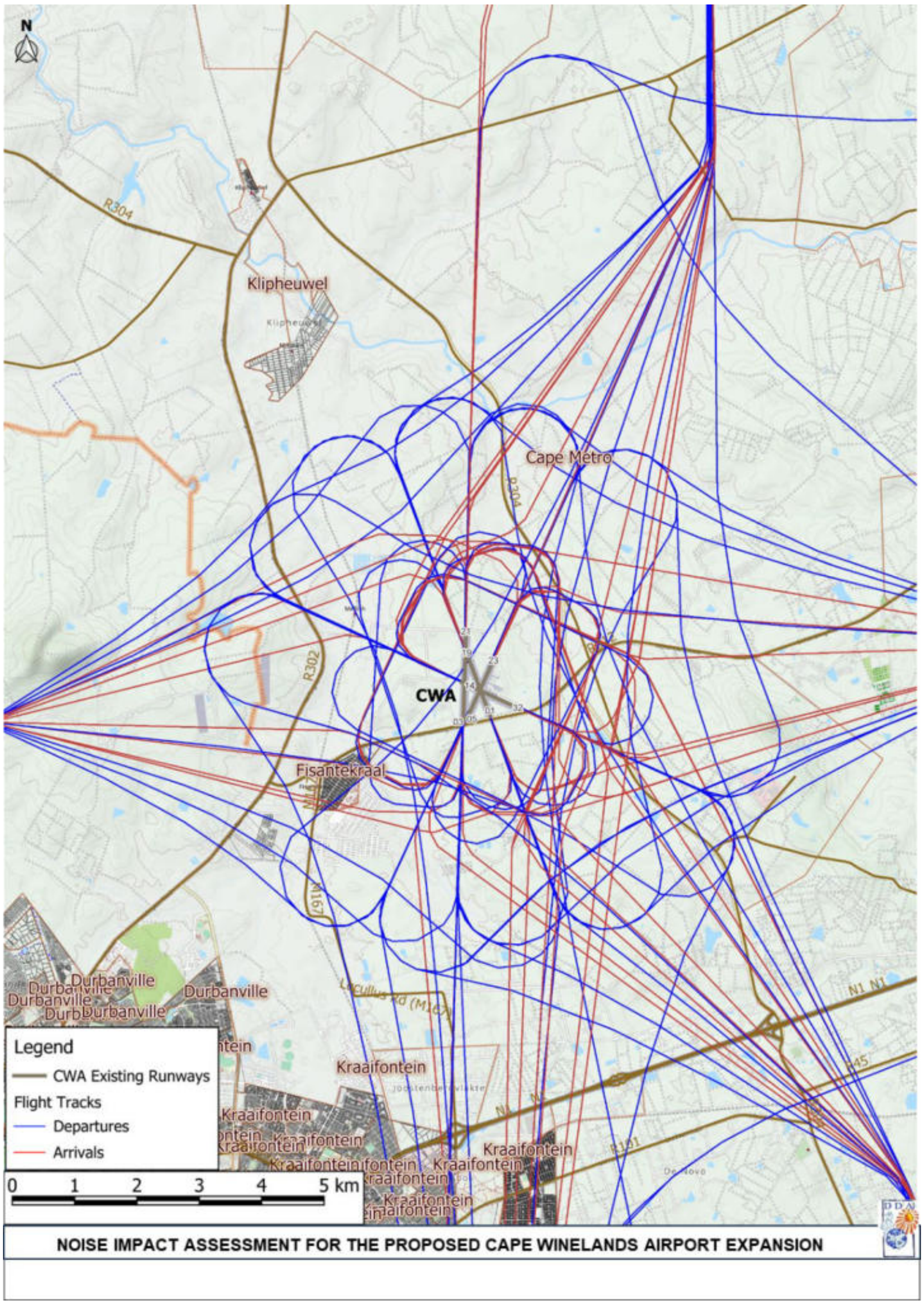

Figure 4-1. Current Runway System Flight Paths

The busy day operations for the new runway 01/19 during the opening year (Scenario 2) will be reduced to only 29 per day, and large aircraft, such as the Boeing 737-800, will have only 2 movements per day (see Table 4-7).

The air traffic in the opening year will depend on several factors, including the phased construction and rollout of general aviation hangar facilities, which are yet to be finalized. Initially, a rapid increase in general aviation traffic is anticipated as development aligns with market demand. This growth is expected to continue over time, eventually reaching the maximum traffic levels outlined in Scenario 3. However, the peak general aviation traffic under Scenario 3 will not exceed the current maximum operational capacity of Scenario 1, the No-Go Alternative.

As such, at any given moment in time after the opening year of the new runway, the noise levels due to the general aviation operations will always be lower than those with the existing operations at full capacity.

The hourly distribution of the aircraft operations for Scenario 2 can be found in Table 4-9. These operations will take place primarily between 09h00 and 16h00, and there are no flights allocated during night-time.

For Scenario 3, i.e. for the new runway 01/19 under full utilisation, the total number of operations for the typical busy day is 208 per day. The large aircrafts, which will be predominantly utilised, are the Boeing 737-800 and the Boeing 777-200 ER, accounting for 20% of the total daily movements (see Table 4-8).

For the new runway under full utilisation, most of the daily movements will take place between 08h00 and 18h00, and there will be three night-time operations (see Table 4-9). These night-time operations are programmed to take place before 11h00.

It should be noted that some future aircraft types may differ from those listed in the tables. They are expected, however, to be of a similar type with comparable noise footprints. In addition, as the technology improves, the trend is to have lower noise emission levels. As such, if new aircraft types are introduced in the future, it is expected that the resulting noise levels would rather be lower.

Similarly, the AirTOp simulation for the full utilisation of the new runway 01/19 generated two input files with the flight path segments for every arrival and departure of each aircraft and the flight paths per aircraft. The resulting arrival and departure flight paths in the AEDT for the new runway 19 (i.e. approaching or departing in a southerly direction) and 01 (i.e. approaching or departing in a northerly direction) can be seen in and Figure 4-3 further below. The same figure with satellite imagery as background can be found in APPENDIX F.

Table 4-7 New Runway at Opening Year (Scenario 2)

Aircraft ID	Aircraft Model	Opening Year Operations			
		Runway 01-19			
		Arr.	Circ.	Dep.	Total
C172	CESSNA 172R	7	0	5	12
DHC6-3	DeHavilland DHC-6-300 Twin Otter	3	0	4	7
B737-8	Boeing 737-800 Series	2	0	2	4
P28A	PIPER WARRIOR PA-28-161	0	6	0	6
Grand Total (24-hour)		12	6	11	29

Table 4-8 New Runway System at Full Utilisation (Scenario 3)

Aircraft ID	Aircraft Model	Full Capacity Operations			
		Runway 01-19			
		Arr.	Circ.	Dep.	Total
A330-3	Airbus A330-300 Series	1	0	1	2
B737-3	Boeing 737-300 Series	2	0	2	4
B737-4	Boeing 737-400 Series	1	0	0	1
B737-8	Boeing 737-800 Series	13	0	14	27
B777-2ER	Boeing 777-200-ER	9	0	9	18
CL601	Bombardier Challenger 601	1	0	1	2
CNA172	CESSNA 172R	27	0	22	49
DHC6-3	DeHavilland DHC-6-300 Twin Otter	12	0	12	24
DHC8Q-4	Bombardier de Havilland Dash 8 Q400	2	0	2	4
EMB120	Embraer EMB120 Brasilia	4	0	4	8
ERJ145	Embraer ERJ145	16	0	16	32
GULF4-SP	Gulfstream IV-SP	8	0	8	16
PA28	PIPER WARRIOR PA-28-161	0	21	0	21
Total (24-hour)		96	21	91	208

Table 4-9 New Runway 01/19 Operations per Hour (Scenario 2 & 3)

Hour	Operations				Operations			
	Scenario 2				Scenario 3			
	Arrival	Circuit	Departure	Total	Arrival	Circuit	Departure	Total
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	5	5
7	0	0	0	0	1	0	1	2
8	0	0	1	1	5	0	8	13
9	3	1	0	4	11	3	4	18
10	2	0	2	4	8	0	10	18
11	3	0	1	4	13	0	9	22
12	1	0	1	2	6	0	5	11
13	0	2	0	2	4	8	2	14
14	1	1	2	4	11	4	8	23
15	0	2	1	3	4	6	9	19
16	2	0	1	3	16	0	9	25
17	0	0	1	1	3	0	8	11
18	0	0	1	1	4	0	6	10

Hour	Operations Scenario 2				Operations Scenario 3			
	Arrival	Circuit	Departure	Total	Arrival	Circuit	Departure	Total
19	0	0	0	0	3	0	2	5
20	0	0	0	0	4	0	3	7
21	0	0	0	0	1	0	1	2
22	0	0	0	0	2	0	1	3
23	0	0	0	0	0	0	0	0
Grand Total (24-hour)	12	6	11	29	96	21	91	208

Note: Hour values are rounded to the closest integer.

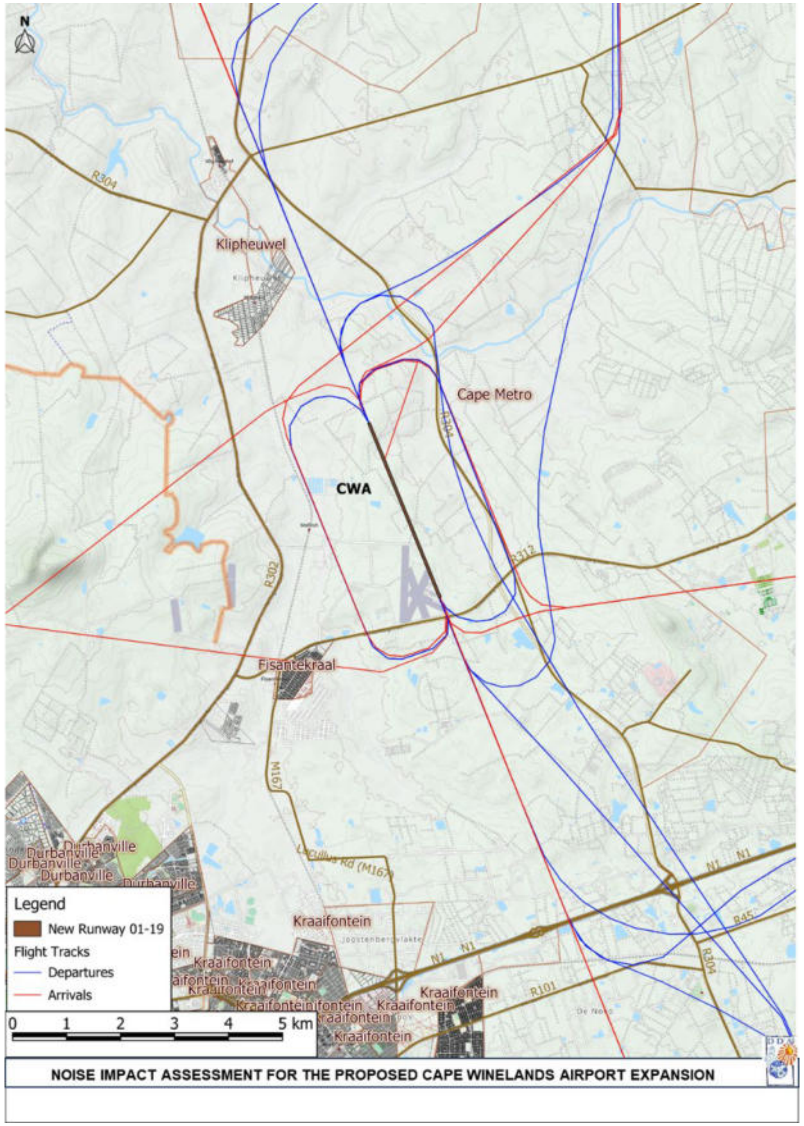

Figure 4-2. New Runway 01/19 Flight Paths at Operational Year

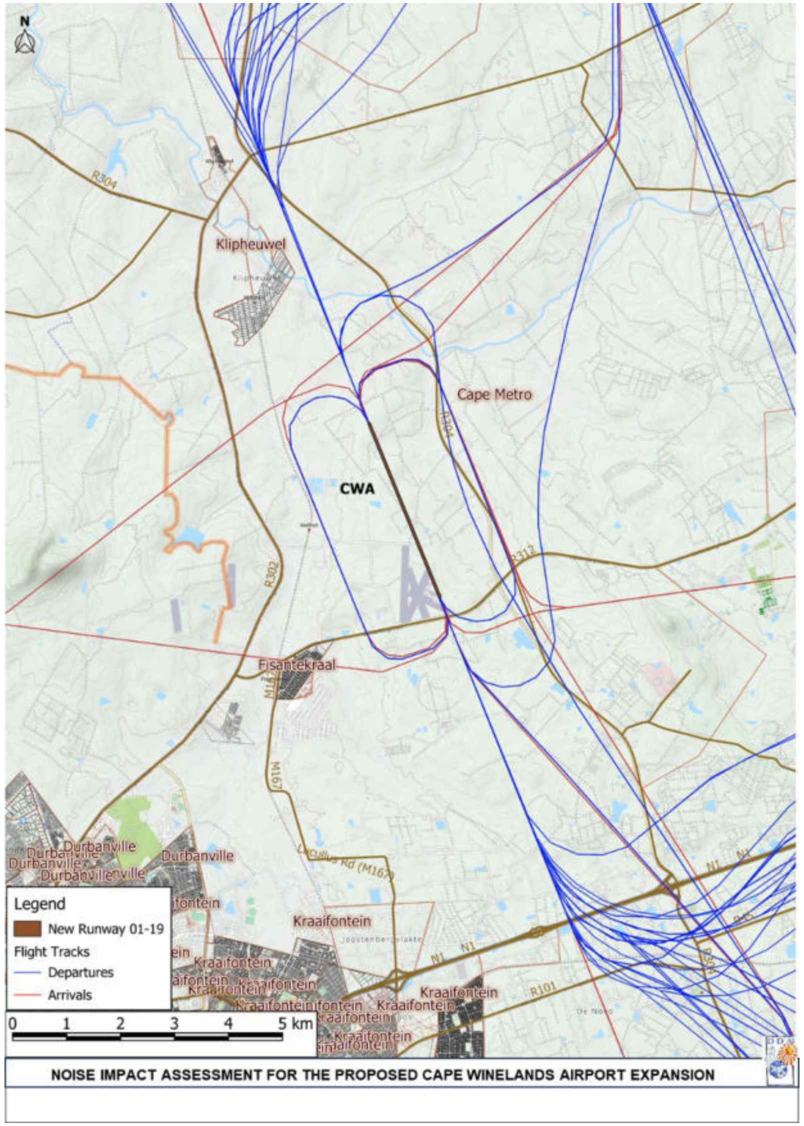

Figure 4-3. New Runway 01/19 Flight Paths at Full Utilisation

4.2.3 Other Model Inputs

Annual average weather data was obtained from the South African Weather Service for the Cape Town International Airport. The temperature, relative humidity and barometric pressure were averaged and then entered into the AEDT:

- Temperature: 15.1 °C;
- Relative Humidity: 70.0 %;
- Barometric Pressure: 759.97 mm-Hg; and
- Elevation: 125 m.

The AEDT model utilises these variables in the calculation of the flight profiles for each aircraft.

Based on the 4 years of hourly meteorological data obtained, the annual utilisation of the various runways was allocated in the AEDT, in accordance with the wind direction frequency distributions.

The aircraft landing and take-off operations at the airport are directly correlated to the local wind directions. For example, when southerly winds are blowing (i.e. wind is from the south) the airport controllers direct the aircraft to take off and land towards the south. The opposite occurs when northerly winds are blowing, i.e. aircraft take off and land towards the north.

The allocation of the operations for the current runway system corresponds to the wind direction distribution, in accordance with the directions that the wind is blowing from. The runway utilisations for the current runways can be found in Table 4-10.

For the new runway 01/19, this allocation corresponds to the percentages of wind from the general southerly and general northerly directions respectively and are also included in Table 4-10 .

Table 4-10 Runway Utilisation Allocations

Existing Runway System		New Runway	
	Utilisation		Utilisation
Runway	Percentage	Runway	Percentage
01	12.4%	01	38.7%
03	13.3%	-	-
05	4.2%	-	-
14	12.5%	-	-
19	23.9%	19	61.3%
21	14.9%	-	-
23	5.9%	-	-
32	12.8%	-	-
Total	100%	Total	100%

4.2.4 Noise Districts and Sensitive Receptors

The Cape Winelands Airport development site is situated on the border of the Urban Development Edge. The site's southern portion is located within the Urban Development Edge, whereas its northern part is within the Discouraged Growth Area.

All properties immediately around the site, including those directly across from and south of Lichtenburg Road (R312), are zoned Agriculture.

However, as indicated in Section 3.2, the areas west and south of the airport are marked for urban residential development and fall within the current Urban Development Edge.

In 2014 for the Cape Town International Airport runway realignment impact assessment, the Spatial Planning and Urban Design Department, in consultation with the City of Cape Town Health Department, generated a GIS map with the district types and noise guidelines, as defined in the SANS 10103, i.e.:

a) Urban districts;
b) Urban districts with one or more of the following: workshops; business premises; and main roads;
c) Central business districts; and
d) Industrial districts.

The above-mentioned map with the district types for the areas around the CWA can be seen in Figure 4-4.

Based on the proposed residential developments of Bella Riva Lifestyle & Country Estate and Greenville Garden City development on the west and south of the airport, the original districts map was updated and can be seen in Figure 4-5. In addition, this update includes the area in accordance with the Northern District Plan 2023 from Figure 3-2.

These areas were then allocated the appropriate district noise level guideline L_{Rdn}, as indicated in SANS, in accordance with Table 2-3. These guideline levels were used for the calculation of the exceedances generated by the aircraft operations in the surrounding areas.

It should be noted that this map designates the various district types, as reflected in the Spatial Development Framework (SDF) and using the district types defined in the SANS Code. The noise levels in these district types are not established via noise measurements and do not necessarily reflect actual noise levels in an area. However, the depicted noise levels in these districts are based on planning considerations with respect to the recommended acceptable noise levels, in accordance with SANS 10103.

In addition, several discrete receptors were positioned within the above-mentioned residential areas, which included sensitive receptors, such as schools and other individual farmhouses around the CWA airport. A receptor description and their coordinates can be found in Table 4-11, and their locations can be seen in Figure 4-6 further below.

Table 4-11 Discrete Receptors

Receptor	Latitude	Longitude	Description
R01	-33.78925	18.77809	Farmhouse, ~3.3 km southeast of CWA
R02	-33.77839	18.79414	Farmhouse, ~4.0 km southeast of CWA
R03	-33.76902	18.78542	Farmhouse, ~3.5 km east of CWA
R04	-33.77927	18.72215	Fisantekraal High School, ~1.3 km west of CWA
R05	-33.79009	18.71398	Fisantekraal residence, ~2.6 km southwest of CWA
R06	-33.77963	18.70834	Farmhouse, ~2.6 km west of CWA
R07	-33.77472	18.70905	Farmhouse, ~2.4 km west of CWA
R08	-33.76873	18.72696	Bella Riva Development, ~400 m west of CWA
R09	-33.76818	18.71969	Bella Riva Development, ~1.1 km west of CWA
R10	-33.77611	18.71709	Bella Riva Development, ~1.7 km west of CWA
R11	-33.78130	18.73579	Farmhouse, ~600 m south of CWA
R12	-33.74553	18.71445	Bella Riva Development, ~1.6 km northwest of CWA
R13	-33.74269	18.72119	Bella Riva Development, ~1.3 km west of CWA
R14	-33.76171	18.72454	Bella Riva Development, ~500 m west of CWA
R15	-33.75490	18.72295	Bella Riva Development, ~600 m west of CWA
R16	-33.79681	18.71168	Greenville Garden City Development, ~3.2 km south of CWA
R17	-33.79708	18.72167	Greenville Garden City Development, ~2.7 km south of CWA
R18	-33.79254	18.73126	Greenville Garden City Development, ~1.9 km south of CWA
R19	-33.79170	18.74400	Greenville Garden City Development, ~1.8 km south of CWA
R20	-33.79021	18.75675	Greenville Garden City Development, ~2.0 km south of CWA
R21	-33.77520	18.74677	Greenville Garden City Development south of CWA
R22	-33.78500	18.73875	Greenville Garden City Development, ~1 km south of CWA
R23	-33.79251	18.70153	Darwin Industrial Park in Durbanville, ~3.7 km southwest of CWA
R24	-33.73328	18.69679	Farmhouse, ~3.7 km northwest of CWA
R25	-33.72738	18.70673	Klipheuwel Equitots School, ~3.5 km northwest of CWA
R26	-33.72276	18.70283	Klipheuwel residence, ~4.0 km northwest of CWA
R27	-33.71900	18.71270	Klipheuwel Primary School, ~4.0 km northwest of CWA
R28	-33.72410	18.72041	Farmhouse, east of Klipheuwel, ~3.2 km northwest of CWA
R29	-33.77310	18.73400	Chicken Farm, west of CWA

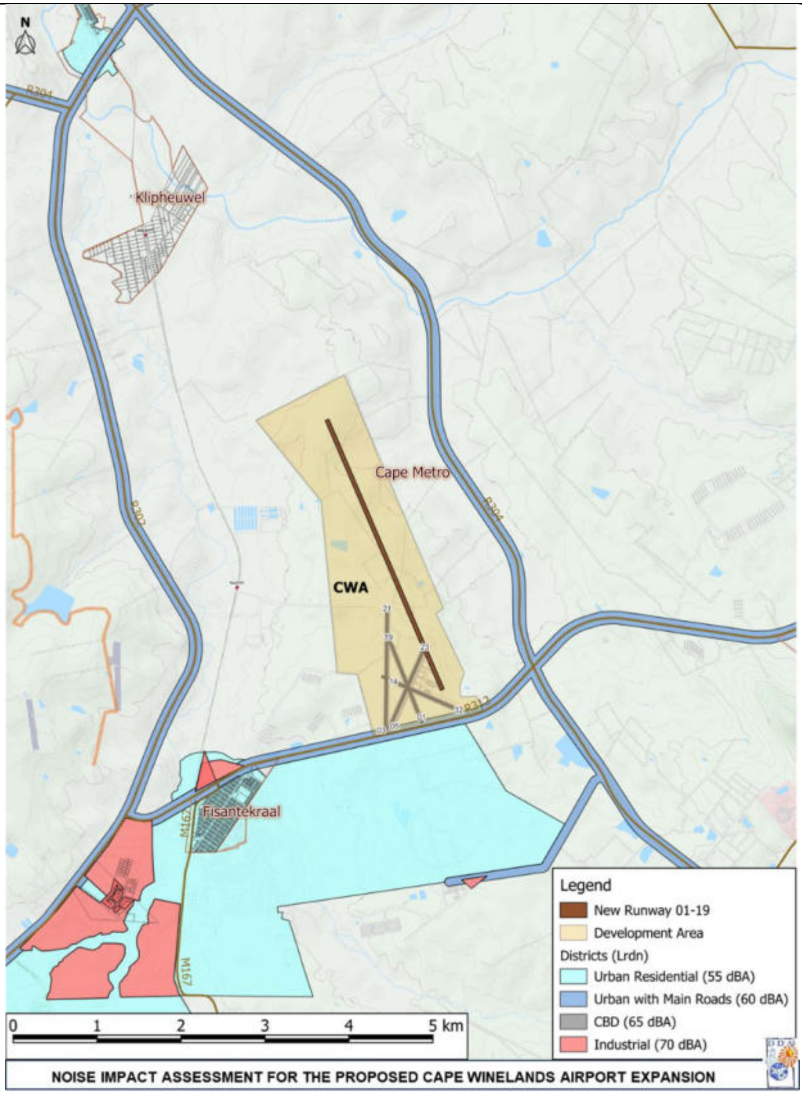

Figure 4-4. City Districts in Accordance with SANS 10103 ~~Noise~~ (2014)

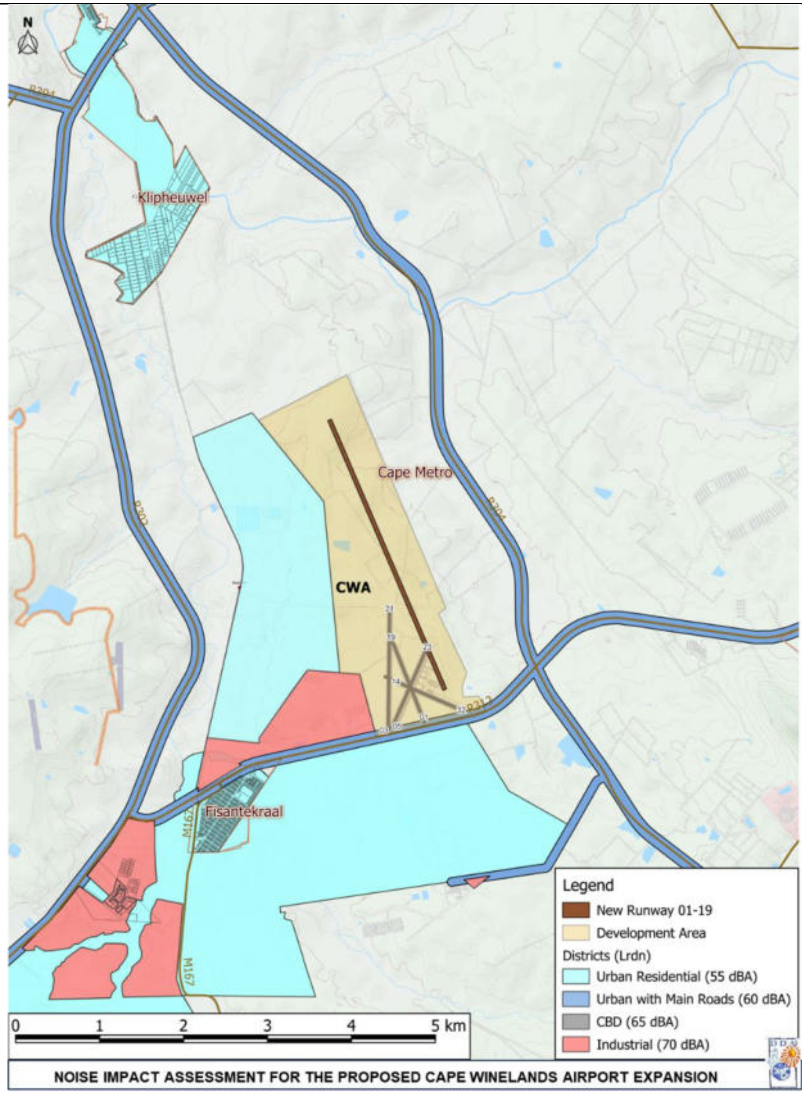

Figure 4-5. Updated City Districts in Accordance with SANS 10103

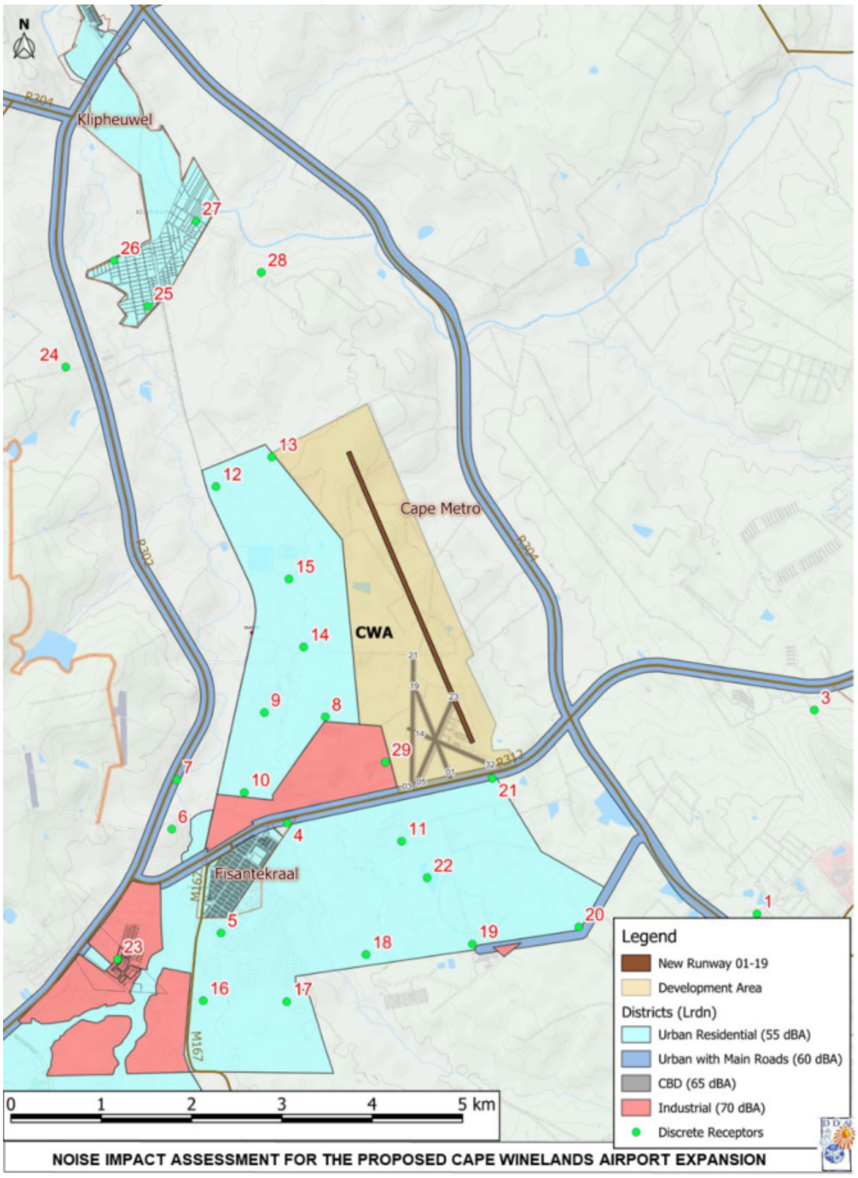

Figure 4-6. Discrete Receptor Locations

4.3 Predicted Noise Levels

Based on the noise modelling methodology and input data outlined in the sections above, the resulting noise levels for each study scenario were estimated. It should be noted that the modelled noise levels in this section assume no mitigation measures are implemented and thus represent the worst-case scenario.

The modelled operational scenarios were:

Scenario 1: Existing operations at full capacity (No-Go Alternative);

Scenario 2: New runway in operational year; and

Scenario 3: New runway at full capacity.

These scenarios were selected, in order to identify high impact areas due to the aircraft operations and highlight the differences between the current and future options. The modelling results, showing the resulting noise contours for the day-night rating level (L_{Rdn}), as well as the number of events where the maximum (L_{Amax}) levels exceed 60 dBA and 70 dBA are presented in the sections below.

4.3.1 Scenario 1: Existing Operations at Full Capacity

Figure 4-7 shows the day-night noise rating level L_{Rdn} noise contours, resulting from the current airport operations. The same figure with satellite imagery as background can be found in APPENDIX F.. The areas that the various contour zones encompass within each day-night noise rating level can be seen in Table 4-12. The total area affected by noise levels higher than 55 dB(A) is 2.47 km^2. A small portion of this contour extends beyond the R312 towards the south, within the Greenville Garden City. As can be seen, for Scenario 1, the 60 dB(A) zone is completely contained within the airport site.

Table 4-12 Scenario 1: Area under L_{Rdn} Contours

	Within L_{Rdn} Noise Contour dB(A)					
	55-60	60-65	65-70	70-75	75-80	>80
Area (km^2)	2.47	0.77	0.25	0.02	0.00	0.00

The areas with noise levels above the various district guideline levels from SANS 10103, can be found in Figure 4-8 for the current airport runway system at full capacity. It is evident that there is a small area (0.44 km^2), south of the airport, where the potential Greenville Garden City residents will be experiencing an L_{Rdn} between 0 and 5 dB(A) above the district guideline for Urban Districts of 55 dB(A).

In order to describe the footprints of individual aircraft levels and the impact of each of their operations over an area, the 'Number Above' contours were also calculated. The N70 contours indicate the number of aircraft movements that exceed 70 dB(A) L_{Amax} at a given location. Locations with similar numbers of aircraft movements that exceed 70 dB(A) L_{Amax}, i.e. locations with similar N70 results, were joined together to provide the various N70 contours.

Figure 4-9 shows the 24-hour N70 contours for Scenario 1. These contours illustrate the locations and the number of events that exceed the 70 dB(A) L_{Amax} over the 24-hour period. It should be noted that for Scenario 1, there are no flights allocated during night-time. The same figure with satellite imagery as background can be found in APPENDIX F.

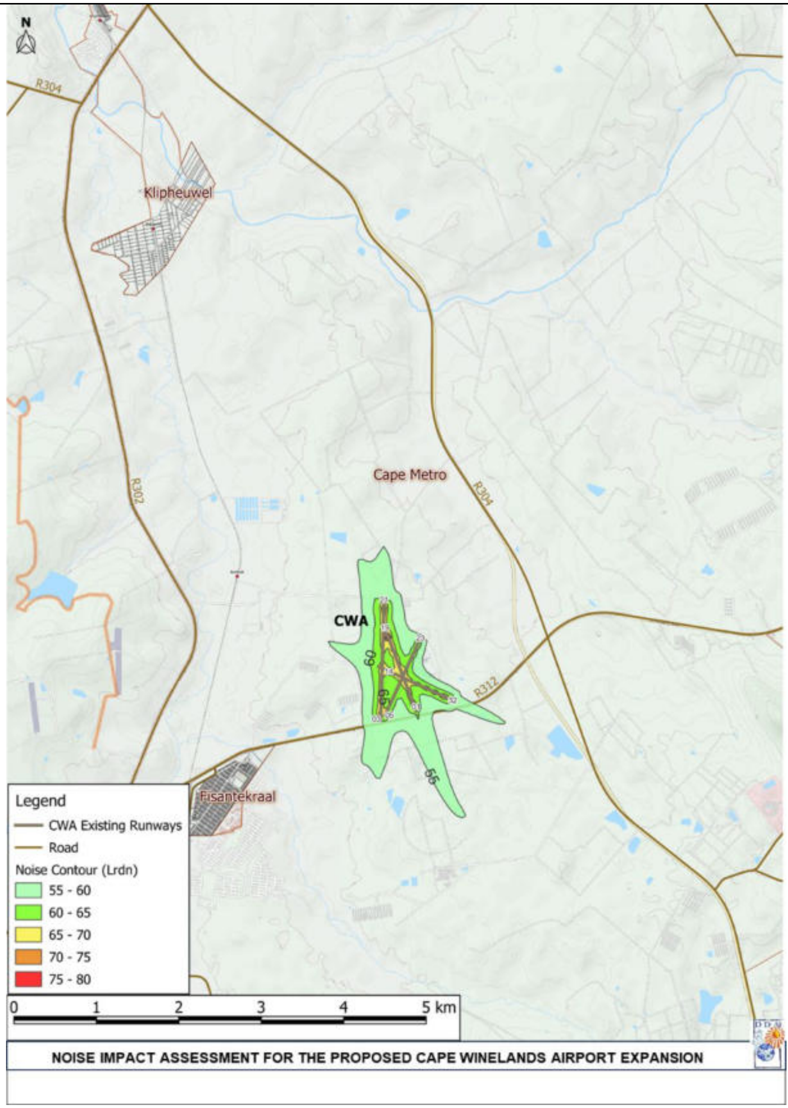

Figure 4-7. Scenario 1: Day-Night Noise Rating Level (L_{Rdn})

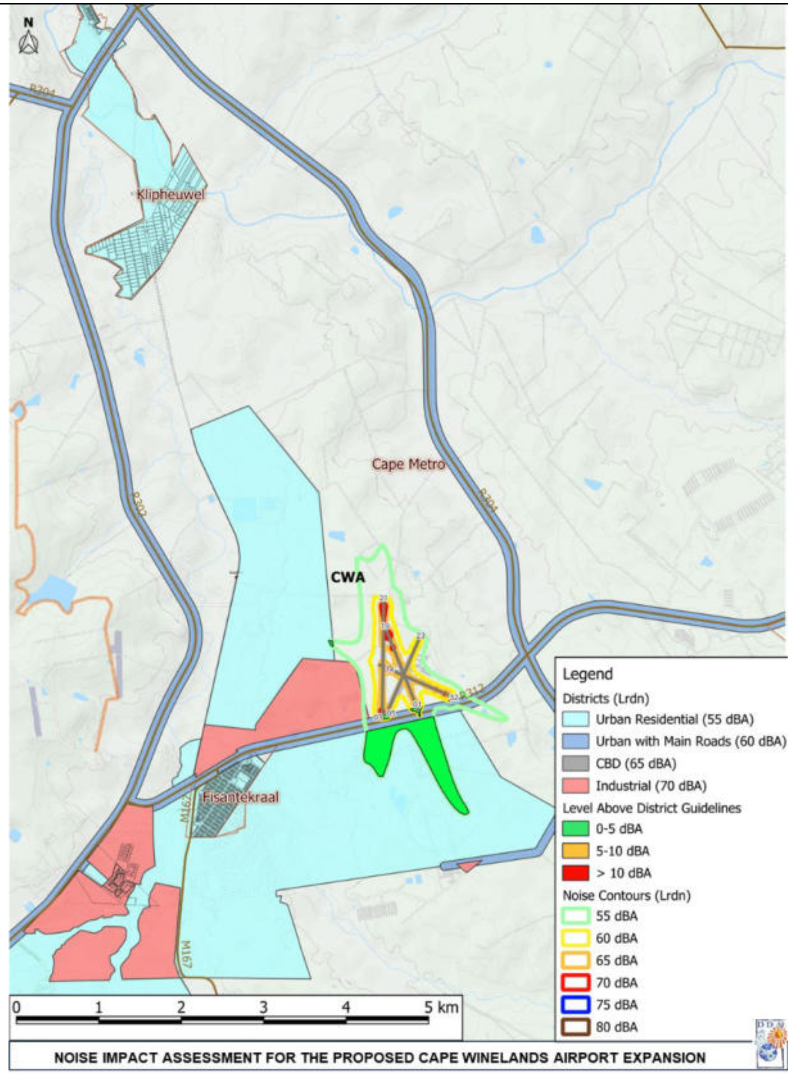

Figure 4-8. Scenario 1: Day-Night Noise Rating Level (L_{Rdn}) above the SANS 10103 District Guidelines

Based on Figure 4-9 for Scenario 1, the following table shows the areas that are encompassed by the 'Number Above' contours for the 70 dB(A) L_{Amax} events.

The contour with more than 30 L_{Amax} events above 70 dB(A) is 8.6 km^2, and a large portion of this area extends beyond the airport site boundaries into the Bella Riva development and primarily into the Greenville Garden City.

Table 4-13 Scenario 1: Zones with Number of Events above 70 dB(A) L_{Amax}

Day-Night	
Events N70	**Area (km^2)**
5 - 10	19.60
10 - 20	16.80
20 - 30	9.71
30 - 50	5.90
> 50	2.73

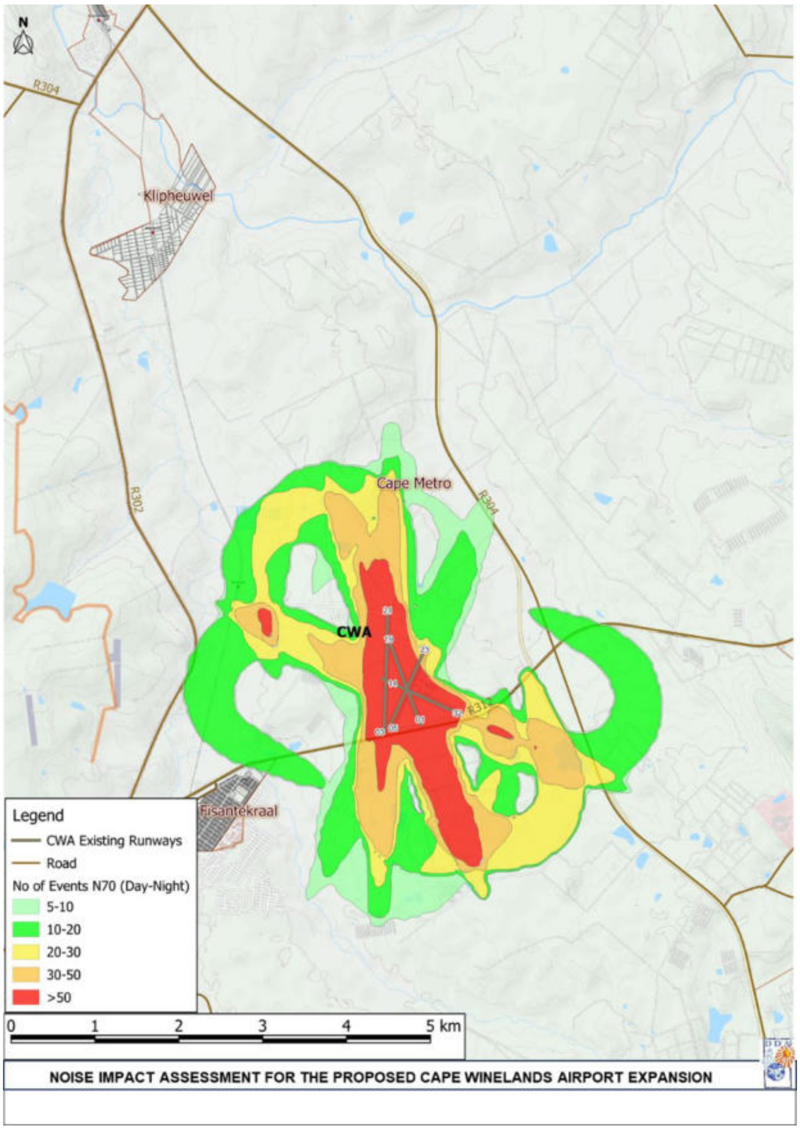

Figure 4-9. Scenario 1: Day-Night N70 Contours

This scenario, which represents the existing runway operating at maximum capacity, is considered the No-Go alternative for the purposes of this EIA, and it is expected that these noise levels would be reached if the proposed new runway does not go ahead, or is not completed before the existing runway system reaches its maximum utilisation.

4.3.2 Scenario 2: New Runway in Operational Year

Figure 4-10 shows the day-night noise rating level L_{Rdn} noise contours, resulting from the new runway 01/19 during the operational year. It is evident that the 55 dB(A) contour will be contained within the development area of the airport site.

The areas which the various contour zones encompass under each day-night noise rating level can be seen in Table 4-14. During the operational year, the area with L_{Rdn} 55 dB(A) will only be 1.44 km^2 and will not extend into the proposed residential areas west and south of the airport. As such, there was no figure generated for the overlapping of the L_{Rdn} noise contours over the various districts.

Therefore, the new runway over the first year of operation will generate noise levels lower than the existing runway system at full capacity.

Table 4-14 Scenario 2: Area under L_{Rdn} Contours

	Within L_{Rdn} Noise Contour dB(A)					
	55-60	60-65	65-70	70-75	75-80	>80
Area (km^2)	1.44	0.51	0.15	0.03	0.00	0.00

Figure 4-11 depicts the 24-hour N70 contours for Scenario 2. These contours illustrate the locations and the number of events that exceed the 70 dB(A) L_{Amax} over the 24-hour period, with the new runway 01/19 during its operational year. It is evident that the contour of the aircraft operations that exceed 10 events will be contained within the airport site and only 5-10 events per day will exceed the 70 dB(A) L_{Amax} outside the air airport's site boundary towards the south.

The following table for Scenario 2 shows the areas that are encompassed by the 'Number Above' contours for the 70 dB(A) L_{Amax} events. The 10-20 events area covers 4.5 km^2, which is much smaller than the same area for Scenario 1, which is 16.8 km^2.

Table 4-15 Scenario 2: Zones with Number of Events above 70 dB(A) L_{Amax}

Day-Night	
Events N70	Area (km2)
5 - 10	7.33
10 - 15	2.68
15 - 20	1.78
20 - 25	0.11

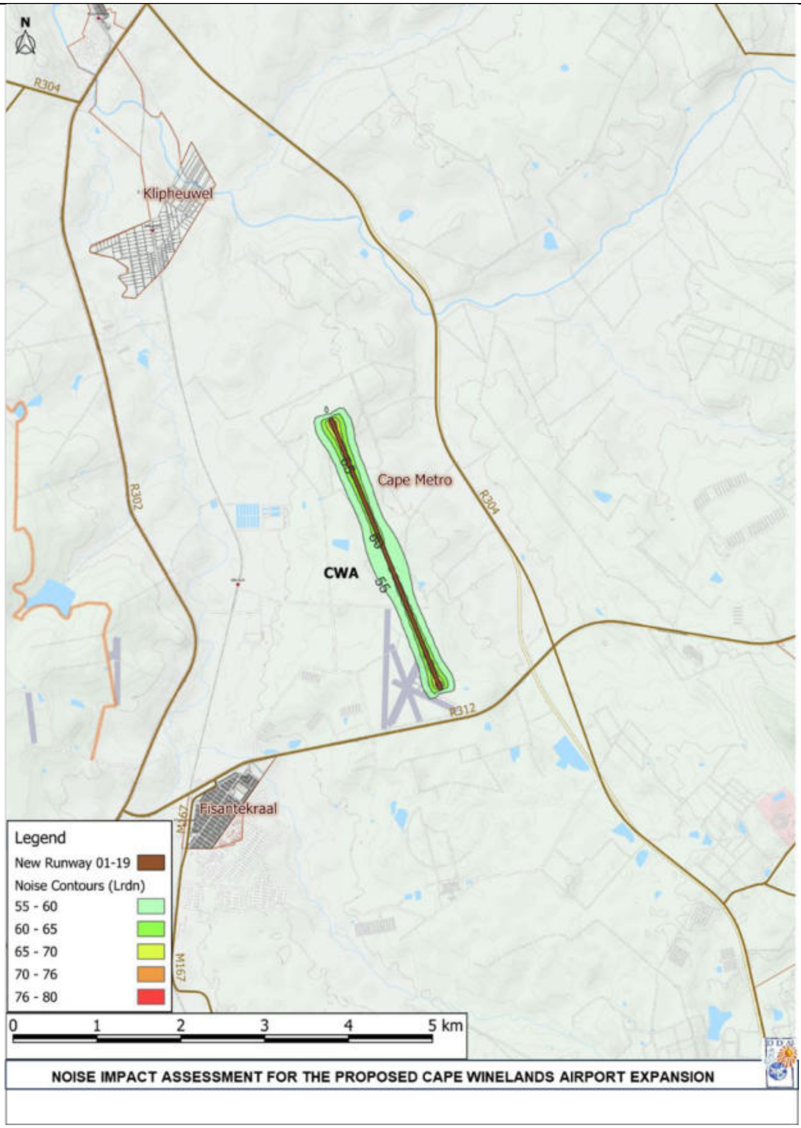

Figure 4-10. Scenario 2: Day-Night Noise Rating Level (L_{Rdn})

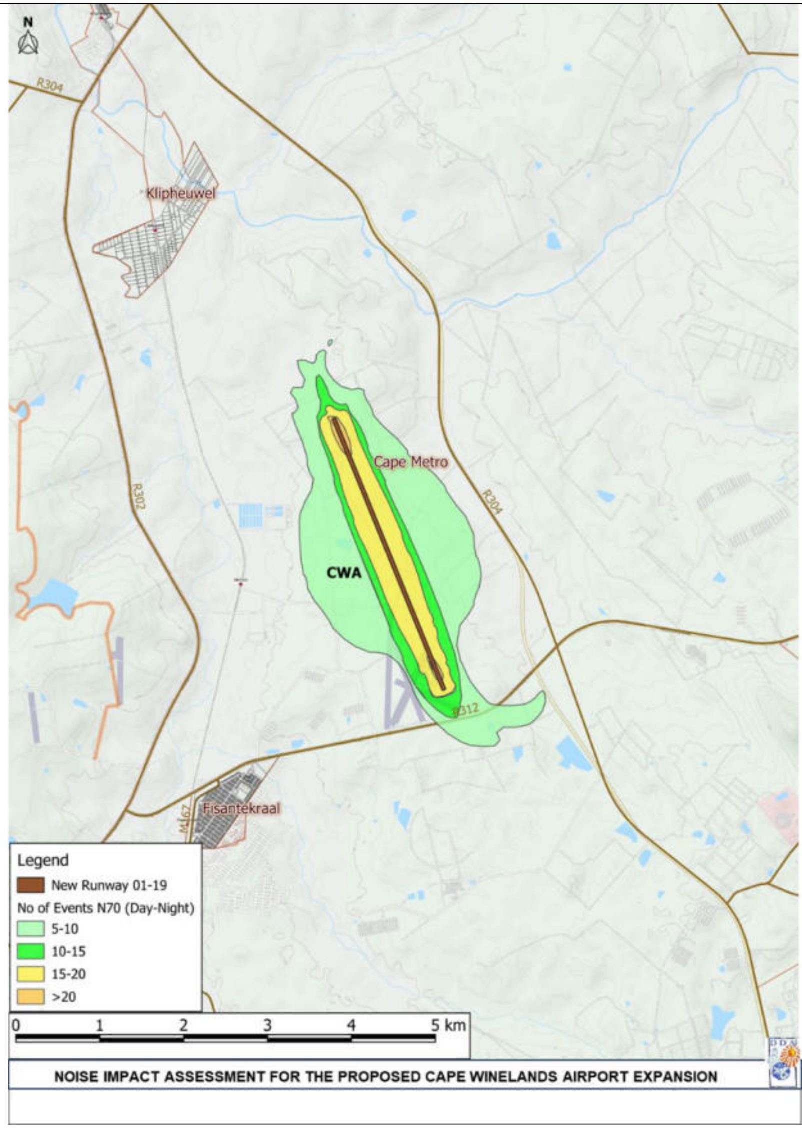

Figure 4-11. Scenario 2: Day-Night N70 Contours

4.3.3 Scenario 3: New Runway at Full Capacity

Figure 4-12 shows the day-night noise rating level noise contours (L_{Rdn}) resulting from the new runway 01/19 operating at maximum capacity. It is evident that the impact zones, when this capacity is reached, will extend beyond the development area boundaries, primarily towards the north and the south, but also towards the west and east. The same figure with satellite imagery as background can be found in APPENDIX F.

The length of the 55 dB(A) impact zone will reach 4 km north from the airport's northern site boundary, in a north-north-westerly direction and reach the Klipheuwel residential area. However, the 55 dB(A) contour will not overlap the above-mentioned residential area, but will be outside its eastern boundary. This contour, north and east of the airport, will be situated over only agricultural land. It should be noted that the community around the Mikpunt train station is considered as part of the general Klipheuwel area and will also fall outside the 55 dB(A) noise contour.

Towards the west, the 55 dB(A) contour will reach the Bella Riva residential development, extending approximately 300m within Bella Riva, measured from its eastern further most point. This zone will follow the orientation of the new 01/19 runway (see Figure 4-13).

South of the airport, the 55 dB(A) noise contour will extend less, reaching a distance of 3.3 km. This zone will overlap the Greenville Garden City area covering approximately 1.03 km^2.

For this scenario, there is small area of 0.11 km^2 within the Greenville Garden City area and immediately south of the runway, where the noise levels will be between 60 dB(A) and 63 dB(A) (see Figure 4-13).

The total areas, which the various contour zones encompass under each day-night noise rating level can be seen in Table 4-16. The 55 dB(A) contour for Scenario 3 will cover a 10.3 km^2 area, compared to Scenario 1, which will cover an area of 2.5 km^2. The 55 dB(A) contour marks the entire area that is expected to experience day-night noise rating levels of 55 dB(A) or higher.

Table 4-16 Scenario 3: Area under L_{Rdn} Contours

	Within L_{Rdn} Noise Contour dB(A)					
	55-60	60-65	65-70	70-75	75-80	>80
Area (km^2)	10.30	3.81	1.60	0.63	0.23	0.00

Figure 4-14 and Figure 4-15 show the 24-hour and night only N70 contours for Scenario 3 respectively. These contours illustrate the locations and the number of events that exceed the 70 dB(A) L_{Amax} over the relevant period, with the operations under Scenario 3. The same figures with satellite imagery as background can be found in APPENDIX F.

As can be seen, most of the Bella Riva area will fall within the 10-20 events contour. Most of the Greenville Garden City area will also be within the same contour. However, the latter area will have certain portions of it within the 20-30, 30-50, as well as greater than 50 events during the daytime (Figure 4-14).

A portion of the Klipheuwel residential area was found to be within the 5-10 events contour but outside the 20-30 events contour.

The number of events that exceed the 70 dB(A) L_{Amax} during night-time, i.e. between 22h00 and 06h00, are expected to be only 3, and their zone of influence is shown in Figure 4-15. As can be seen, this zone is primarily around the northern section of the new runway and is contained by the airport development site.

Figure 4-16 shows the number of events that exceed the 60 dB(A) L_{Amax} during night-time, which is associated with sleep disturbance. As can be seen, the 3 events contour will extend outside the airport site boundaries and cover a small portion of the northern Bella Riva development area. However, this is considered of very low significance, since it only refers to 3 events and will take place before 11h00. The same figure with satellite imagery as background can be found in APPENDIX F.

The areas which are encompassed by the 'Number Above' contours for the 70 dB(A) L_{Amax} events for the day-night period and the 70 dB(A) and 60 dB(A) L_{Amax} events for night-time, are shown in Table 4-17 for Scenario 3.

For Scenario 3, the contours that represent the areas with the relevant number of events above 70 dB(A), are between 2.5 and 3 times larger than those for Scenario 1. However, outside the airport site boundaries, the number of events during the day-night and the only-night periods are considered of low significance for both scenarios. The only exception is the small area south of the runway, where the day-night events are above 50 but below 75 and 65 for Scenario 3 and Scenario 1 respectively, which is considered of moderate significance.

Table 4-17 Scenario 3: Zones with Number of Events above 70 dB(A) and 60 dB(A) L_{Amax}

Day-Night		Night		Night	
Events N70	**Area (km2)**	**Events N70**	**Area (km2)**	**Events N60**	**Area (km2)**
5 - 10	64.42	3	1.63	3	5.63
10 - 20	43.38	-	-	-	-
20 - 30	25.43	-	-	-	-
30 - 50	16.68	-	-	-	-
> 50	6.70	-	-	-	-

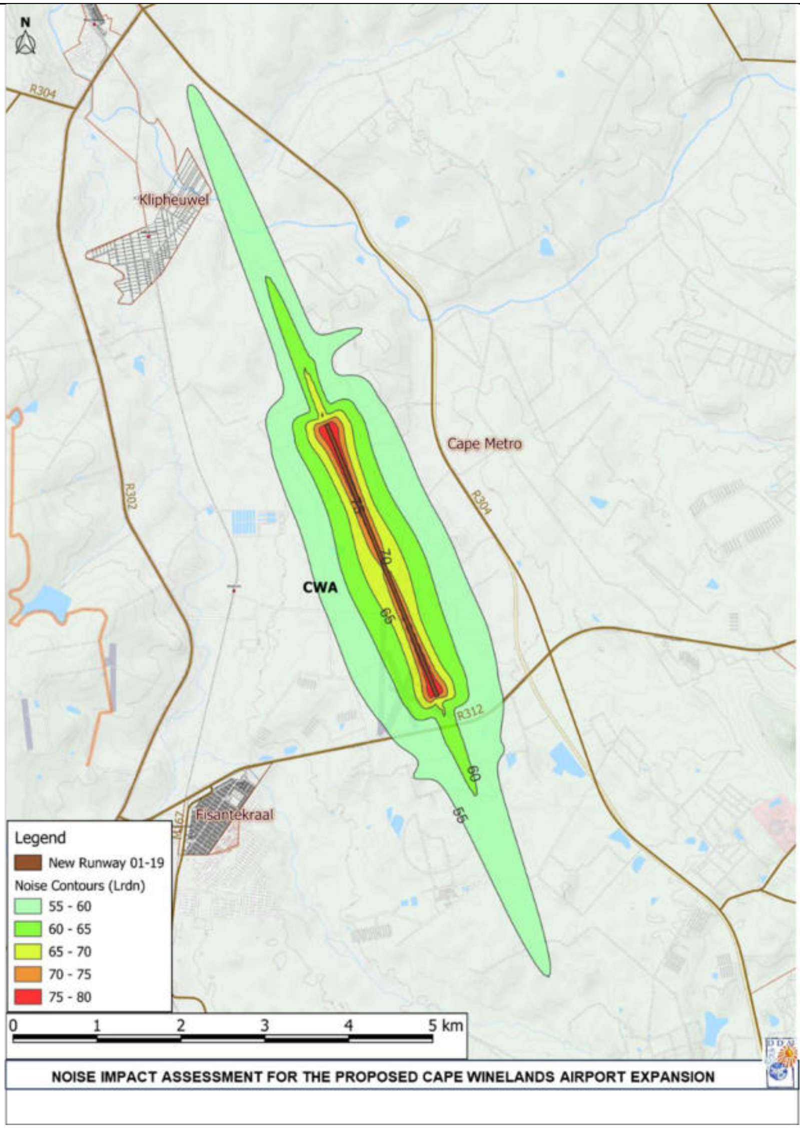

Figure 4-12. Scenario 3: Day-Night Noise Rating Level (L_{Rdn})

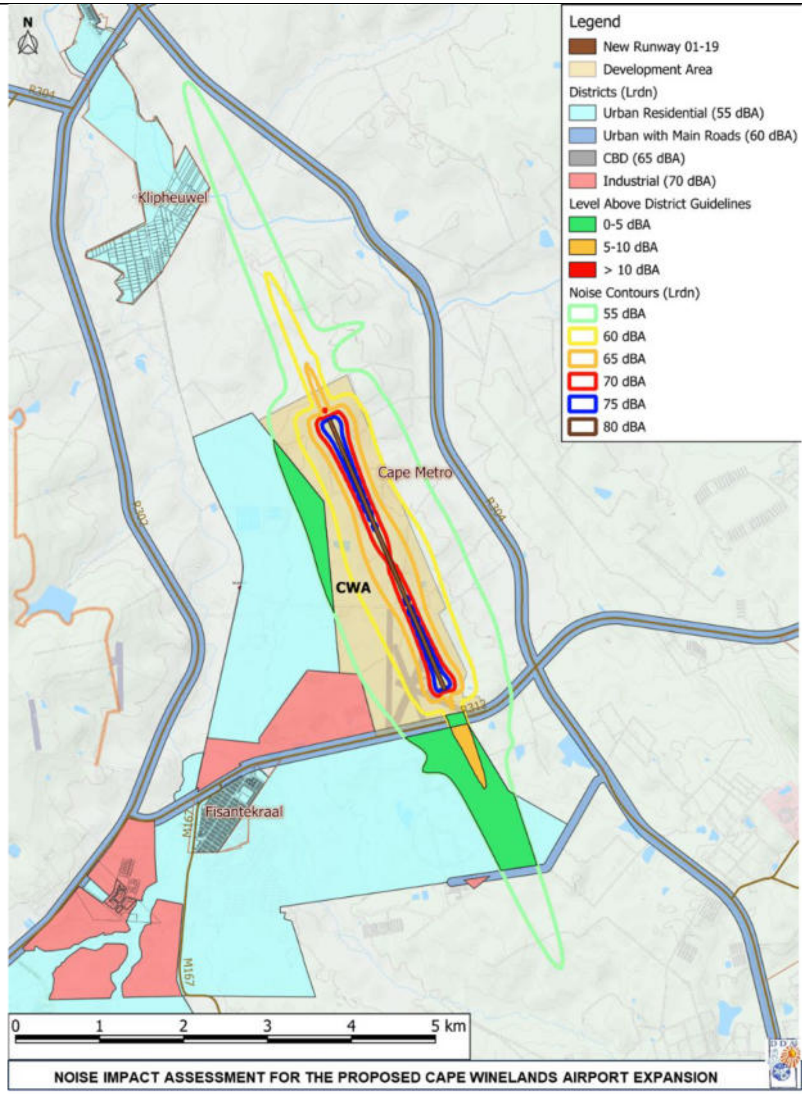

Figure 4-13. Scenario 3: Day-Night Noise Rating Level (L_{Rdn}) above the SANS 10103 District Guidelines

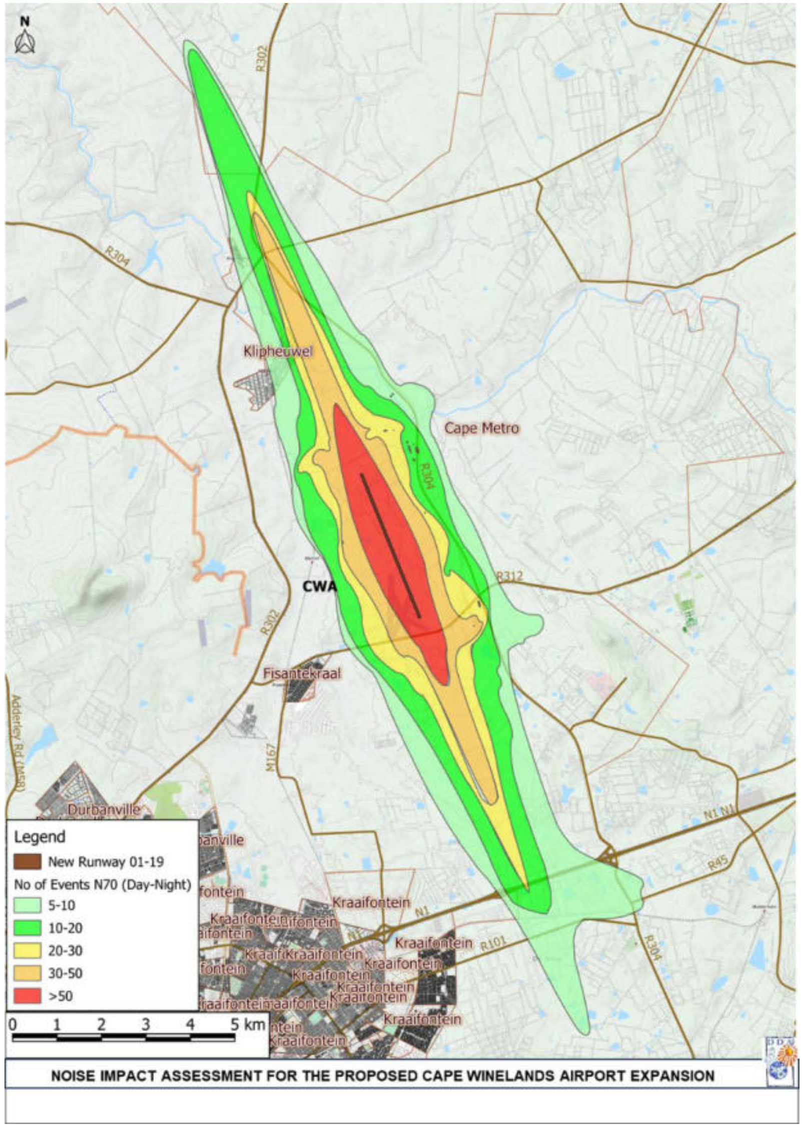

Figure 4-14. Scenario 3: Day-Night N70 Contours

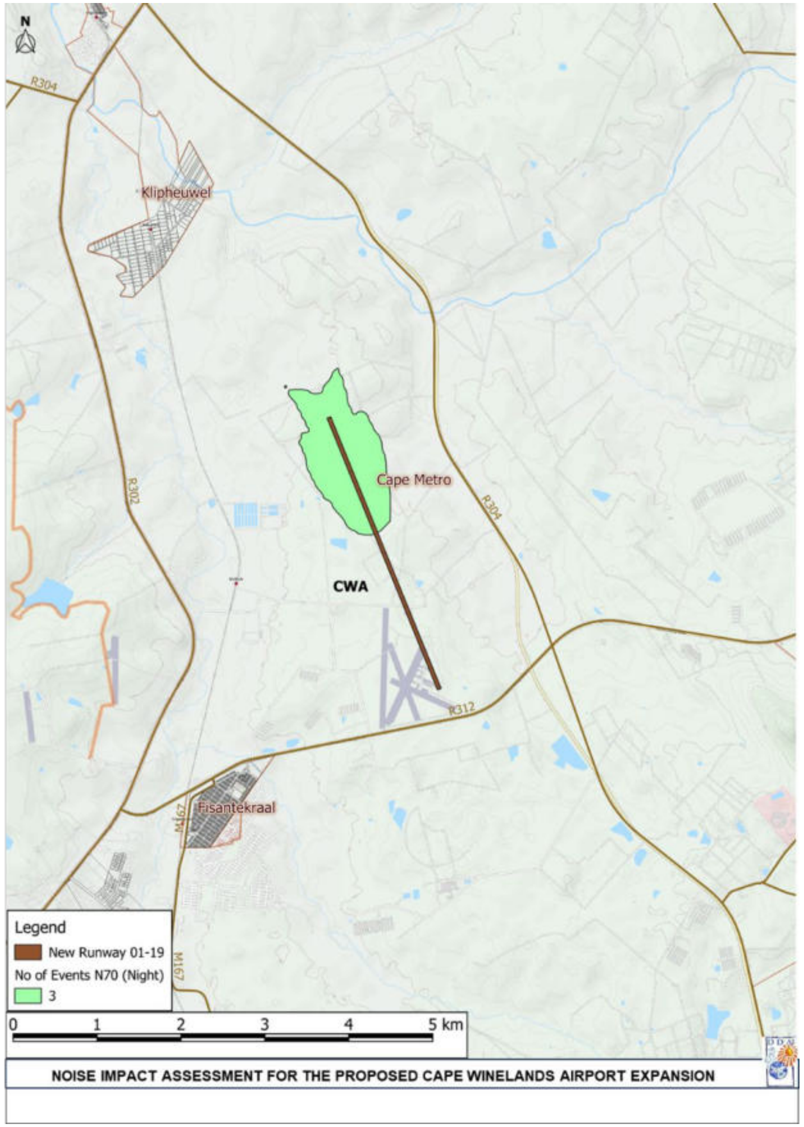

Figure 4-15. Scenario 3: Night N70 Contours

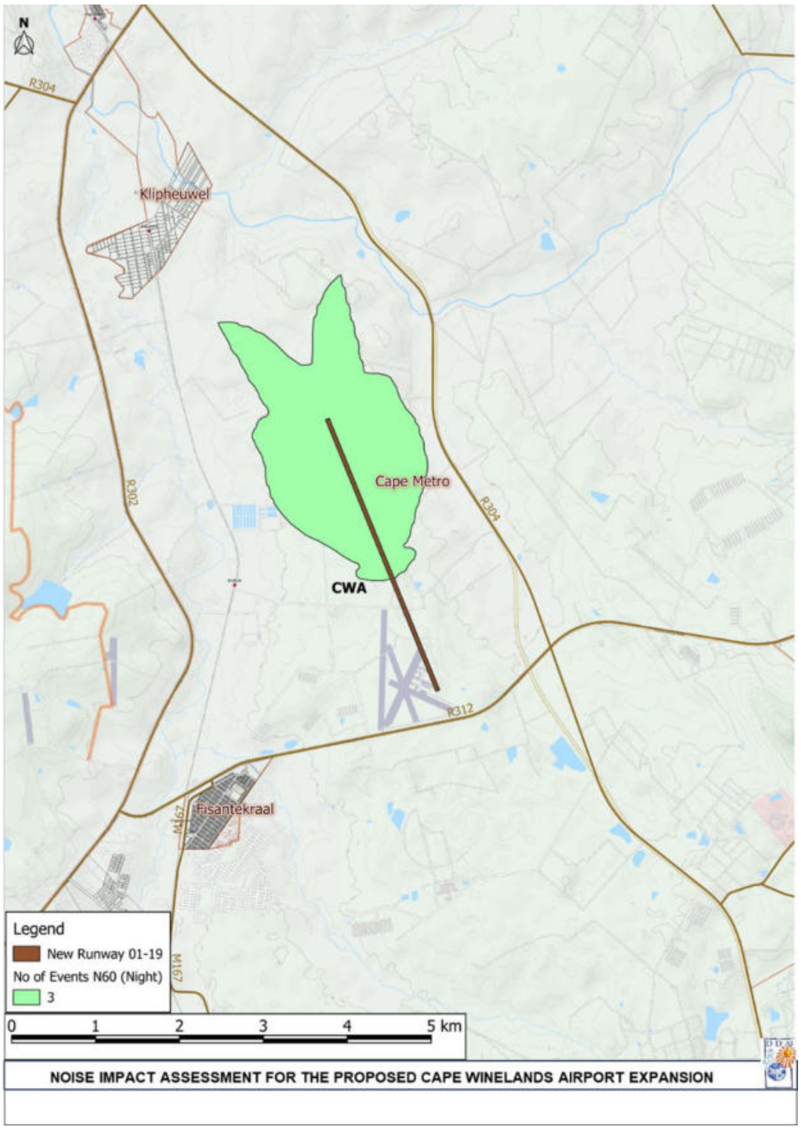

Figure 4-16. Scenario 3: Night N60 Contours

4.3.4 Noise Levels at Discrete Receptors

As mentioned in Section 4.2.4, the noise levels due to the aircraft operations were calculated at several discrete receptors, which were positioned at the existing and the proposed residential developments around the airport. Their coordinates and their positions can be found in Table 4-11 and in Figure 4-6.

From the noise levels at these receptors and residential areas, it is evident that the schools identified (R04, R25 and R27) will be outside the 50 dBA zone for all three scenarios.

In addition, it can be seen that the SANS 10103 district guidelines for Urban Residential areas are not exceeded for any of the three scenarios. The exceptions are one small area on the eastern side of Bella Riva for Scenario 3, as well as an area immediately south of the airport for Scenario 1 and Scenario 3 (R21).

For the receptors further away from the airport, the only other exception is a farm house (R28), which is situated on the eastern side of Klipheuwel. The L_{Rdn} during the opening year will reach 44 dBA, and will gradually increase to reach 58 dBA under Scenario 3.

Table 4-18 Noise Levels at Discrete Receptors

Receptor	Description	Scen. 1	Scen. 2	Scen. 3
		L_{Rdn} (dBA)		
R01	Farmhouse, ~3.3 km southeast of CWA	42.2	35	43.3
R02	Farmhouse, ~4.0 km southeast of CWA	38.7	31.3	38.7
R03	Farmhouse, ~3.5 km east of CWA	38.2	32.1	42
R04	Fisantekraal High School, ~1.3 km west of CWA	48.5	36.5	44.3
R05	Fisantekraal residence, ~2.6 km southwest of CWA	40.7	31.7	38.3
R06	Farmhouse, ~2.6 km west of CWA	40.7	32.5	39.1
R07	Farmhouse, ~2.4 km west of CWA	41.8	33.6	39.9
R08	Bella Riva Development, ~400 m west of CWA	50.6	41.3	50.4
R09	Bella Riva Development, ~1.1 km west of CWA	49.2	38.5	46.1
R10	Bella Riva Development, ~1.7 km west of CWA	47.9	35.7	42.9
R11	Farmhouse, ~600 m south of CWA	54.3	40.8	51.7
R12	Bella Riva Development, ~1.6 km northwest of CWA	40.9	40.6	49.2
R13	Bella Riva Development, ~1.3 km west of CWA	42.3	44.4	53.2
R14	Bella Riva Development, ~500 m west of CWA	49.6	42.3	50.2
R15	Bella Riva Development, ~600 m west of CWA	49.6	42.8	50.9
R16	Greenville Garden City Development, ~3.2 km south of CWA	39.3	30.1	36.3
R17	Greenville Garden City Development, ~2.7 km south of CWA	42.1	32.1	39.2
R18	Greenville Garden City Development, ~1.9 km south of CWA	46.7	35.4	43.7
R19	Greenville Garden City Development, ~1.8 km south of CWA	48.7	40	49.5
R20	Greenville Garden City Development, ~2.0 km south of CWA	46.8	42.8	53.7
R21	Greenville Garden City Development south of CWA	55.2	50	62.8
R22	Greenville Garden City Development, ~1 km south of CWA	52.5	40.3	49.6
R23	Darwin Industrial in Durbanville, ~3.7 km southwest of CWA	37.6	29	34.4
R24	Farmhouse, ~3.7 km northwest of CWA	34.4	32.5	40.1
R25	Klipheuwel Equitots School, ~3.5 km northwest of CWA	35.9	35.9	44.6
R26	Klipheuwel residence, ~4.0 km northwest of CWA	34.5	34.7	43.2
R27	Klipheuwel Primary School, ~4.0 km northwest of CWA	37	39.3	49.6
R28	Farmhouse, east of Klipheuwel, ~3.2 km northwest of CWA	39.5	44.1	57.6
R29	Chicken Farm, west of CWA	53.5	42.8	53.3

The following Table 4-19 summarises for each scenario the total overlapping areas between the noise contours and the proposed developments around the airport outside its boundaries.

As can be seen, the total overlap area will be reduced from Scenario 1 (No-Go Alternative) once the new runway is introduced and will reach a maximum total area of 1.52 km^2 when the new runway reaches its capacity, i.e. Scenario 3.

Table 4-19 Noise Contours Overlap with Proposed Development Beyond the Airport Boundary

	Noise Zone L_{Rdn} (dBA)						
	55-60	60-65	65-70	70-75	75-80	>80	Total
Scenario 1 (km^2)	0.44	-	-	-	-	-	0.44
Scenario 2 (km^2)	-	-	-	-	-	-	-
Scenario 3 (km^2)	1.40*	0.11	-	-	-	-	1.52

* Includes zones within the Bella Riva and the Greenville Garden City developments

5 CONCLUSIONS, RECOMMENDATIONS AND IMPACT RATINGS

5.1 Construction Phase

During construction the noise levels at the closest community receptors are not expected to exceed the SANS guidelines for Urban Residential areas.

No specific noise mitigation measures are necessary for the construction operations, other than ensuring that the equipment is in good working order and properly maintained, as well as providing training to the personnel to adhere to operational procedures that reduce the occurrence and magnitude of individual noisy events.

With regard to the construction operations, the following general measures are considered essential and should be adhered to:

- Limit the night-time construction activities;
- Avoid night-time construction activities on the property to the west of the airport boundary (earthworks), which are closer to the Fisantekraal residential area.

The significance of the unmitigated impact is anticipated to be *VERY LOW*. It should be noted that for a short duration, when the working face is closest to the Fisantekraal community towards the western boundary of the site, this impact may be *LOW*, albeit for a limited time.

With mitigation measures, the noise impact during construction is anticipated to be *INSIGNIFICANT*.

Table 5-1. Construction Noise Impact Ratings

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	Low 1	Short-term 1	**Very Low** **3**	Probable	**VERY LOW**	**– ve**	Medium
	Extent	**Intensity**	**Duration**	**Consequence**	**Probability**	**Significance**	**Status**	**Confidence**
With mitigation	Local 1	Low 1	Short-term 1	**Very Low** **3**	Possible	**INSIGNIFICANT**	**– ve**	Medium

5.2 Operational Phase

The resulting noise levels from the Cape Winelands Airport aircraft operations were simulated with the use of the US FAA's AEDT model. Based on the noise modelling methodology and input data, the resulting noise contour levels were estimated for the following scenarios:

Scenario 1: Existing runway setup under full utilisation (No-Go Alternative);
Scenario 2: Operations on the new runway 01/19 in the operational year;
Scenario 3: Operations on the new runway 01/19 at full capacity.

The busy day operations are expected to reach 301 by the time the current runway system reaches its operational capacity (Scenario 1). For Scenario 2, the expected busy day aircraft operations per day with the new runway 01/19 will be reduced to 29. When the new airport operates at capacity the busy day operations will reach 208.

Based on the modelling results in the previous sections, the impacts for the operational phase of the project are summarised below.

5.2.1 Scenario 1: Existing Runway System at Full Utilisation (No-Go Alternative)

For Scenario 1, the day-night noise rating level L_{Rdn} noise contour of 55 dB(A) will encompass a total area of 2.47 km^2 around the airport. A small portion of this contour extends beyond the R312 towards the south, within the Greenville Garden City and covers a zone of approximately 0.44 km^2. Within this zone it would not be recommended to establish residences, without providing additional noise mitigation measures.

The L_{Rdn} 60 dB(A) zone is completely contained within the airport site for Scenario 1.

From the day-night N70 contours, which indicate the number of aircraft movements that exceed 70 dB(A) L_{Amax} at a given location, it was found that the 30 and above events area is 8.6 km^2, and a portion of this zone extends beyond the airport site boundaries into the Bella Riva development and primarily into the Greenville Garden City. The area affected in the latter development is 1.6 km^2. This is considered significant, and mitigation measures in terms of appropriate land use planning should be implemented for this zone.

No night-time aircraft operations are planned for the night-time period for this scenario.

Based on the resulting noise contours, it is evident that the existing residential areas of Fisantekraal and Klipheuwel fall outside of the above-mentioned impact zones.

In addition, the fact that the proposed residential developments of Bella Riva and the Greenville Garden City are in the design phase could provide an opportunity to consider and implement appropriate mitigation measures, taking into account the areas of impact in each development.

Based on the above, the overall impact rating without mitigation for Scenario 1 was found to be of *HIGH* significance. With the implementation of the mitigation measures, primarily in terms of land use planning for the proposed residential areas adjacent to the airport, the overall impact rating was found to be of *MODERATE* significance and is summarised in Table 5-2.

Table 5-2. Operation Noise Impact Ratings: Scenario 1 (No-Go Alternative)

Noise	**Extent**	**Intensity**	**Duration**	**Consequence**	**Probability**	**Significance**	**Status**	**Confidence**
Without mitigation	Local 1	High 3	Long-term 3	**High** **7**	Probable	**HIGH**	**– ve**	High
Noise	**Extent**	**Intensity**	**Duration**	**Consequence**	**Probability**	**Significance**	**Status**	**Confidence**
With mitigation	Local 1	Medium 2	Long-term 3	**Medium** **6**	Probable	**MEDIUM**	**– ve**	High

5.2.2 Scenario 2: New Runway 01/19 in Operational Year

With the introduction of the new runway, the noise impact zones during the operational year will be greatly reduced compared to the ones resulting from the current runway system at full capacity.

The area with L_{Rdn} 55 dB(A) during the operational year will only be 1.44 km^2 and will not extend into the proposed residential areas west and south of the airport, and will be contained within the development area of the airport site.

The aircraft operations that will cause 5-10 events per day exceeding the 70 dB(A) L_{Amax}, will extend outside air airport's site boundary towards the south. However, this zone is very small, and the number of events is considered of low significance.

Based on the above, the overall impact rating for Scenario 2 was found to be of *LOW* significance without mitigation and is summarised in Table 5-3.

Additional noise abatement procedures for the aircraft operations are not required for the operational year of the new runway. However, consideration of such measures and operations should be initiated before the full capacity of the new runway is reached, based on the noise monitoring around the airport and noise modelling of the applicable mitigation measures.

Table 5-3. Operation Noise Impact Ratings: Scenario 2 (New Runway 01/19 at Operational Year)

Noise	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	Medium 2	Long-term 3	**Medium** **6**	Possible	**LOW**	**– ve**	High

5.2.3 Scenario 3: New Runway 01/19 at Full Capacity

By the time that the new airport and runway 01/19 reaches its capacity, the length of the L_{Rdn} 55 dB(A) impact zone will reach 4 km north of its northern site boundary. The Klipheuwel residential area will be outside this impact zone. The noise level on the south-eastern part of Klipheuwel community is expected to reach 49 dB(A), which is in accordance with the SANS 10103 guideline for Urban Districts with little road traffic.

Towards the south, the 55 dB(A) noise contour will extend less, reaching a distance of 3.3 km. This zone will overlap the Greenville Garden City development and cover an area of approximately 1.03 km^2.

It should be noted that immediately south of the runway, there will also be a small zone of 0.11 km^2 within the Greenville Garden City area, where the L_{Rdn} reaches between 60 dB(A) and 63 dB(A).

Towards the Bella Riva area, the L_{Rdn} 55 dB(A) contour will extend approximately 300m from its eastern further most point of this development. The area that is covered by this contour within the Bella Riva development is 0.38 km^2.

From the N70 day-night contours it is evident that there is an area within the Greenville Garden City that will experience more than 30 events of 70 dB(A) L_{Amax}. This is considered significant, and mitigation measures in terms of appropriate land use planning should be implemented for this zone, which is approximately 1.2 km^2.

It should be noted that the above-mentioned zone that should be considered for appropriate land use planning is smaller than the relevant one for Scenario 1, which is 1.6 km^2.

The Klipheuwel residential area was found to fall within the 5-10 events contour but outside the 20-30 events.

The number of events that exceed the 70 dB(A) L_{Amax} during night-time, i.e. between 22h00 and 06h00, are expected to be only 3, and their contour is contained around the northern section of the new runway, within the airport development site.

Similarly, the number of events that exceed the 60 dB(A) L_{Amax} during night-time is 3, and its contour is primarily around the northern section of the new runway. This contour marginally extends beyond the airport site boundaries and covers a small portion of the northern Bella Riva development area. However, this is considered of low significance, since it only refers to 3 events and will take place before 11h00.

The investigation of noise abatement operational procedures should be initiated before the full capacity of the new runway is reached, taking into account the recommended noise monitoring around the airport and noise modelling of the applicable mitigation measures.

Based on the above, the unmitigated overall impact rating for Scenario 3 was found to be of *HIGH* significance and is summarised in Table 5-4. With the implementation of appropriate land use planning for the proposed adjacent residential areas, the overall impact rating for Scenario 3 was found to be of *MEDIUM* significance.

Table 5-4. Operation Noise Impact Ratings: Scenario 3 (New Runway 01/19 at Full Capacity)

Noise	**Extent**	**Intensity**	**Duration**	**Consequence**	**Probability**	**Significance**	**Status**	**Confidence**
Without mitigation	Local 1	High 3	Long-term 3	**High** **7**	Probable	**HIGH**	**– ve**	High
Noise	**Extent**	**Intensity**	**Duration**	**Consequence**	**Probability**	**Significance**	**Status**	**Confidence**
With mitigation	Local 1	Medium 2	Long-term 3	**Medium** **6**	Probable	**MEDIUM**	**– ve**	High

5.3 Recommendations

5.3.1 Operational Phase Noise Mitigation Procedures

It should be noted that even though several mitigation measures have been identified in this section for the airport's operations, the identification of the most suitable and cost-effective mitigation measures, together with a realistic time schedule for their implementation, can only be a result of consultations between the various stakeholders associated with all the airport operations, and taking into consideration the safety and security requirements associated with these airport operations. This process falls outside the scope of the present noise impact study. Once these consultations take place and the mitigation measures, together with the implementation schedule have been determined, their effects can be quantified and the mitigated impact rating tables determined.

The following actions can be considered, in order to minimise the noise impacts around the Cape Winelands Airport.

- Encourage airport compatible land-use planning via:
  - establishing compatible land use (such as industrial and commercial) to be located around airport facilities.
  - directing incompatible land use (such as houses and schools) away from the airport environs and the runway alignments;
- Provide incentives for airlines to obtain aircraft with the latest available noise reduction technology, through for example noise-related landing charges.

- Consider the use of specific take-off or approach procedures (such as Continuous Descent Operations, or steeper landing trajectories) to minimise and optimize the distribution of noise on the ground.
- Use noise preferential routes to assist aircraft in avoiding noise-sensitive areas, such as Klipheuwel, on departure and arrival, and the use of turns to direct aircraft away from noise-sensitive areas.
- Consider approaches at slightly steeper angles. A small increase in the glide-path angle to 3.2°, rather than the standard 3.0°, may be feasible and offer scope for noise reduction.
- Establish and maintain effective communication channels with the affected public and provide real-time information on incoming and outgoing flights and their evolving noise footprints.
- Consider noise-related operating restrictions for night-time. These can be imposed on a voluntary basis by the airport, or by the Government.

In conjunction with the above-mentioned noise abatement measures, the introduction of 'passive' mitigation measures, such as noise insulation on existing residential dwellings and noise-sensitive buildings (schools, hospitals, etc.) may be considered.

5.4 Monitoring Network and Monitoring Plan

5.4.1 Construction Phase

Noise monitoring should be conducted during the construction phase of the new airport and runway. This monitoring is to be carried out in accordance with the methods stipulated in the SANS 10103:2008 Code of Practice and the current Western Cape Noise Control Regulations.

Two points should be used for the noise monitoring locations, positioned on the inside of the airport boundary. These locations should cover the area close to the entry point of the trucks to the site and the community closest to the construction activities. These locations should be finalised once the construction plan and schedule are determined.

The monitoring should be conducted every three months during construction and on a monthly basis during the period when night-time construction will be taking place.

Three-monthly reports should be submitted to the authorities[1], including a brief assessment indicating if any construction-specific noise exceedances above baseline and SANS district guidelines are taking place. In the event of exceeding noise guidelines, appropriate site- and operation-specific noise mitigation measures should be investigated and implemented.

5.4.2 Operational Phase

Three permanent noise monitoring terminals should be established before or by the operational year of the new airport and runway.

The first of these terminals should be established at the Klipheuwel area, preferably close to its south-eastern boundary. The second should be positioned within the Greenville Garden City Development, in line with the new runway 01/19 and the third on the eastern side of the Bella Riva development.

[1] City of Cape Town Environmental Health Department: Noise Control Administration Unit.

A summary of the noise monitoring results should be reported on a quarterly basis to the appropriate authorities. These reports should contain, but not be limited to the:

- 24-hour equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$;
- equivalent continuous day-night rating level, L_{Rdn};
- equivalent continuous day and night rating levels, L_{Rd} and L_{Rn} ;
- maximum A-weighted level, L_{Amax};
- percentile levels L_n;
- number of exceedances above 70 dB(A) and 60 dB(A) of the L_{Amax} and SEL.

A noise complaints registry should be established and connected with the noise monitoring system, in order to provide the capability for correlation of the complaints with the actual measured levels, as well as the aircraft-related operational data.

The complaints and relevant aircraft-related operational data should be included in the quarterly report to the authorities.

6 REFERENCES

Basner, M., 2008. Nocturnal aircraft noise exposure increases objectively assessed daytime sleepiness. Somnologie 12(2):110-117.

European Parliament & Council, 2021. Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise (consolidated version). EUR-Lex.

H & A Planning, 2024. Cape Winelands Airport in the Context of Spatial Policies and Land Use Rights.

International Civil Aviation Organization, 2013. Safety Management Manual (SMM) (Doc 9829, 3rd ed.). ICAO.

IFC, 2007. Environmental, Health, and Safety (EHS) Guidelines.

NACO, ATNS, NLR, 2023. Development of an Airspace CONOPS for the Cape Winelands Airport. 02 November 2023.

NLR, 2023. AirTOp model of Cape Winelands Airport. September 2023.

South Africa Department of Transport, 1998a. White Paper on National Policy on Airports and Air Space Management. Pretoria.

South Africa Department of Transport, 1998b. National Policy on Aircraft Noise and Engine Emissions. Pretoria.

South Africa Department of Transport, 2017. White Paper on National Civil Aviation Policy.

South African National Standard SANS 10103, 2008. The Measurement and Rating of Environmental Noise with Respect to Annoyance and to Speech Communication. Edition 6, Standards South Africa, Pretoria.

South African National Standard SANS 10117, 2008. Calculation and Prediction of Aircraft Noise Around Airports for Land Use Purposes. Edition 2. Standards South Africa, Pretoria.

Standards Australia, 2015. AS 2021: Acoustics - Aircraft noise intrusion - Building siting and construction. Standards Australia.

World Health Organization, 1999. Guidelines for Community Noise eds. Berglund, B., Lindvall, T., Schwela, D. H., World Health Organization, Geneva, Switzerland.

World Health Organization, 2003. World Health Organization (WHO). International Society of Hypertension (ISH) Statement on Management of Hypertension. Journal of Hypertension 21(11):1983-1992.

World Health Organization, 2005. Quantifying Burden of Disease from Environmental Noise: Second Technical Meeting Report, Bern, Switzerland, 15-16 December 2005. WHO European Center for Environment and Health.

World Health Organization, 2009a. Health Effects and Risks of Transportation Systems: the HEARTS Projects, World Health Organization, Regional Office for Europe's Health effects and risk of transport systems (HEARTS) Program, http://www.euro.who.int/hearts/models/ 20020513_1608.

World Health Organization, 2009b. Night Noise Guidelines.(NNGL) for Europe: Final Implementation Report, European Center for Environment and Health, Bonn, Germany.

World Health Organization, 2018. Environmental noise guidelines for the European Region. WHO Regional Office for Europe.

APPENDIX A CHECKLIST OF SPECIALIST REPORT

Requirements as per the EIA Regulations (2014) - Appendix 6

Table A-1. Checklist of Specialist Report

EIA REGULATIONS 2014 GNR 982 Appendix 6 **CONTENT OF THE SPECIALIST REPORTS**	**Required at Scoping/Desk-top Phase**	**Required at BA/EIA Phase**	**Cross-reference in this report**
(a) details of— the specialist who prepared the report; and the expertise of that specialist to compile a specialist report including a curriculum vitae;	X	X	Appendix E
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	X	X	Page iii
(c) an indication of the scope of, and the purpose for which, the report was prepared	X	X	Introduction
(d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	X	X	The site visit was conducted on 17 April 2022. The seasons are not relevant to project. The seasons were taken into consideration in the modelling, via the hourly meteorological input.
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process;	X	X	Section 1.3
(f) the specific identified sensitivity of the site related to the activity and its associated structures and infrastructure;	X	X	Section 3
(g) an identification of any areas to be avoided, including buffers;	X	X	N/A
(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	X	X	Figure 1-1
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	X	X	Section 1.3
(j) a description of the findings and potential implications of such findings on the impact of the	X	X	Section 5

EIA REGULATIONS 2014 GNR 982 Appendix 6 **CONTENT OF THE SPECIALIST REPORTS**	**Required at Scoping/Desk-top Phase**	**Required at BA/EIA Phase**	**Cross-reference in this report**
proposed activity, including identified alternatives on the environment;			
(k) any mitigation measures for inclusion in the EMPr		X	Section 5.3
(l) any conditions for inclusion in the environmental authorisation;		X	None
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;		X	Section 5.4
(n) a reasoned opinion— i. as to whether the proposed activity or portions thereof should be authorised; and ii. if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;		X	Section 5
(o) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	X	X	N/A
(p) any other information requested by the competent authority	X	X	N/A

APPENDIX B Construction Equipment Sound Power Emissions

Table B-1: Construction Equipment Sound Power Emission Levels

Equipment	Octave Band (Hz)							
	63	125	250	500	1000	2000	4000	8000
	Sound Power Level (dB), re 1 pW							
Bulldozer	88.0	118.0	111.0	109.0	107.0	103.0	97.0	67.0
Excavator	82.0	112.0	118.0	105.0	106.0	99.0	95.0	65.0
Grader	81.0	111.0	108.0	108.0	106.0	104.0	98.0	68.0
Haul truck	83.0	113.2	116.9	114.4	110.6	106.8	100.2	70.0
Concrete mixer unloading	71.0	101.0	103.1	97.5	95.1	92.2	87.4	57.4
Compressor	71.1	101.1	103.9	104.1	103.4	112.4	113.1	83.1
Concrete mixing equipment	76.8	106.8	100.9	101.2	99.0	94.1	87.3	57.3

APPENDIX C Impact Assessment Methodology

The significance of all potential impacts that would result from the proposed project is determined in order to assist decision-makers. The significance rating of impacts is considered by decision-makers, as shown below.

- **INSIGNIFICANT**: the potential impact is negligible and **will not** have an influence on the decision regarding the proposed activity.
- **VERY LOW**: the potential impact is very small and **should not** have any meaningful influence on the decision regarding the proposed activity.
- **LOW**: the potential impact **may not** have any meaningful influence on the decision regarding the proposed activity.
- **MEDIUM**: the potential impact **should** influence the decision regarding the proposed activity.
- **HIGH**: the potential impact **will** affect a decision regarding the proposed activity.
- **VERY HIGH:** the proposed activity should only be approved under special circumstances.

The **significance** of an impact is defined as a combination of the **consequence** of the impact occurring and the **probability** that the impact will occur. The significance of each identified impact[f] must be rated according to the methodology set out below:

Step 1 – Determine the **consequence** rating for the impact by determining the score for each of the three criteria (A-C) listed below and then **adding** them. The rationale for assigning a specific rating, and comments on the degree to which the impact may cause irreplaceable loss of resources and be irreversible, must be included in the narrative accompanying the impact rating:

Rating	Definition of Rating	Score
A. ***Extent***– *the area over which the impact will be experienced*		
Local	Confined to project or study area or part thereof	1
Regional	The region, which may be defined in various ways, e.g. cadastral, catchment, topographic	2
(Inter) national	Nationally or beyond	3
B. ***Intensity***– *the magnitude of the impact in relation to the sensitivity of the receiving environment, taking into account the degree to which the impact may cause irreplaceable loss of resources*		
Low	Site-specific and wider natural and/or social functions and processes are negligibly altered	1
Medium	Site-specific and wider natural and/or social functions and processes continue albeit in a modified way	2
High	Site-specific and wider natural and/or social functions or processes are severely altered	3
C. ***Duration***– *the timeframe over which the impact will be experienced and its reversibility*		
Short-term	Up to 2 years	1

[f] This does not apply to minor impacts which can be logically grouped into a single assessment.

Medium-term	2 to 15 years	2
Long-term	More than 15 years	3

The combined score of these three criteria corresponds to a **Consequence Rating**, as follows:

Combined Score (A+B+C)	3 – 4	5	6	7	8 – 9
Consequence Rating	Very low	Low	Medium	High	Very high

Step 2 – Assess the **probability** of the impact occurring according to the following definitions:

Probability– the likelihood of the impact occurring	
Improbable	< 40% chance of occurring
Possible	40% - 70% chance of occurring
Probable	> 70% - 90% chance of occurring
Definite	> 90% chance of occurring

Step 3 – Determine the overall **significance** of the impact as a combination of the **consequence** and **probability** ratings, as set out below:

		Probability			
		Improbable	Possible	Probable	Definite
Consequence	Very Low	**INSIGNIFICANT**	**INSIGNIFICANT**	**VERY LOW**	**VERY LOW**
	Low	**VERY LOW**	**VERY LOW**	**LOW**	**LOW**
	Medium	**LOW**	**LOW**	**MEDIUM**	**MEDIUM**
	High	**MEDIUM**	**MEDIUM**	**HIGH**	**HIGH**
	Very High	**HIGH**	**HIGH**	**VERY HIGH**	**VERY HIGH**

Step 4 – Note the **status** of the impact.

Status of impact	
Indication whether the impact is adverse (negative) or beneficial (positive).	+ ve (positive – a 'benefit')
	– ve (negative – a 'cost')

Step 5 – State your level of **confidence** in the assessment of the impact (high, medium or low).

Confidence of assessment	
The degree of confidence in predictions based on available information, and/or specialist knowledge.	Low
	Medium
	High

Step 6 – Identify and describe practical mitigation and optimisation measures that can be implemented effectively to reduce or enhance the significance of the impact.

APPENDIX D NLR AirTOp Simulation Document

Dedicated to innovation in aerospace

NLR-CR-2023-336 |

AirTOp model of Cape Winelands Airport

CUSTOMER: NACO

AUTHOR(S):

T. Dufourmont NLR

Royal NLR - Netherlands Aerospace Centre

APPENDIX E Specialist CV

APPENDIX F Figures with Satellite Imagery as Background

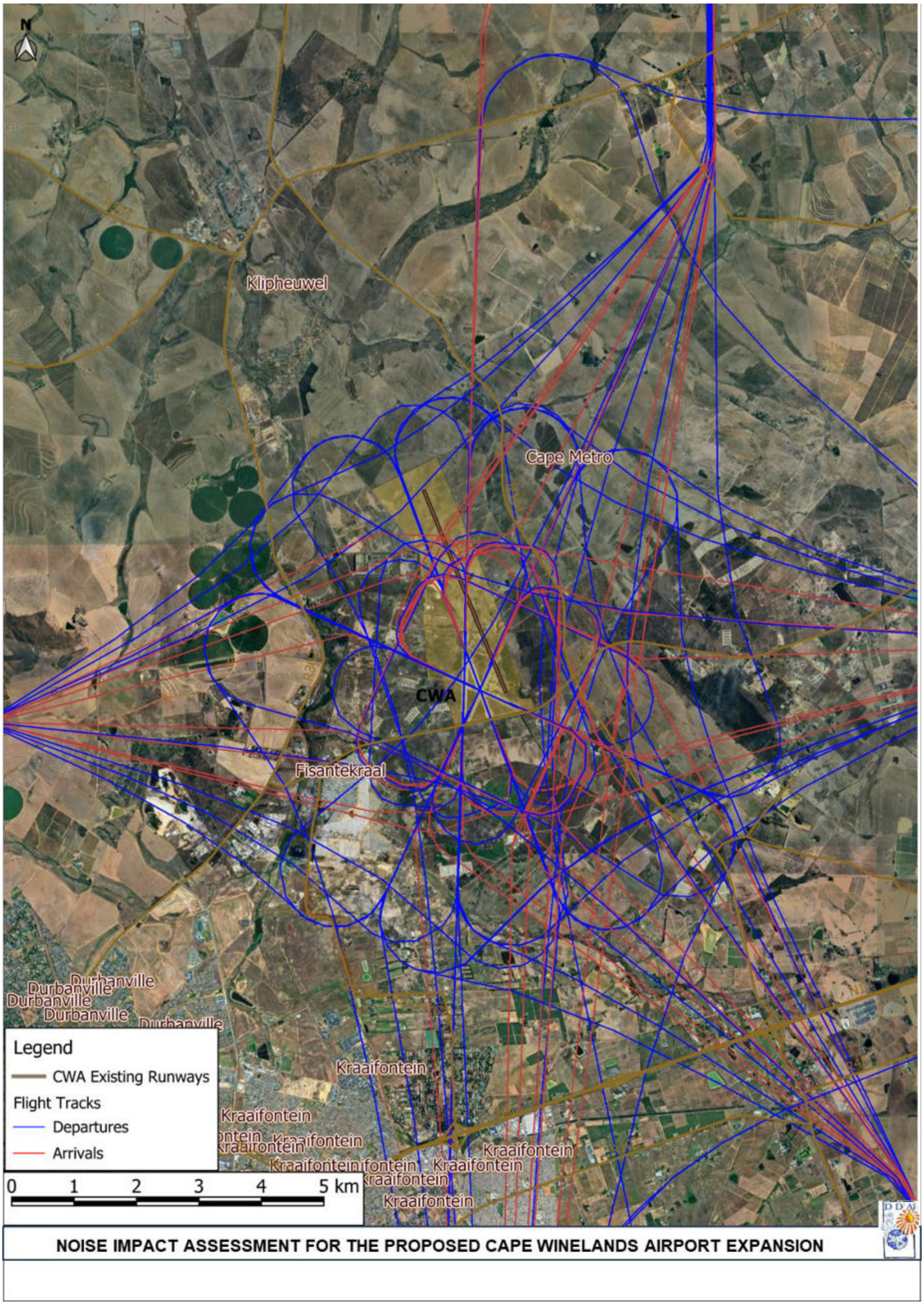

Figure F-1. Current Runway System Flight Paths

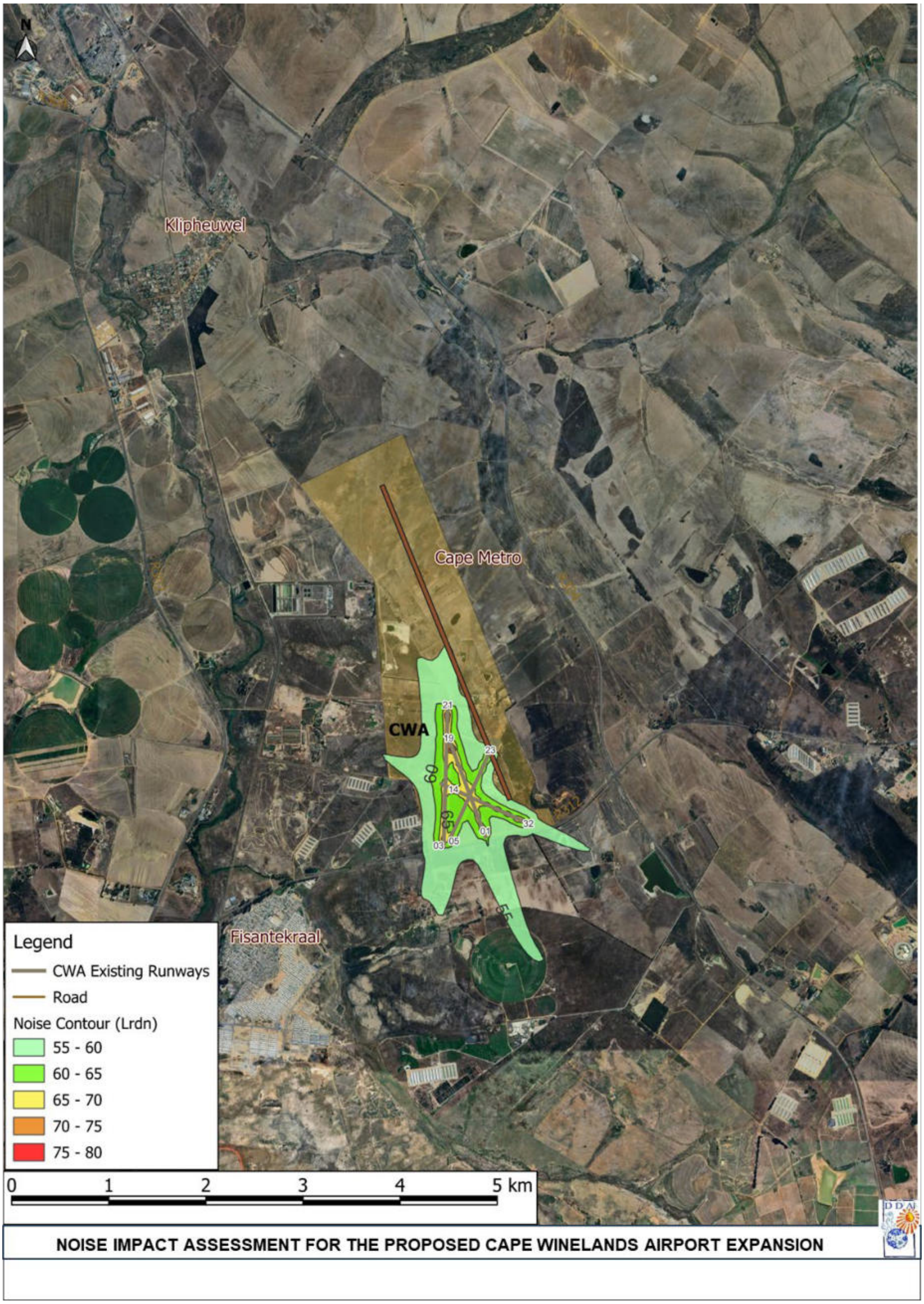

Figure F-2. Scenario 1: Day-Night Noise Rating Level (L_{Rdn})

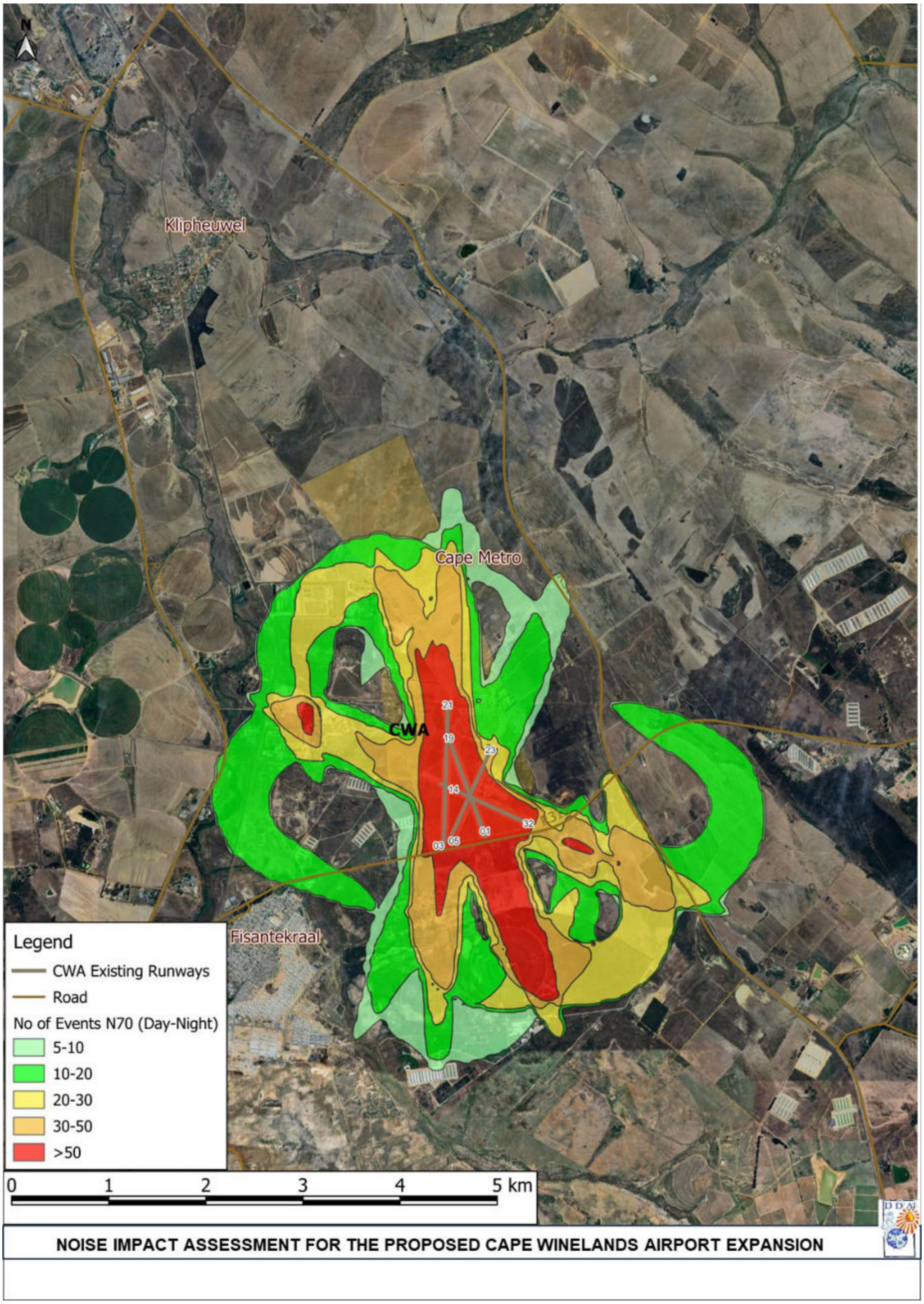

Figure F-3. Scenario 1: Day-Night N70 Contours

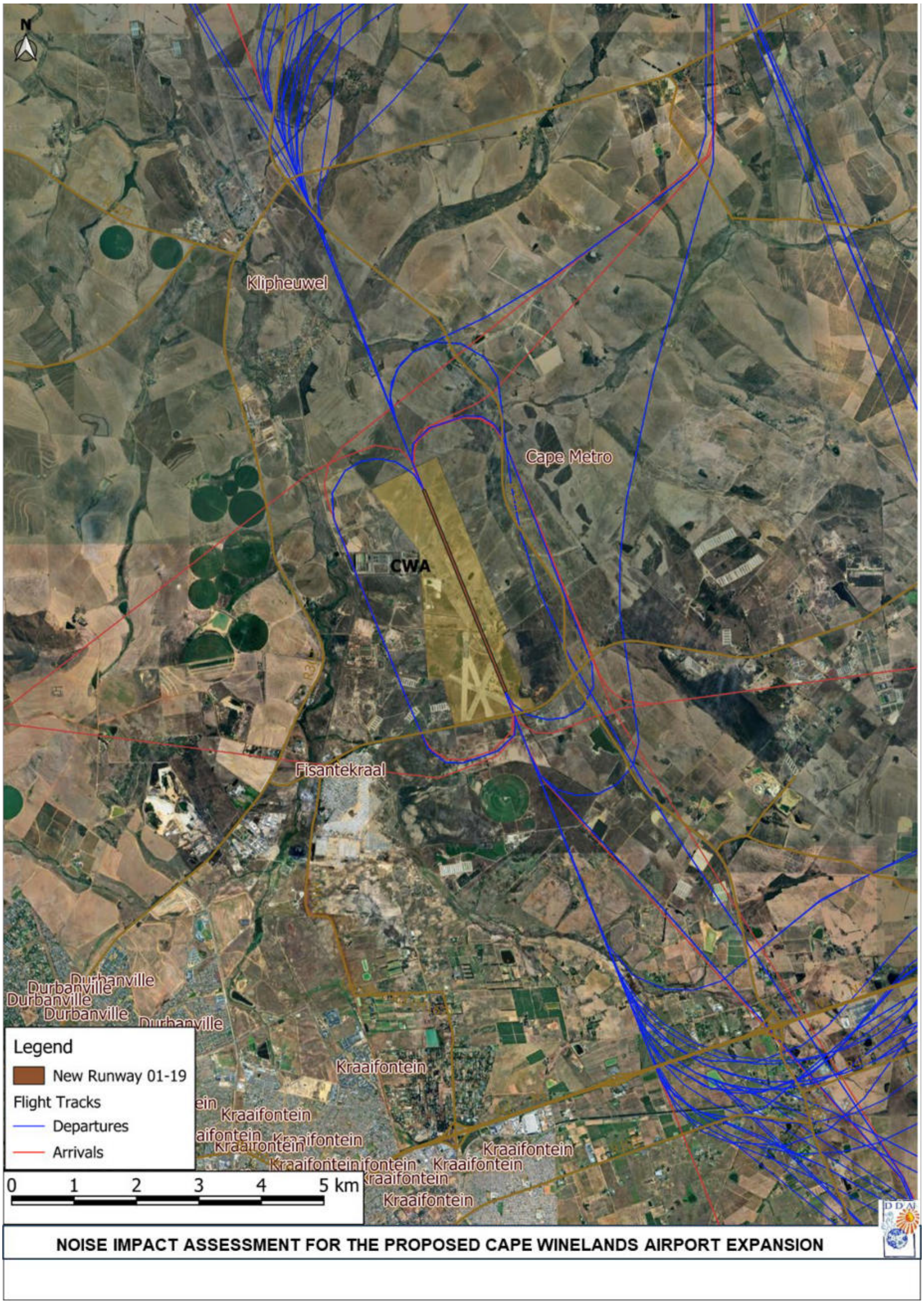

Figure F-4. New Runway 01/19 Flight Paths at Full Utilisation

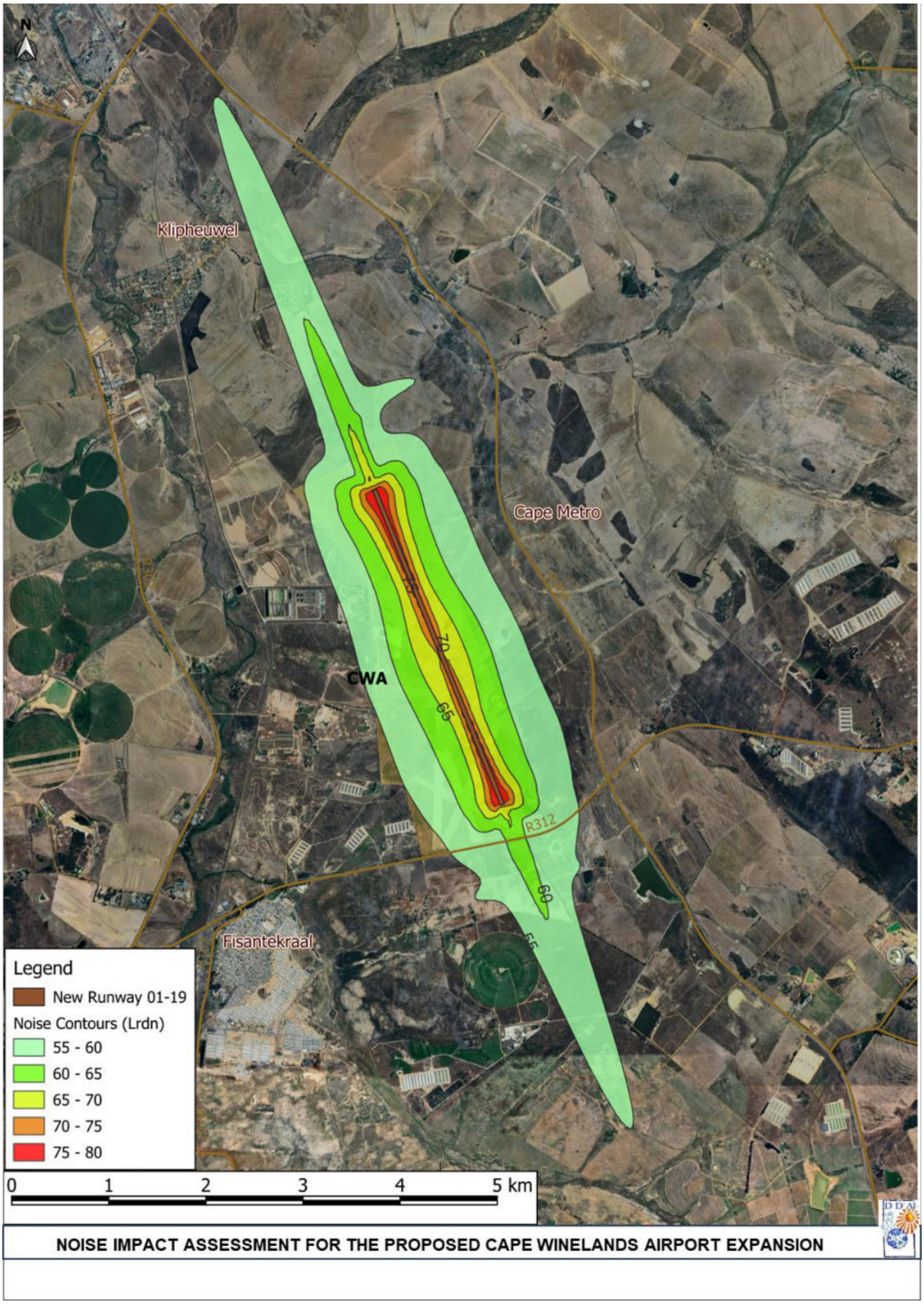

Figure F-5. Scenario 3: Day-Night Noise Rating Level (L_{Rdn})

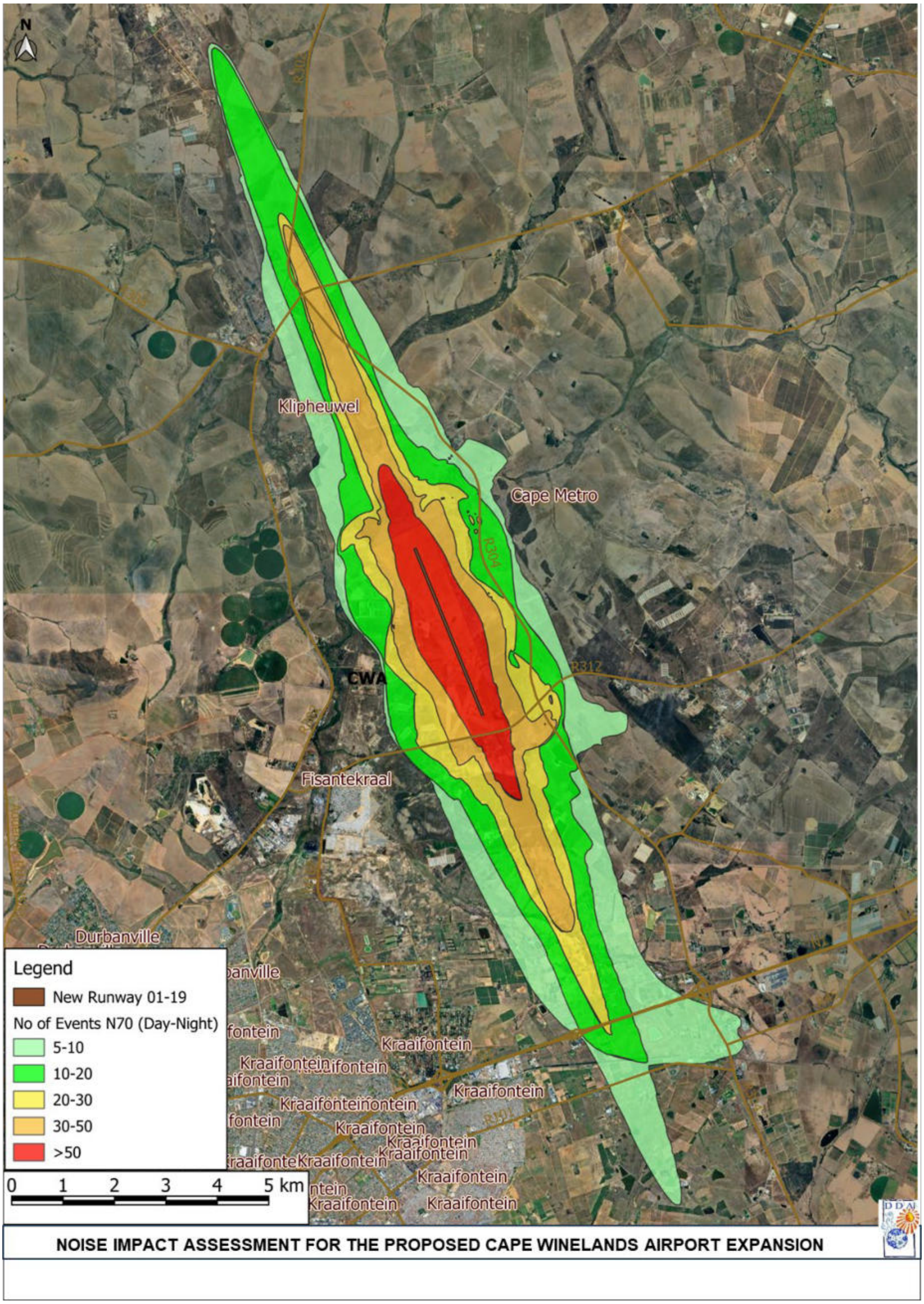

Figure F-6. Scenario 3: Day-Night N70 Contours

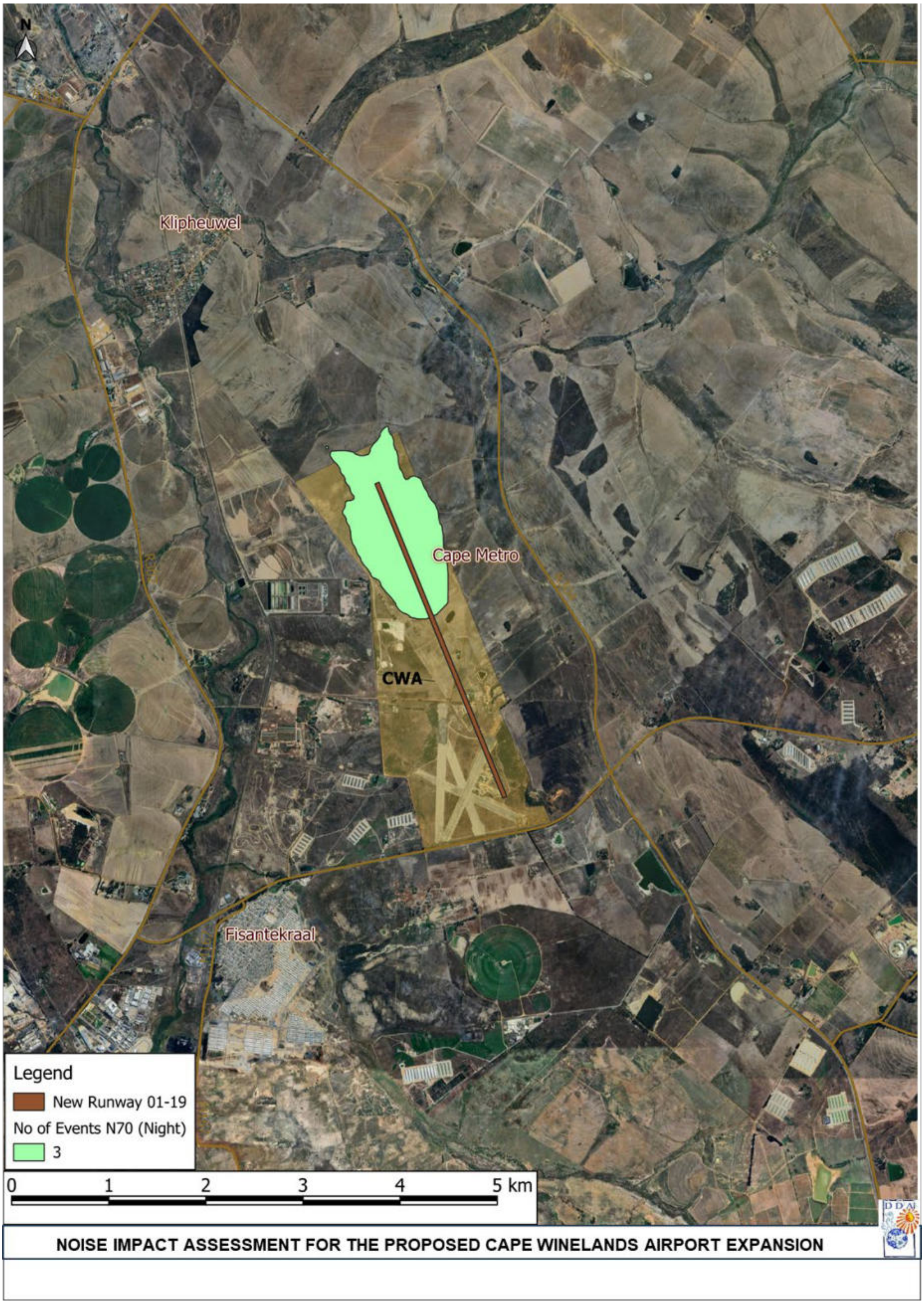

Figure F-7. Scenario 3: Night N70 Contours

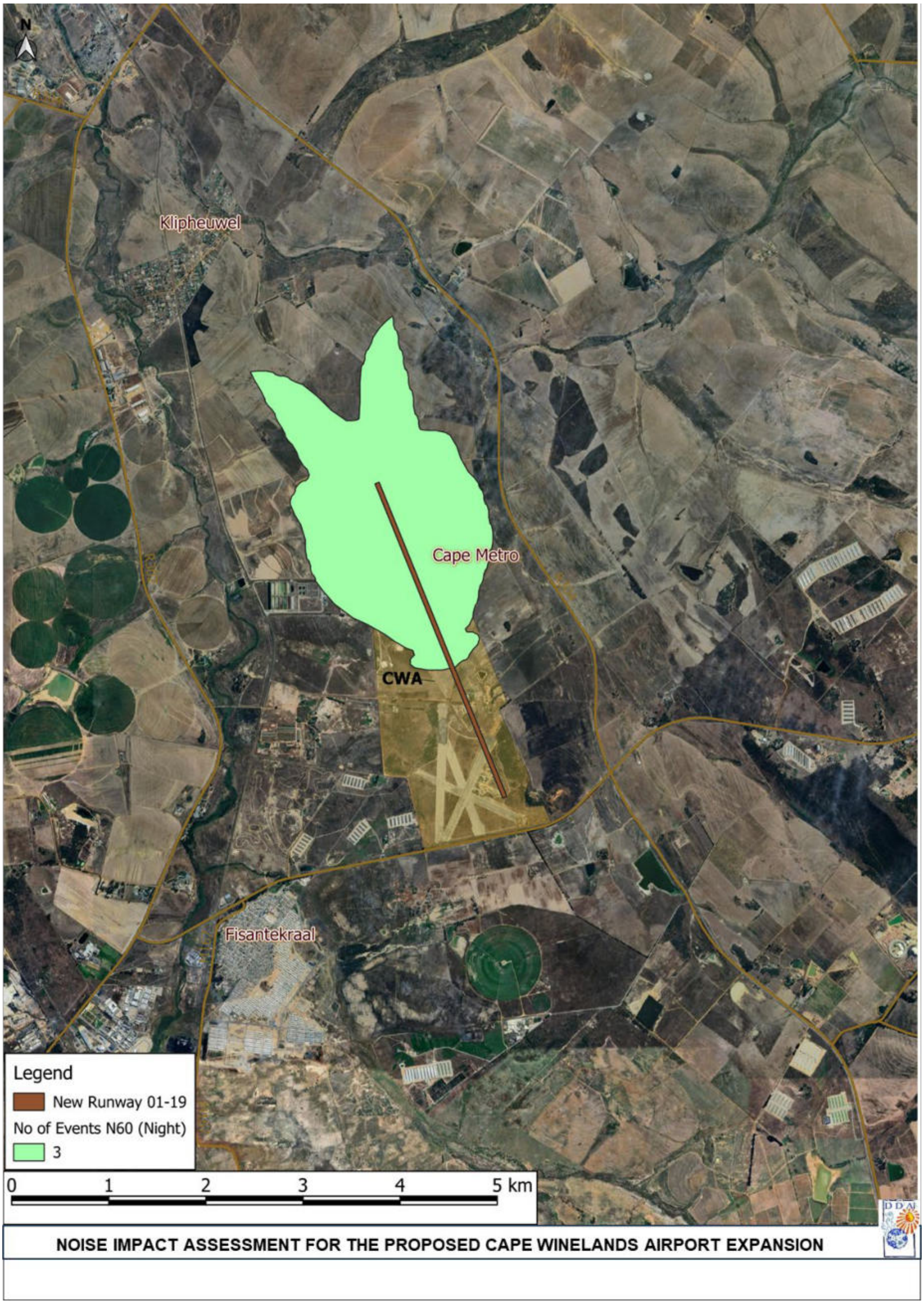

Figure F-8. Scenario 3: Night N60 Contours