AECOM

ACOUSTICAL AMBIENT SOUND LEVELS

Acoustical Baseline study on the Ambient Sound Levels for the Proposed Richards Bay Port Expansion, KZN

Study done for:

AECOM

M² Environmental Connections cc
P.O. Box 2047
Garsfontein East
0060
Tel: 012 – 993 2165
Fax: 086 – 621 0292
E-mail: morne@menco.co.za

EXECUTIVE SUMMARY

M^2 Environmental Connections was commissioned by AECOM SA Pty (Ltd) to undertake a specialist study to determine the current baseline ambient sound and noise levels in and around the Port of Richards Bay, KwaZulu-Natal.

Potentially sensitive receptors were identified and measurements were collected from the 17th – 21st of January 2013. During site investigations it was clear that the only receptors that fall within the study area (1,000m from footprint) are the Protea Waterfront Hotel, the Waterways Residential Estate and the Mzingazi Waterfront Village in the suburb of Meer-en-See. Other areas in and around the project footprint is zoned for industrial, commercial or other land uses but not for residential purpose.

There are no significant noise contributors at the above mentioned receptors except for the paved non-porous Ridge Town Road. The Ridge Town Road does contribute a measurable amount of noise in terms of road traffic volumes, but these volumes are not comparable to those in an urban setting. During the daytime the Ridge Town Road will have a slight contribution to ambient sound levels (calculated as an equivalent) in the area. During the night-time the insignificant traffic volumes (in terms of acoustical reporting) on the Ridge Town Road were not considered. This does not mean that the road will not have infrequent/insignificant traffic traversing it during the night-times.

At best the existing commercial area and small boats port adjacent to the Protea Waterfront Hotel, one of the identified receptors, may be audible during times (day or night). This is specifically relevant to times when the port is used for commercial activities or when the restaurants in the area play loud music during night-times. These noise sources were not calculated or considered as part of the ambient soundscape. These noise sources may contribute to the ambient soundscape at times, they are minor contributors of noise at the Protea Waterfront Hotel, the Waterways Residential Estate and the Mzingazi Waterfront Village (audible at times).

At over 1,500m distance from the existing Richards Bay and Transnet facilities, the current activities in the Port of Richards Bay cannot be considered as a noise source of significance at identified receptors.

Measurements conducted indicated noise levels due to faunal, meteorological (during rainy conditions) and anthropogenic noises emanating from daily activities associated at the receptors dwellings. The truck and car traffic on Ridge Town Road would contribute a

fair amount of measurable data to the soundscape during day-times. Taking into account the measured ambient sound levels and detected noises, the residential areas can be classified as "**Urban Districts"**.

The commercial and industrial areas (both considered to be industrial areas for the ambient noise baseline study) would be rated as non-residential area with higher allowable noise levels of over 60 dBA during the night and 70 dBA during the day, and as defined by SANS 10103:2008

Title:

Acoustical Ambient Sound Levels - Acoustical Baseline Study on the Ambient Sound Levels for the Proposed Port of Richards Bay Expansions, Kwa-Zulu/Natal

Client:

AECOM SA (Pty) Ltd

Block E
Hatfield Gardens
333 Grosvenor Street
Hatfield
0083

Report no:

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Author:

M. de Jager *(B. Ing (Chem))*

Review:

S. Weinberg

Date:

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GLOSSARY OF ABBREVIATIONS

AZSL	Acceptable Zone Sound Level (Rating Level)
dB	Decibel
dB(A)	A-weighted Decibel
DEDEA	Department of Economic Development and Environmental Affairs
DEA	Department of Environmental Affairs
ECA	Environment Conservation Act (Act 73 of 1989)
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
FEL	Front End Loader
Hz	Hertz
IAPs	Interested and Affected Parties
i.e.	*id est* (that is)
IEM	Integrated Environmental Management
kHz	kiloHertz
km	kilometer
$L_{Aeq,T}$	Equivalent continuous A-weighted sound pressure level
$L_{Req,T}$	Equivalent continuous A-weighted sound pressure level including corrections
m	meter (measurement of distance)
m^2	square meter
mamsl	meters above mean sea level
MENCO	M² Environmental Connections cc
NEMA	National Environmental Management Act, 1998 (Act 107 of 1998)
NCR	Noise Control Regulations (in terms of Section 25 of the ECA)
PWL	Sound Power Level
SANS	South African National Standards
SPL	Sound Pressure Level
UTM	Universal Transverse Mercator
WHO	World Health Organisation

GLOSSARY OF TERMS

1/3-Octave Band	A filter with a bandwidth of one-third of an octave representing four semitones, or notes on the musical scale. This relationship is applied to both the width of the band, and the centre frequency of the band. See also definition of octave band.
A – Weighting	An internationally standardised frequency weighting that approximates the frequency response of the human ear and gives an objective reading that therefore agrees with the subjective human response to that sound.
Air Absorption	The phenomena of attenuation of sound waves with distance propagated in air, due to dissipative interaction within the gas molecules.
Alternatives	A possible course of action, in place of another, that would meet the same purpose and need (of proposal). Alternatives can refer to any of the following, but are not limited hereto: alternative sites for development, alternative site layouts, alternative designs, alternative processes and materials. In Integrated Environmental Management the so-called "no go" alternative refers to the option of not allowing the development and may also require investigation in certain circumstances.
Ambient	The conditions surrounding an organism or area.
Ambient Noise	The all-encompassing sound at a point being composed of sounds from many sources both near and far. It includes the noise from the noise source under investigation.
Ambient Sound	The all-encompassing sound at a point being composite of sounds from near and far.
Ambient Sound Level	Means the reading on an integrating impulse sound level meter taken at a measuring point in the absence of any alleged disturbing noise at the end of a total period of at least 10 minutes after such a meter was put into operation. In this report the term Background Ambient Sound Level will be used.
Amplitude Modulated Sound	A sound that noticeably fluctuates in loudness over time.
Applicant	Any person who applies for an authorisation to undertake a listed activity or to cause such activity in terms of the relevant environmental legislation.
Assessment	The process of collecting, organising, analysing, interpreting and communicating data that is relevant to some decision.
Audible Frequency Range	Generally assumed to be the range from about 20 Hz to 20,000 Hz, the range of frequencies that our ears perceive as sound.
Background Ambient Sound Level	The level of the ambient sound indicated on a sound level meter in the absence of the sound under investigation (e.g. sound from a particular noise source or sound generated for test purposes). Ambient sound level as per Noise Control Regulations.
C-Weighting	This is an international standard filter, which can be applied to a pressure signal or to a *SPL* or *PWL* spectrum, and which is essentially a pass-band filter in the frequency range of approximately 63 to 4000 Hz. This filter provides a more constant, flatter, frequency response, providing significantly less adjustment than the A-scale filter for frequencies less than 1000 Hz.
dBA	Sound Pressure Level in decibel that has been A-weighted, or filtered, to match the response of the human ear.
Decibel dB	A logarithmic scale for sound corresponding to a multiple of 10 of the threshold of hearing. Decibels for sound levels in air are referenced to an atmospheric pressure of 20 μ Pa.
Diffraction	Modification of the progressive wave distribution due to the presence of obstacles in the field. Reflection and refraction are special cases of diffraction.
Direction of Propagation	The direction of flow of energy associated with a wave.
Disturbing noise	Means a noise level that exceeds the zone sound level or, if no zone sound level has been designated, a noise level that exceeds the ambient sound level at the same measuring point by 7 dBA or more.

Environment	The external circumstances, conditions and objects that affect the existence and development of an individual, organism or group; these circumstances include biophysical, social, economic, historical, cultural and political aspects.
Environmental Control Officer	Independent Officer employed by the applicant to ensure the implementation of the Environmental Management Programme (EMPr) and manages any further environmental issues that may arise.
Environmental impact	A change resulting from the effect of an activity on the environment, whether desirable or undesirable. Impacts may be the direct consequence of an organisation's activities or may be indirectly caused by them.
Environmental Impact Assessment	An Environmental Impact Assessment (EIA) refers to the process of identifying, predicting and assessing the potential positive and negative social, economic and biophysical impacts of any proposed project, plan, programme or policy that requires authorisation of permission by law and that may significantly affect the environment. The EIA includes an evaluation of alternatives, as well as recommendations for appropriate mitigation measures for minimising or avoiding negative impacts, measures for enhancing the positive aspects of the proposal, and environmental management and monitoring measures.
Environmental issue	A concern felt by one or more parties about some existing, potential or perceived environmental impact.
Equivalent continuous A-weighted sound exposure level ($L_{Aeq,T}$)	The value of the average A-weighted sound pressure level measured continuously within a reference time interval *T*, which have the same mean-square sound pressure as a sound under consideration for which the level varies with time.
Equivalent continuous A-weighted rating level ($L_{Req,T}$)	The Equivalent continuous A-weighted sound exposure level *($L_{Aeq,T}$)* to which various adjustments has been added. More commonly used as ($L_{Req,d}$) over a time interval 06:00 – 22:00 (T=16 hours) and ($L_{Req,n}$) over a time interval of 22:00 – 06:00 (T=8 hours).
Footprint area	Area to be used for the construction of the proposed development, which does not include the total study area.
Frequency	The rate of oscillation of a sound, measured in units of Hertz (Hz) or kiloHertz (kHz). One hundred Hz is a rate of one hundred times per second. The frequency of a sound is the property perceived as pitch: a low-frequency sound (such as a bass note) oscillates at a relatively slow rate, and a high-frequency sound (such as a treble note) oscillates at a relatively high rate.
Green field	A parcel of land not previously developed beyond that of agriculture or forestry use; virgin land. The opposite of Greenfield is Brownfield, which is a site previously developed and used by an enterprise, especially for a manufacturing or processing operation. The term Brownfield suggests that an investigation should be made to determine if environmental damage exists.
G-Weighting	An International Standard filter used to represent the infrasonic components of a sound spectrum.
Harmonics	Any of a series of musical tones for which the frequencies are integral multiples of the frequency of a fundamental tone.
Infrasound	Sound with a frequency content below the threshold of hearing, generally held to be about 20 Hz. Infrasonic sound with sufficiently large amplitude can be perceived, and is both heard and felt as vibration. Natural sources of infrasound are waves, thunder and wind.
Integrated Development Plan	A participatory planning process aimed at developing a strategic development plan to guide and inform all planning, budgeting, management and decision-making in a Local Authority, in terms of the requirements of Chapter 5 of the Municipal Systems Act, Act 32 of 2000.
Integrated Environmental Management	IEM provides an integrated approach for environmental assessment, management, and decision-making and to promote sustainable development and the equitable use of resources. Principles underlying IEM provide for a democratic, participatory, holistic, sustainable, equitable and accountable approach.
Interested and affected parties	Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors,

	work force, consumers, environmental interest groups and the general public.
Key issue	An issue raised during the Scoping process that has not received an adequate response and that requires further investigation before it can be resolved.
Listed activities	Development actions that is likely to result in significant environmental impacts as identified by the delegated authority (the Minister of Environmental and Water Affairs) in terms of Section 21 of the Environment Conservation Act.
Loudness	The attribute of an auditory sensation that describes the listener's ranking of sound in terms of its audibility.
Magnitude of impact	Magnitude of impact means the combination of the intensity, duration and extent of an impact occurring.
Masking	The raising of a listener's threshold of hearing for a given sound due to the presence of another sound.
Mitigation	To cause to become less harsh or hostile.
Negative impact	A change that reduces the quality of the environment (for example, by reducing species diversity and the reproductive capacity of the ecosystem, by damaging health, or by causing nuisance).
Noise	a. Sound that a listener does not wish to hear (unwanted sounds). b. Sound from sources other than the one emitting the sound it is desired to receive, measure or record. c. A class of sound of an erratic, intermittent or statistically random nature.
Noise Level	The term used in lieu of sound level when the sound concerned is being measured or ranked for its undesirability in the contextual circumstances.
Noise-sensitive development	Developments that could be influenced by noise such as: a) districts (see table 2 of SANS 10103:2008) 1. rural districts, 2. suburban districts with little road traffic, 3. urban districts, 4. urban districts with some workshops, with business premises, and with main roads, 5. central business districts, and 6. industrial districts; b) educational, residential, office and health care buildings and their surroundings; c) churches and their surroundings; d) auditoriums and concert halls and their surroundings; e) recreational areas; and f) nature reserves. In this report noise-sensitive developments is also referred to as a Potential Sensitive Receptor
Octave Band	A filter with a bandwidth of one octave, or twelve semi-tones on the musical scale representing a doubling of frequency.
Positive impact	A change that improves the quality of life of affected people or the quality of the environment.
Property	Any piece of land indicated on a diagram or general plan approved by the Surveyor-General intended for registration as a separate unit in terms of the Deeds Registries Act and includes an erf, a site and a farm portion as well as the buildings erected thereon
Public Participation Process	A process of involving the public in order to identify needs, address concerns, choose options, plan and monitor in terms of a proposed project, programme or development
PWL	?
Reverberant Sound	The sound in an enclosure excluding that is received directly from the source.
Reverberation	The persistence, after emission of a sound has stopped, of a sound field within an enclosure.
Significant Impact	An impact can be deemed significant if consultation with the relevant authorities and other interested and affected parties (IAPs), on the context and intensity of its effects, provides reasonable grounds for mitigating measures to be included in the environmental management report. The onus will be on the applicant to include the relevant authorities and other IAPs in the consultation

	process. Present and potential future, cumulative and synergistic effects should all be taken into account.
Sound Level	The level of the frequency weighted and time weighted sound pressure as determined by a sound level meter.
Sound Power	Of a source, the total sound energy radiated per unit time.
Sound Pressure Level (SPL)	Of a sound, 20 times the logarithm to the base 10 of the ratio of the RMS sound pressure level to the reference sound pressure level. International values for the reference sound pressure level are 20 microPascals in air and 100 milliPascals in water. SPL is reported as L_p in dB (not weighted) or in various other weightings.
Soundscape	Sound or a combination of sounds that forms or arises from an immersive environment. The study of soundscape is the subject of acoustic ecology. The idea of soundscape refers to both the natural acoustic environment, consisting of natural sounds, including animal vocalizations and, for instance, the sounds of weather and other natural elements; and environmental sounds created by humans, through musical composition, sound design, and other ordinary human activities including conversation, work, and sounds of mechanical origin resulting from use of industrial technology. The disruption of these acoustic environments results in noise pollution.
Study area	Refers to the entire study area encompassing all the alternative routes as indicated on the study area map.
Sustainable Development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts: the concept of "needs", in particular the essential needs of the world's poor, to which overriding priority should be given; and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and the future needs (Brundtland Commission, 1987 and National Environmental Management Act, 1998).
Zone of Potential Influence	The area defined as the radius about an object, or objects beyond which the noise impact will be insignificant.
Zone Sound Level	Means a derived dBA value determined indirectly by means of a series of measurements, calculations or table readings and designated by a local authority for an area. This is similar to the Rating Level as defined in SANS10103.

1 INTRODUCTION

1.1 INTRODUCTION AND PURPOSE

M^2 Environmental Connections cc (MENCO) was commissioned by AECOM SA (Pty) Ltd (hereinafter referred to as AECOM) to undertake a specialist study to determine the current baseline ambient sound and noise levels in and around the Port of Richards Bay, KwaZulu-Natal (KZN).

This report describes the current ambient sound and noise levels in the vicinity of the proposed project, highlighting the methodologies used as well as potential issues identified. This report does not cover blasting or vibrations.

1.2 BRIEF BASELINE DESCRIPTION

Transnet SOC Limited (Transnet) has proposed to extend their operations at the Port of Richards Bay in KZN. These may include the General Freight Bulk (GFB) Port Terminal, the Coal Swaziland Link and the Coal 500 Series expansions. **Figure 1-1** illustrates the proposed project footprints (**red** line) in relation to identified receptors (**green** dots) in the study area.

1.3 METHODOLOGY

1. Identification of noise sensitive developments using available information (GoogleEarth), supported by a site visit from the 17th to the 21st of January 2013 to confirm the status of any potential noise-sensitive developments.
2. The collection of Ambient Sound Measurements around the proposed project footprints in accordance to SANS 10103:2008:
   - 1.1 Ambient sound monitoring during the day and night at identified points. These ambient sound monitoring points will be relevant as to reference these with existing zoning levels, and will be measured in 10 minute bins in terms of $L_{Aeq,i}$, $L_{A(90)}$ and spectral analysis. Ambient sound levels have been measured for three locations;
   - 1.2 Road monitoring: during the day on any identified roads in accordance with SANS 10210; and
   - 1.3 Meteorological data monitoring.
3. Data and information accumulation for modelling and compilation of this report, and identification of the current ambient rating level. Current noise studies in or around the proposed project footprints have been taken into consideration, as well as any laws, if any, regarding noise in KZN (and the uMhlatuze Local Municipality).
4. The compilation of a stand-alone baseline report.

1.4 STUDY AREA

The study area is described in terms of environmental components that may contribute or change the sound character in the area. The study made use of a 1km section around the proposed project footprints. A site locality map is presented in **Figure 1-1**.

1.4.1 Location

The study area falls within the uMhlathuze Local Municipality.

1.4.2 Topography

The geographical topography is mainly plains but there are a significant number of man-made structures that is altering the landscape.

1.4.3 Roads and railway lines

The main public roads in the area are the R34 and R619 roads. Many secondary roads feature in the study area including the Ridge Town Road past **NSD01 – NSD03** (refer to **Figure 1-1** for green dots). Public main roads are illustrated as yellow lines in **Figure 1-1**. Railway lines do feature in the study area. One of the railway lines is inactive of which it is situated near the mentioned receptors **NSD01 – NSD03**.

1.4.4 Land use

The areas surrounding the Port of Richards Bay can be classified as residential, commercial and industrial. Besides the residential areas of Brackenham, Arboretum and "*Meer en See*" (illustrated as green areas in **Figure 1-1)** all other immediate areas around or on the footprint are classified as industrial/commercially zoned (telephonic discussions with uMhlathuze Local Municipality Town Planning).

1.4.5 Residential areas

The closest identified receptors to the site are illustrated in **Figure 1-1** as green dots or lines. The closest receptors to the expansion footprint are illustrated in **Figure 1-2**.

1.4.6 Ground conditions and vegetation

Many trees and low growing vegetation feature in the study area. Trees, however, do not act as a good acoustical barrier and at best only assist in masking noise during windy conditions. Ground conditions (when considering how well acoustic can reverberate off the ground on a flat plain) can be classed as medium, which implies that it is relatively good at absorbing acoustical energy.

1.4.7 Existing background ambient sound levels

On-site measurements and the existing soundscape are discussed in more detail in **Section 2**.

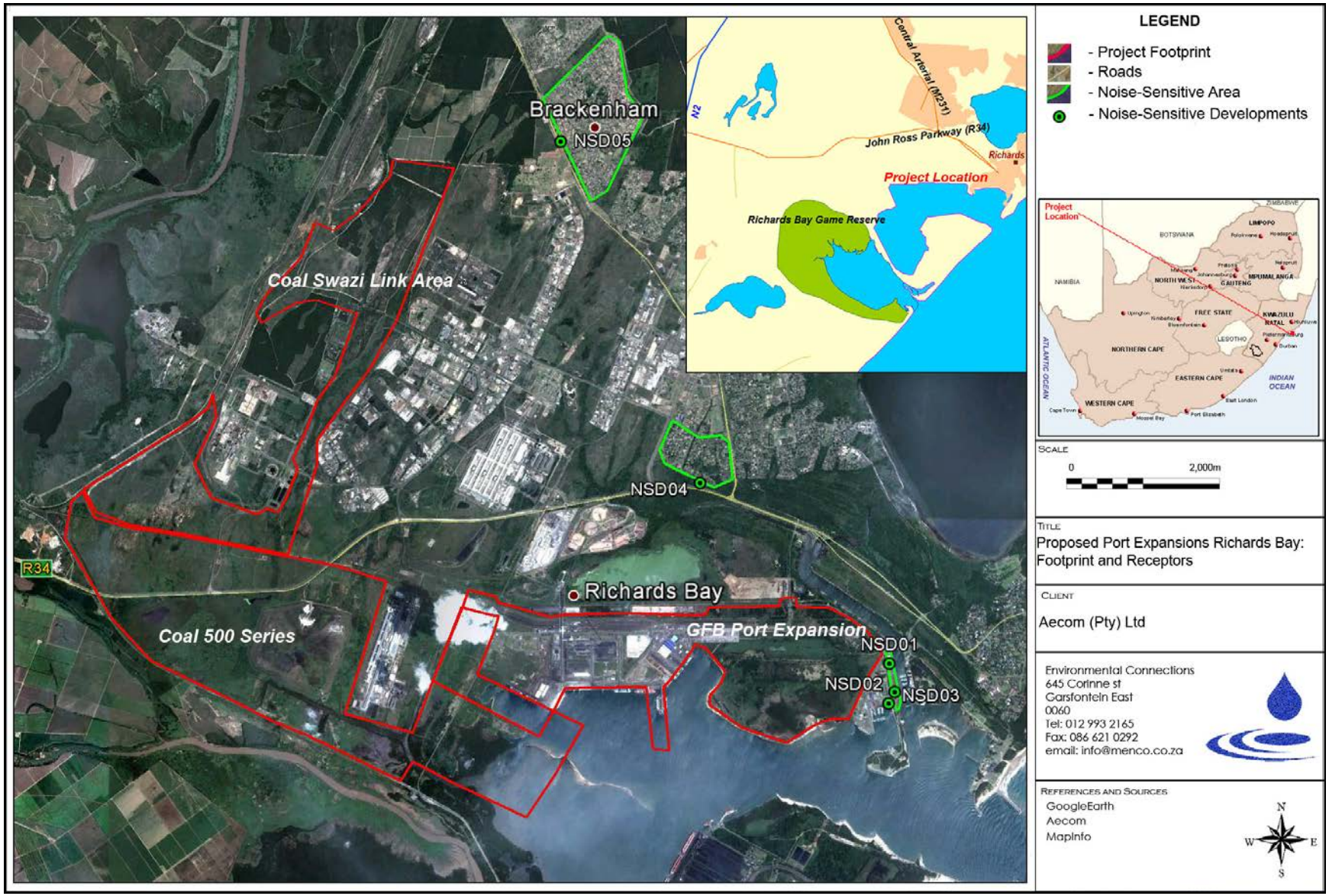

Figure 1-1: Site Map Indicating the Locality of the Proposed Project Footprints in Relation to Receptors in the Study Area

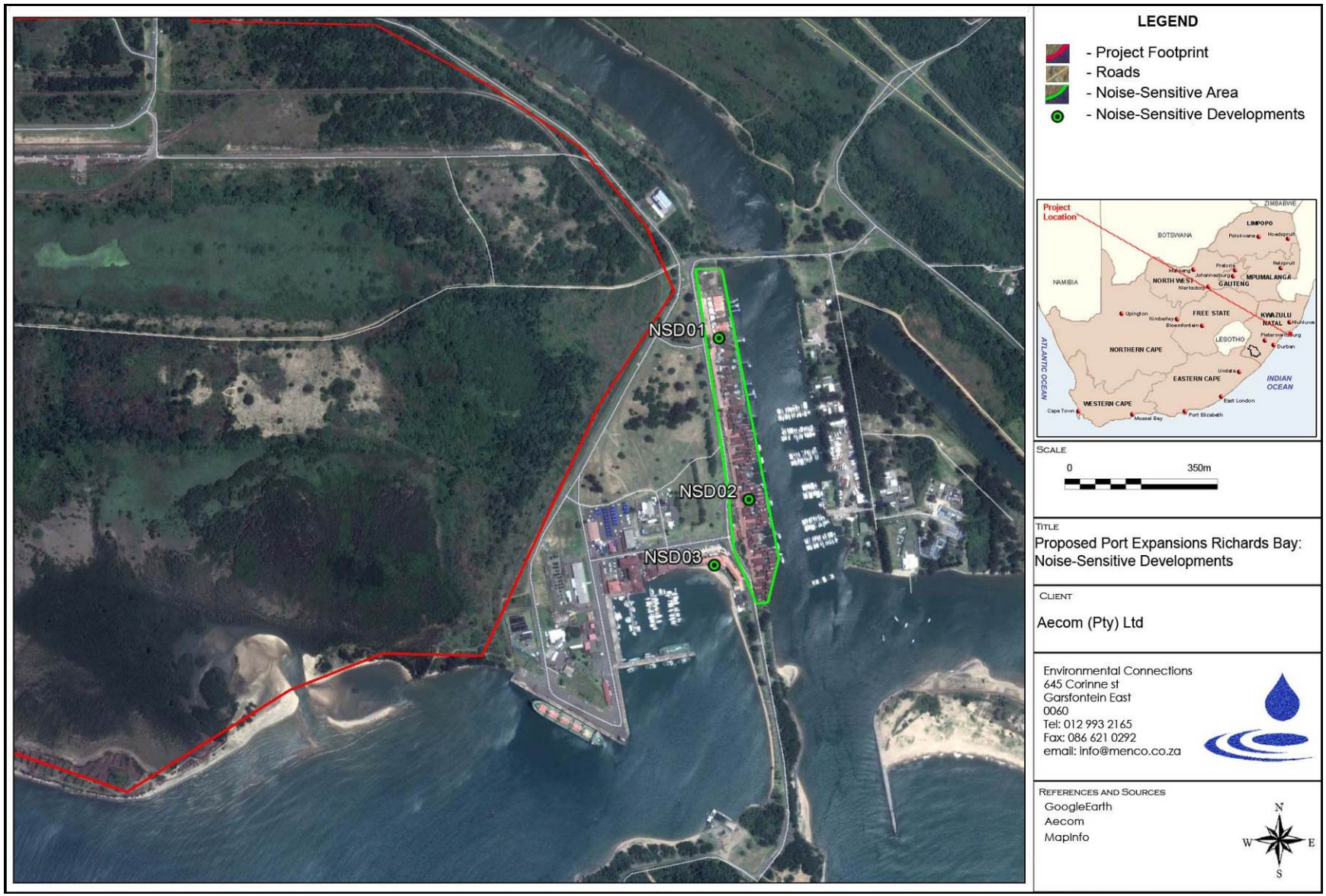

Figure 1-2: Location of Potential Noise-Sensitive Developments in Relation to the GFB Study Area Boundary

1.5 POTENTIAL SENSITIVE RECEPTORS (NOISE SENSITIVE DEVELOPMENTS)

Potentially Sensitive Receptors, defined as Noise-Sensitive Developments (NSDs – SANS 10103) were identified making use of site investigations from the 17th January – 21st January 2013.

Potential noise-sensitive developments are illustrated **Figure 1-1** as green dots, with localities defined in **Table 1-1**. During the site investigations it was confirmed that **NSD04 – NSD05** are too far away from the project footprint as illustrated in **Table 1-1** to be taken into consideration. This baseline report will then only concentrate on the three receptors within 1,000m of the footprint area namely **NSD01 – NSD03** (**Figure 1-2**).

Table 1-1: Locations of the identified noise-sensitive developments (Datum type: Latitude, Longitude)

Noise-Sensitive Development	Status of Structure	Location (Latitude)	Location (Longitude)	Est. Distance to Project Footprint Boundary (m)
NSD01	Waterways Estate (Meer en See Suburb)	28°47'19.09"S	32° 4'50.83"E	65
NSD02	Mzingazi Waterfront Village Estate (Meer en See Suburb)	28°47'31.14"S	32° 4'53.38"E	250
NSD03	Protea Waterfront Hotel	28°47'36.03"S	32° 4'50.44"E	300
NSD04	Arboretum Suburb	28°46'2.47"S	32° 3'19.38"E	1,470
NSD05	Brackenham Suburb	28°43'36.66"S	32° 2'11.80"E	1,650

The following should be noted:

- Receptor **NSD01** is the entire Waterways Residential Estate;
- **NSD02** is the entire Mzingazi Waterfront Village;
- Situated directly in front of **NSD02** (illustrated as **NSD03**) is the Protea Waterfront Hotel;
- Various commercial and/or business sites are featured in and around the three mentioned NSDs;
- **NSD04 – NSD05** (residential suburbs) are too far out of the study area to be considered as a potential noise-sensitive development in terms of the proposed footprint areas. Please refer to **Table 1-1** indicating distance between project footprint and receptors; and
- The entire GFB Port Expansion area adjacent to the east of **NSD01 – NSD03** is zoned industrial (specifically Alton suburb). This was confirmed during site investigations, discussions with Transnet Legal, Risk, Quality and Sustainability Department, telephonic discussions with the uMhlathuze Local Municipality Town

Planning Department as well as various companies in the area. An employee at Mondi, a company based in the study area, did mention that there may be some residents staying in the industrial zone. Rating levels for industrial areas are considered as 70 and 60 dBA during the day and night respectively. Photos taken of the industrial areas during site investigations are presented in **Appendix A**.

2 WHY NOISE CONCERNS COMMUNITIES

Noise can be defined as "unwanted sound", an audible acoustic energy that adversely affects the physiological and/or psychological well-being of people or which disturbs or impairs the convenience or peace of any person. One can generalise by saying that sound becomes unwanted when it:

- Hinders speech communication;
- Impedes the thinking process;
- Interferes with concentration;
- Obstructs activities (work, leisure and sleeping); and inconvenience
- Presents a health risk due to hearing damage.

However, it is important to remember that whether a given sound is "noise" depends on the listener (or sound receptor) . The driver playing loud rock music on his/her car radio hears only music, but the person in the traffic behind him/her hears nothing but noise.

Response to noise is unfortunately not an empirical absolute, as it is seen as a multi-faceted psychological concept, including behavioural and evaluative aspects. For instance, in some cases annoyance is seen as an outcome of disturbances, in other cases it is seen as an indication of the degree of helplessness with respect to the noise source.

Noise does not need to be loud to be considered “disturbing”. One can refer to a dripping tap in the quiet of the night, or the irritating “thump-thump” of the music from a neighbouring house at night when one would like to sleep.

Severity of the annoyance depends on factors such as:

- Background sound levels, and the background sound levels the receptor is used to.
- The manner in which the receptor can control the noise (helplessness).
- The time, unpredictability, frequency, distribution, duration, and intensity of the noise.
- The physiological state of the receptor.
- The attitude of the receptor about the emitter (noise source).

2.1 ANNOYANCE ASSOCIATED WITH INDUSTRIAL ACTIVITIES

Annoyance is the most widely acknowledged effect of environmental noise exposure, and is considered to be the most widespread. It is estimated that less than a third of the

individual noise annoyance is accounted for by acoustic parameters, and that non-acoustic factors play a major role. Non-acoustic factors that have been identified include age, economic dependence on the noise source, attitude towards the noise source, and self-reported noise sensitivity.

On the basis of a number of studies into noise annoyance, exposure-response relationships were derived for high annoyance from different noise sources. These relationships, illustrated in **Figure 2-1**, are recommended in a European Union position paper published in 2002, stipulating policy regarding the quantification of annoyance.

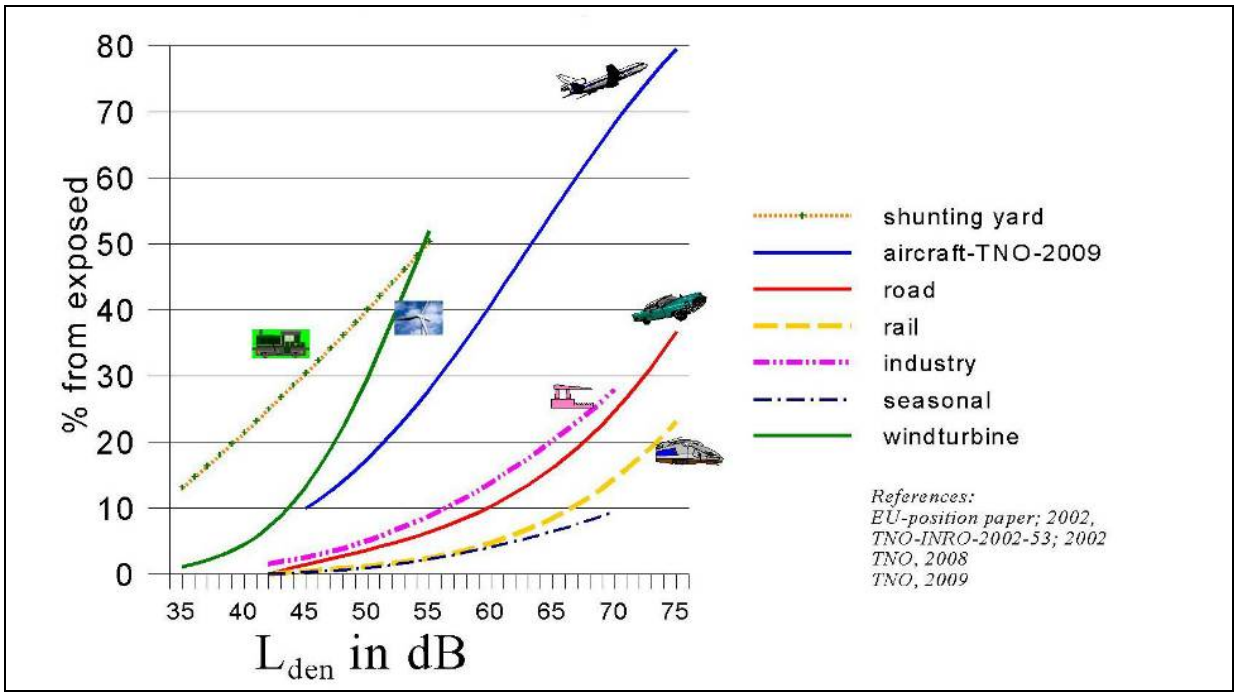

Figure 2-1: Percentage of Annoyed Persons as a Function of the Day-Evening-Night Noise Exposure at the Façade of a Dwelling

This can be used in an Environmental Health Impact Assessment and cost-benefit analysis to translate noise maps into overviews of the numbers of persons that may be annoyed, thereby giving insight into the situation expected in the long term. It is not applicable to local complaint-type situations or to an assessment of the short-term effects of a change in the noise climate.

2.2 NOISE CRITERIA OF CONCERN

There are number of criteria that are of concern for the assessment of noise impacts. These can be summarised in the following manner:

- *Increase in Noise Levels:* People or communities often react to an increase in the ambient noise level they are used to, which is caused by a new source of noise. With

regards to the Noise Control Regulations (promulgated in terms of the ECA), an increase of more than 7 dBA is considered a disturbing noise. This is also the criteria used to define the probability of an impact occurring on potentially sensitive receptors (refer to **Figure 2-2)**.

- *Zone Sound Levels:* Also referred to as the acceptable rating levels, it sets acceptable noise levels for various areas (see **Table 2-1)**.
- *Absolute or Total Noise Levels:* Depending on their activities, people generally are tolerant to noise up to a certain absolute level, e.g. 65 dBA. Anything above this level will be considered unacceptable.

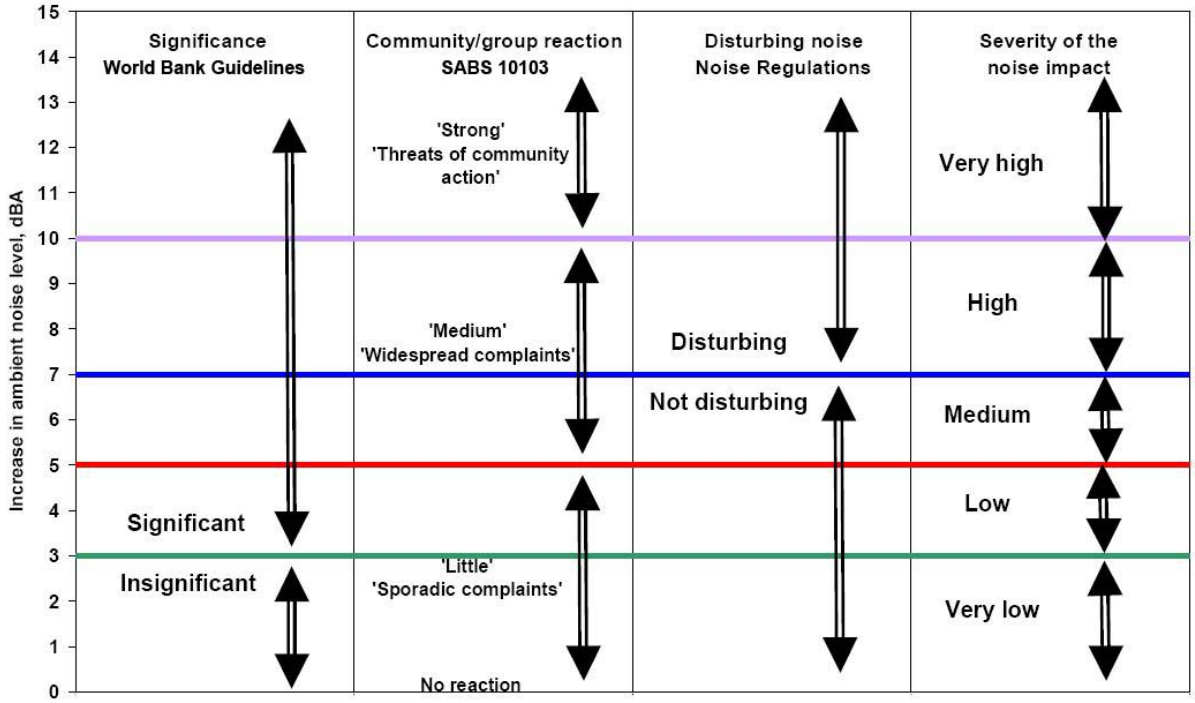

Figure 2-2: Criteria to assess the significance of impacts stemming from noise

In South Africa, the standard that determines the issues concerning environmental noise is SANS 10103 (see **Table 2-1**). It provides the maximum average background ambient sound levels, $L_{Req,d}$ and $L_{Req,n}$, during the day and night respectively to which different types of developments may be exposed.

SANS 10103 also provides a guideline for estimating community response to an increase in the general ambient noise level caused by an intruding noise. If **Δ** is the increase in noise level, the following criteria are of relevance:

- **Δ ≤ 3 dBA:** An increase of 3 dBA or less will not cause any response from a community. It should be noted that for a person with average hearing acuity, an increase of less than 3 dBA in the general ambient noise level would not be noticeable.

- **3 < Δ ≤ 5 dBA:** An increase of between 3 dBA and 5 dBA will elicit 'little' community response with 'sporadic complaints'. People will just be able to notice a change in the sound character in the area.
- **5 < Δ ≤ 15 dBA:** An increase of between 5 dBA and 15 dBA will elicit a 'medium' community response with 'widespread complaints'. In addition, an increase of 10 dBA is subjectively perceived as a doubling in the loudness of a noise. For an increase of more than 15 dBA the community reaction will be 'strong' with 'threats of community action'.

Table 2-1: Acceptable Zone Sound Levels for Noise in Districts (SANS 10103)

1	2	3	4	5	6	7
Type of district	**Equivalent continuous rating level ($L_{Req.T}$) for noise,** dBA					
	Outdoors			**Indoors, with open windows**		
	Day-night $L_{R,dn}$[a]	**Day-time $L_{Req,d}$[b]**	**Night-time $L_{Req,n}$[b]**	**Day-night $L_{R,dn}$[a]**	**Day-time $L_{Req,d}$[b]**	**Night-time $L_{Req,n}$[b]**
RESIDENTIAL DISTRICTS						
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
NON RESIDENTIAL DISTRICTS						
d) Urban districts with some workshops, with business premises, and with 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

3 CURRENT ENVIRONMENTAL SOUND CHARACTER

3.1 MEASUREMENT PROCEDURE

Ambient (background) noise levels were measured from the 17th January until the 21st January 2013 in accordance with the South African National Standard SANS 10103:2008 - "***The measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication***". The standard specifies the acceptable techniques for sound measurements including:

- type of equipment;
- minimum duration of measurement;
- microphone positions;
- calibration procedures and instrument checks; and
- weather conditions.

3.2 EXISTING MEASURED AMBIENT SOUNDSCAPE

The location of the ambient sound measurement locations are illustrated in **Figure 3-1**. Measurement points have been indicated in this map as RP01 (Receptor **NSD01**) and RP02 (receptors **NSD02**). No measurements were conducted at **NSD04** – **NSD05** as these receptors were confirmed to be too far out of the study area (i.e. over 1,000m in distance from the study area footprint boundaries).

3.2.1 Measurement point RP01: Waterways Residential Estate

The measurement location was selected to be reflective of the typical ambient sound levels that the Waterways Residential Estate receptors may experience. Equipment used to gather data is presented in **Table 3-1**. This measurement location was also chosen as it was a safe area for the equipment to be left overnight. Measured data is presented in **Figure 3-2** while **Figure 3-3** illustrates the spectral distribution. Measurement intervals were at 10 minutes each, while each coloured line in **Figure 3-3** represents the spectral distribution of each ten minute bin.

At certain times the study area experienced rainfall (particularly Saturday 19th January 2013). There was a water feature near the measurement location since no other suitable location could be sourced to place the sound level meter. The property boundary wall (barrier) acted as a buffer of noise from the Ridge Town Road in front of the dwellings. Many buildings on this estate had a direct view to this road. Some trees and buildings were present near the sound level meter. Certain measurements would reflect road traffic noise of residents traversing the area within the estate.

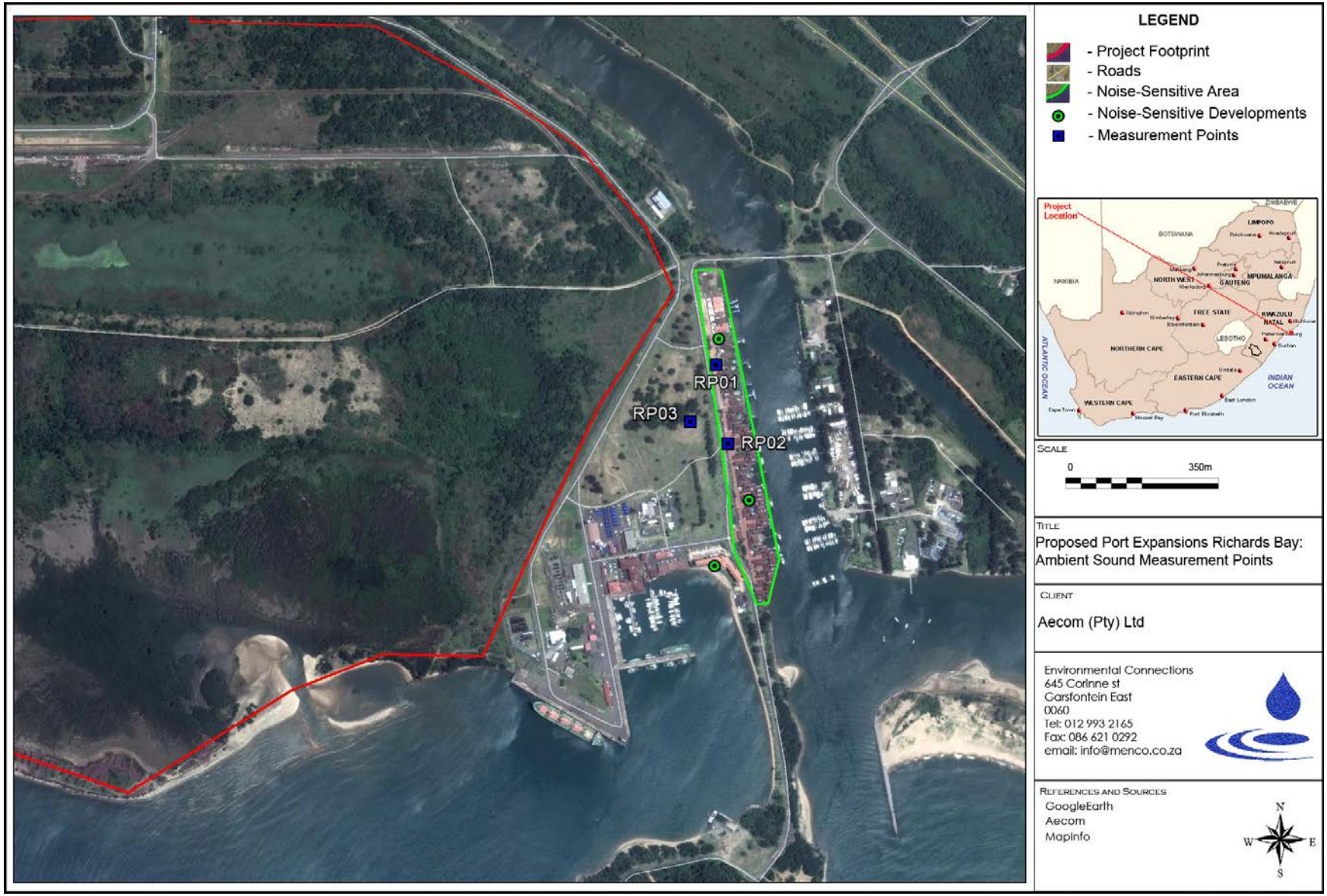

Figure 3-1:Localities of ambient sound measurement points

Table 3-1: Equipment used to gather data

Equipment	Model	Serial No	Calibration Date
SLM	Svan 955	27637	25July 2012
Microphone*	ACO 7052E	49596	25July 2012
Calibrator	Rion NC-74	34494286	24 February 2012
Weather Station	WH3081PC	-	-

*Microphone fitted with the appropriate windshield.

Measured 10 minute L_{Aleq} day/night-time data: During the day-time L_{Aleq} values ranged from 50.7 to 71.9 dBA. The night-time L_{Aleq} values (23:00 – 05:00 timeframe selected) ranged from 50.2 to 65.9 dBA. Measured data reflected noise contributions from dwelling activities and the nearby water feature did contribute to measurements (anticipated at 2 - 3 dBA). Night-time data did indicate a slightly noisy area regardless of the water feature contribution and/or weather conditions. This would include road traffic inside and outside the Estate on Ridge Town Road.

Measured 10 minute L_{A90} day/night-time data: L_{A90} day-time values ranged from 46.0 to 61.6 dBA. The night-time L_{A90} values ranged from 46.8 to 63.1 dBA (night-time reference period 23:00 – 05:00). Measured L_{A90} data indicated that there are consistent background ambient sounds in the study area during all hours at this receptor. Some of these consistent sounds would be attributed to the water feature near the microphone and meteorological conditions.

L_{Aleq} - L_{A90} average difference, day/night-time: The average day-time difference between the L_{Aleq} and L_{A90} variables was 5.0 dBA, while the night-time's was 4.3 dBA.

Third octave spectral analysis:

- Lower frequency (20 – 250 Hz) – Some measurements reflected energy signatures in this range. Noise sources of significance (such as road traffic near the microphone) most probably contribute towards these levels. Lower frequencies can travel further through the atmosphere as well as over certain barriers such as the boundary wall.
- Third octave surrounding the 1000 Hz – This range contains energy mostly associated with human speech (350 Hz – 3500 Hz but mostly below 1,000 Hz) and dwelling noises. A fair amount of energy was measured at this range. Measurements would reflect daily activities from nearby receptors as well as communication near the sound level meter.

- Higher frequency (2000 Hz upwards) – Smaller faunal species such as birds, crickets and cicada would use this range to communicate and hunt, etc. Certain spikes were seen at 8000 Hz and would be contributed to faunal species such as bird song or cicada communications (possibly even bats). [1][2][3]

Spectral data analysis concludes that the area is urban with many anthropogenic and faunal activities occurring in and around this residential area.

L_{Amax} night-time occurrences: Many instantaneous noise events occurred in the area during night-time measurement hours. These could be attributed to noises close to the sound level meter such as wind gusts, road traffic within the estate or on the Ridge Town Road. Noise events may affect sleeping patterns in humans.[4]

C-weighted (L_{Aleq}) vs. A-weighted (L_{Aleq}): No lower frequency issues were measured during measurement dates (C-weighted measurements are not featured in this report).

Sounds heard during measurements dates: Activities at the nearby dock or the existing Richards Bay port were only slightly audible at times (rare occurrences). Faunal noise was audible in the area as well wind induced noises (gusty wind conditions). The fountain near the measurement point was also audible but not loud. The dominating noise sources were the dwelling activities at the estate as well as the traffic on Ridge Town Road.

SANS 10103 Rating Level: The area can be classified as **Urban** when considering the Rating level. Even though measurements did indicate a possible higher rating, dwelling noises, water feature noises and meteorological conditions (unwanted noises) have to be considered.

[1] Colin O' Donnell and Jane Sedgeley, 1994. *An Automatic Monitoring System for Recording Ba Activity*. Series No. 5.

[2] J.C Hartley, 1991. *A Paradoxical Problem in Insect Communication. Can bush crickets discriminate frequency?*

[3] H.C Bennet-Clark, 2002. *The Scaling of song Frequency in Cicadas.*

[4] World Health Organization, 2009. *Night Noise Guidelines for Europe.*

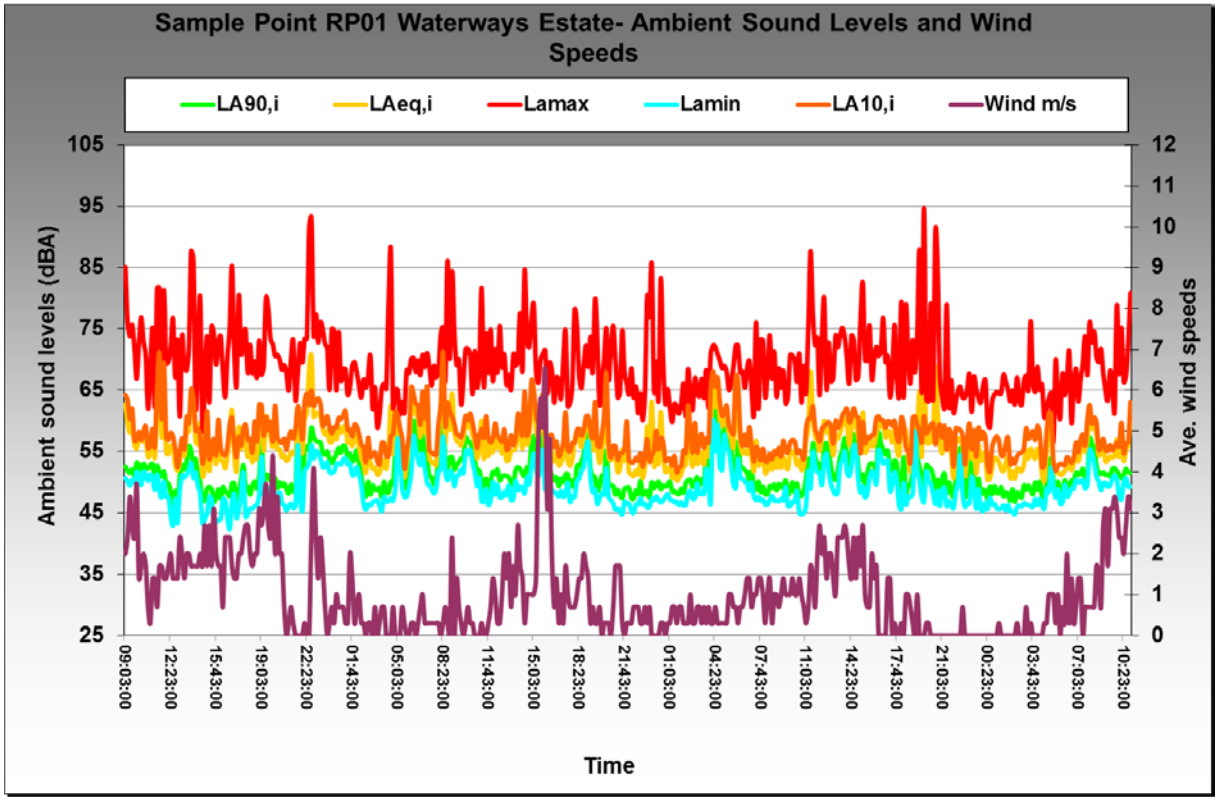

Figure 3-2: Ambient Sound Levels at RP01

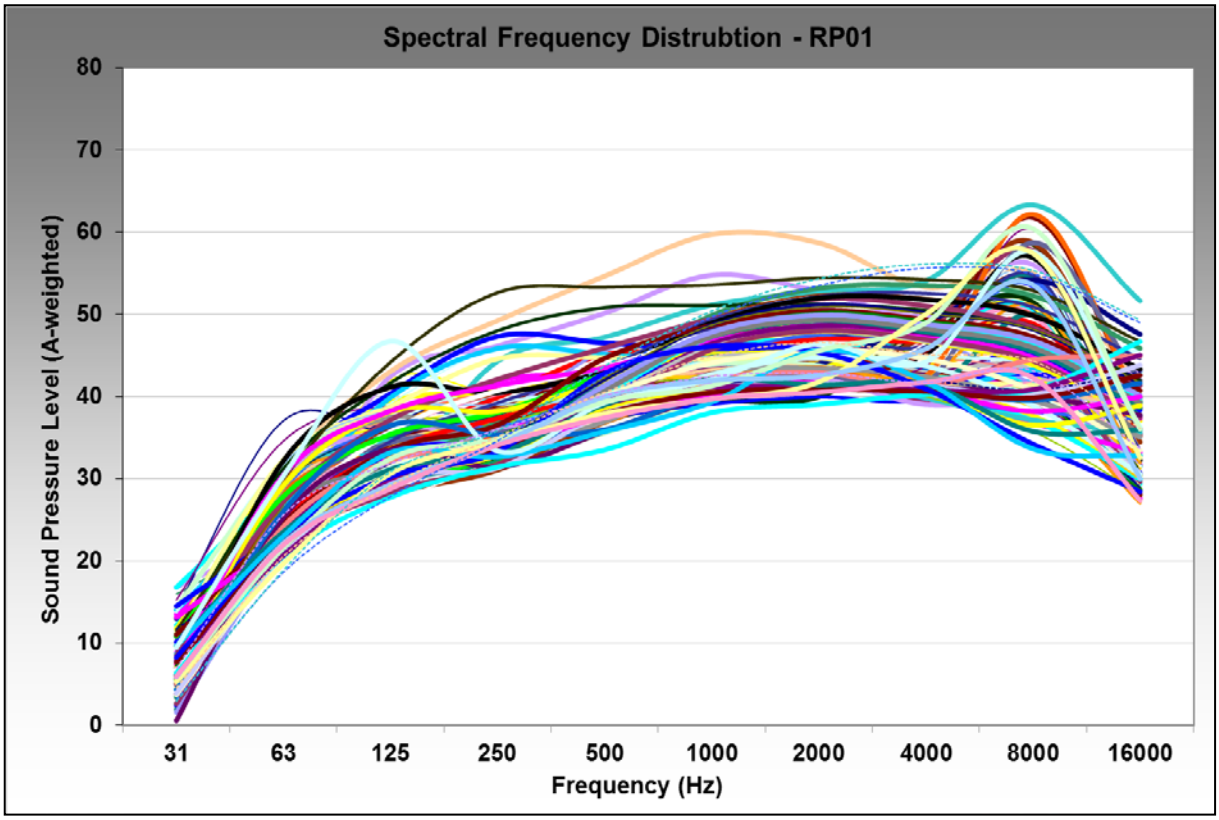

Figure 3-3: Spectral Frequency Distribution as Measured On-Site at RP01

3.2.2 Measurement point RP02: Mzingazi Waterfront Village

The measurement location was selected to be reflective of the typical ambient sound levels that the Mzingazi Waterfront Village receptors may experience. Equipment used to gather data is presented in **Table 3-2**. This location was also chosen as it was a safe area for the equipment to be left overnight. Measured data is presented in **Figure 3-4** while **Figure 3-5** illustrates the spectral distribution (A-weighted).

At certain times, the study area experienced rainfall particularly on Saturday 19th January 2013 (data excluded). The property boundary wall (approximately 2m in height) with palisading on top (barrier) acted as a buffer of noise from the Ridge Town Road in front of the dwellings. Many buildings in this Village had a direct view to this road. Some trees and buildings were present near the sound level meter. Certain measurements would reflect road traffic noise of residents traversing the area. The sound level meter switched itself off (early hours of one morning) which could be a result of a faulty/flat battery or moisture. It was switched on again shortly afterwards.

Table 3-2: Equipment used to gather data

Equipment	Model	Serial No	Calibration Date
SLM	Rion NA-28	00901489	1 June 2012
Microphone*	Rion UC-59	02087	1 June 2012
Calibrator	Rion NC-74	34494286	24 February 2012
Weather Station	WH3081PC	-	-

*Microphone fitted with the appropriate windshield.

Measured 10 minute L_{Aleq} day/night-time data: During the day-time L_{Aleq} values ranged from 45.0 to 71.9 dBA. The night-time L_{Aleq} values (23:00 – 05:00) ranged from 43.2 to 67.6 dBA. Measured data reflected noise contributions from dwelling activities including road traffic inside the Village. The Ridge Town Road traffic movement would also contribute to these measurement levels.

Measured 10 minute L_{A90} day/night-time data: L_{A90} day-time values ranged from 42.6 to 58.6 dBA. The night-time L_{A90} values ranged from 41.4 to 60.7 dBA (23:00 – 05:00 timeframe selected). Measured L_{A90} data indicated that there are consistent background ambient sounds in the study area during all hours at this receptor.

L_{Aleq} - L_{A90} average difference, day/night-time: The average day-time difference between the L_{Aleq} and L_{A90} variables was 8.1 dBA, while the night-time's was 5.4 dBA. This indicates slightly more impulsive noise events during the day when compared to the quieter night-time hours.

L_{Amax} night-time occurrences: Many instantaneous noise events occurred in the area during night-time measurement hours. These could be attributed to noises close to the sound level meter such as wind gusts, road traffic within the Village or on the Ridge Town Road. Noise events may affect sleeping patterns in humans. [5]

C-weighted (L_{Aleq}) vs. A-weighted (L_{Aleq}): No lower frequency issues were measured during measurement dates (C-weighted measurements are not featured in this report).

Sounds heard during measurements dates: Activities at the nearby Waterfront or the existing activities within the Port of Richards Bay were very slightly audible at times (rare occurrences). Faunal noise was audible in the area as well gusty wind conditions. The dominating noise sources were the dwelling activities at the Village as well as the traffic on Ridge Town Road.

SANS 10103 Rating Level: The area can be rated as **Urban**. Even though measurements did indicate a possible higher rating dwelling noise and meteorological conditions have to be considered.

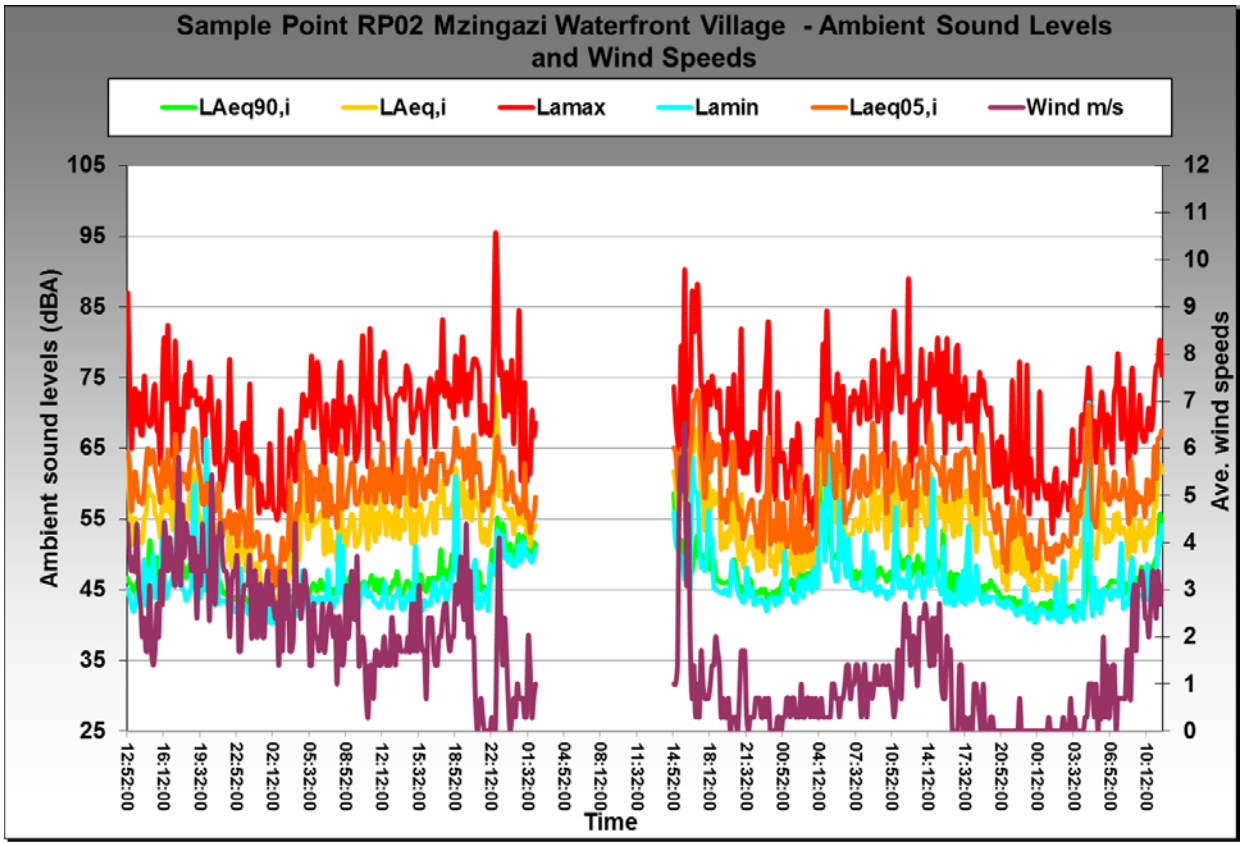

Figure 3-4: Ambient Sound Levels at RP02

[5] World Health Organization, 2009. *Night Noise Guidelines for Europe.*

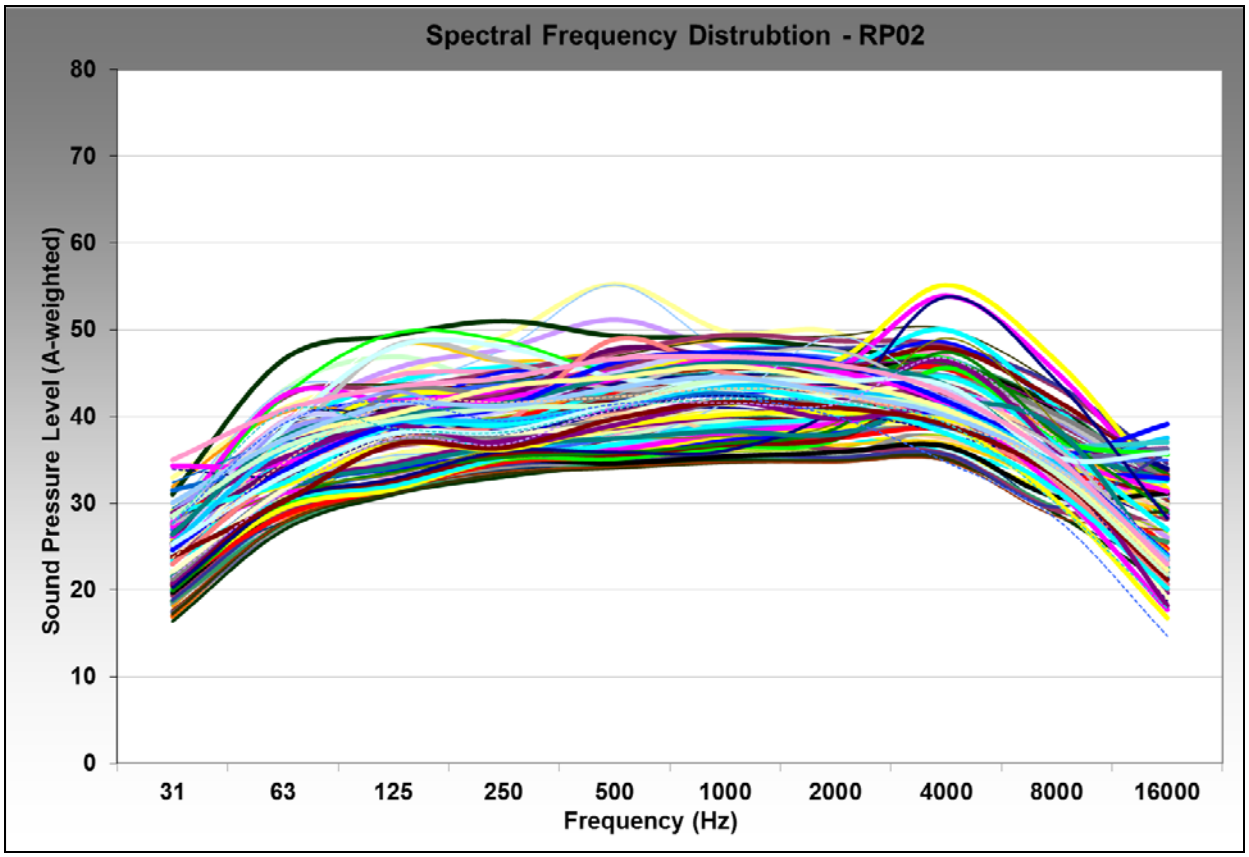

Figure 3-5: Spectral Frequency Distribution as Measured On-Site at RP02

3.2.3 Measurement point RP03: Ridge Town Road

Four sound level measurements were obtained in this area to determine road traffic noise and conditions from the Ridge Town Road. Traffic volumes were also counted during the period that measurements were collected (approximately 30 minutes in total). Results of road traffic sound measurements are presented in **Table 3-3**.

Measurements were taken of the road traffic noise as it is the only and/or main noise source of significance in the study area.

Table 3-3: Results of singular ten minute bin sound level measurements (Datum type: Latitude, Longitude)

Point Name	Latitude, Longitude	Time	L_{Aleq} (dBA)	L_{A90} (dBA)	L_{A10} (dBA)	$L_{A, max}$ (dBA)	$L_{A, min}$ (dBA)	Ave. Wind (m/s)
RP03	28°47'25.27"S 32° 4'48.39"E	10:19	60.4	55.1	61.9	73.9	53.4	3.4
		10:29	57.3	54.1	59.2	68.5	52.1	2.7
		10:39	61.3	55.6	61.7	75.5	54	2.4

Note: SLM fitted at all times with appropriate windshield

3.3 EXISTING AMBIENT CALCULATED SOUNDSCAPE

There is only one identifiable noise source of significance in the study area (only when considering **NSD01** - **NSD03**). This noise source is the Ridge Town Road that is situated adjacent to these receptors. During the day-time this road would be the main contributor of noise apart from dwelling noises, faunal and meteorological (all numerous and significant, but undefinable noise sources).

During the night-time, the Ridge Town Road would have little or no traffic to calculate in terms of acoustics. Also night-time acoustical calculations for any proposed developments must consider the fact that the most critical time of investigations is during a time of rest (i.e. night-time).

Day-time ambient noise levels were calculated using the following assumptions:

- The Ridge Town Road (adjacent to receptors **NSD01 – NSD03**) operates with 144 vehicles per hour travelling at average speeds of 40 km/h, no heavy vehicles were considered. Road conditions, as viewed during site investigations, were tarred with a non-porous surface. Noise levels were calculated in terms of SANS 10210 – "Calculating and predicting road traffic noise". Calculated levels were compared to measured on-site data as illustrated in **Table 3-3**.
- A basic estimation of the existing dwelling noise levels making use of a 30 dBA equivalent ambient soundscape.
- Receptors are regarded as 1.5 meters in height in relation to the surrounding environment.
- Sound propagation was regarded in a free field, no barriers were considered (due to direct line of sight from double storey buildings at **NSD01** - **NSD03**).
- Distance from the receiver to the noise source was considered.
- Intervening ground conditions (when considering how well acoustic can reverberate off the ground on a flat plain) of a medium ground nature (acoustically relatively absorbent).
- Façade correction not taken into account.
- Activities functioning during wind-still conditions, in good sound propagation conditions (20^{o}C and 80% humidity).
- Other potentially significant ambient noise (animals, insects, music, voices, water, wind) were not considered.

Projected Noise Levels in the area were calculated using the methodology stipulated in SANS 10210:2004. Ambient noise levels in the area adjacent to the GFB project footprint are illustrated in **Figure 3-6** of 35 dBA and upward contours. Receptors are illustrated as **green** dots or areas. The proposed footprint area is illustrated as a **red** line.

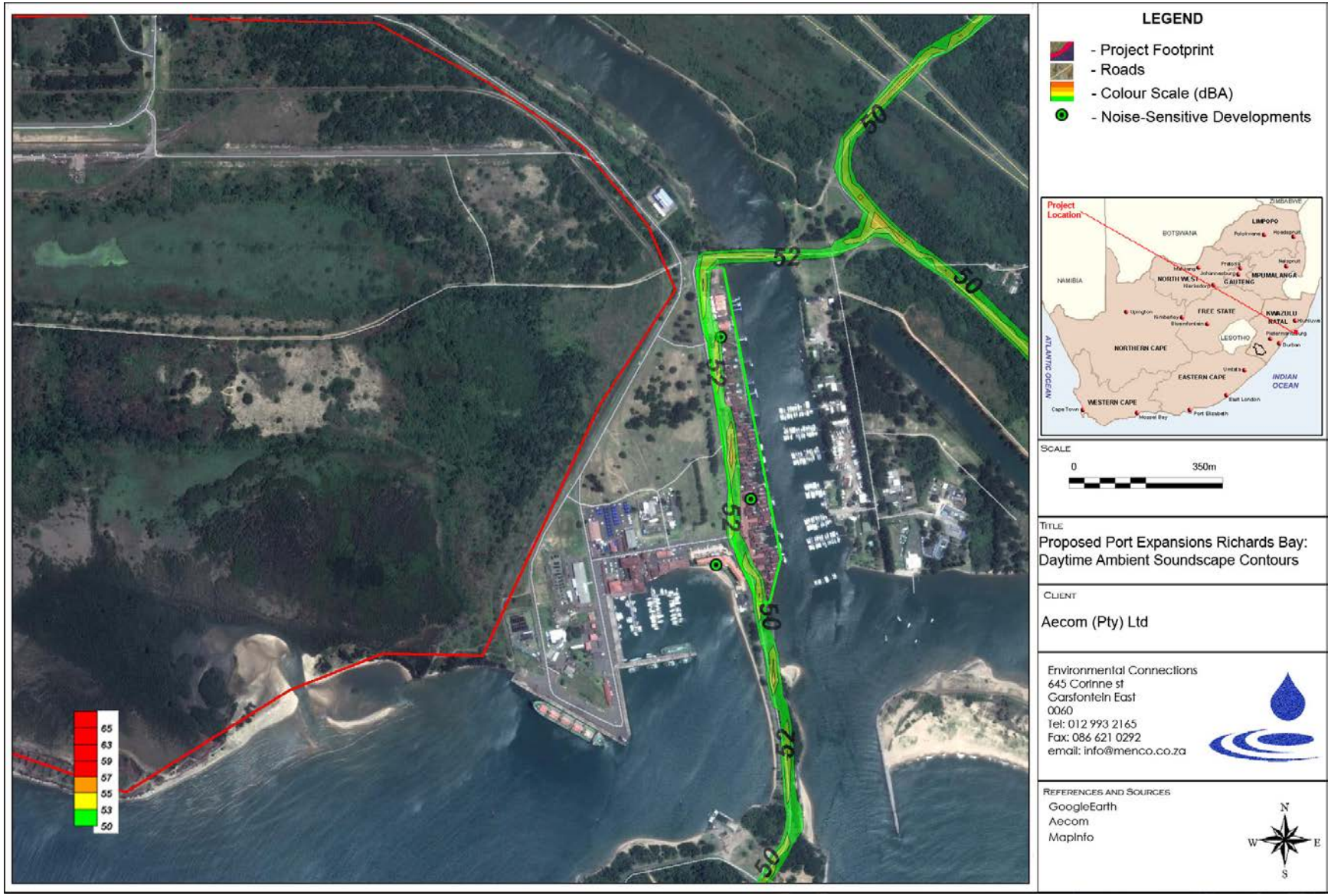

Figure 3-6: Day-time Ambient Sounsdcape Contours

4 FINDINGS AND CONCLUSIONS

Site investigations took place between the 17th and the 21st of January 2013. The only receptors that fall within the study area (1,000m from the project footprint boundary) are receptors **NSD01** to **NSD03**. The immediate area in and around the project footprint is zoned for industrial and commercial land use and not for residential development.

All buildings within the industrial zone must consider the high SANS 10103:2008 guideline Industrial Rating level (70 dBA day and 60 dBA night-times) and no further acoustical investigations are recommended in this industrial area. This includes the Coal 500 Series and Coal Swaziland Link areas, but not the GFB area. This is due to the proximity of receptors **NSD01 – NSD03** to the proposed GFB project footprint (**Figure 1-1**)

There are no significant noise contributors at receptors **NSD01** to **NSD03** except for the tarred non-porous Ridge Town Road**.** This tarred road did contribute an identifiable and measurable amount of noise in terms of road traffic volumes, but volumes are not comparable to those in an urban setting. During the night-times the insignificant traffic volumes (in terms of acoustical reporting) on the Ridge Town Road were not considered or calculated. This does not mean that the road will not have the odd vehicle during these hours.

The existing commercial area and small boats port in close proximity to these receptors will be audible at times. This is specifically relevant to times when the Waterfront is used for commercial activities or when the restaurants in the area play loud music during night-times. These noise sources were not calculated or considered as part of the ambient soundscape. At over 1,500m the existing Richards Bay and Transnet facilities cannot be considered as a noise source of significance at receptors **NSD01** to **NSD03**.

Measurements conducted indicated noise levels due to faunal, metrological (during rainy conditions) and anthropogenic noises emanating from daily activities associated at the dwellings. The Ridge Town Road would contribute a fair amount of measurable data to the soundscape during daytimes. Taking into account the measured ambient sound levels and detected noises it has been selected to classify the residential as "**Urban districts"**.

The commercial and industrial areas would be rated as Non-residential with higher allowable noise levels as defined by SANS 10103:2008 (**Table 2-1**).

5 AUTHOR

The author of this report, M. de Jager (B. Eng (Chem), UP) graduated in 1998 from the University of Pretoria. He has been interested in acoustics as from school days, doing projects mainly related to loudspeaker enclosure design. Interest in the matter brought him into the field of Environmental Noise Measurement, Prediction and Control. As from 2007 he has been involved in the following projects:

- Full Noise Impact Studies for a number of Wind Energy Facilities, including: Cookhouse I and II, Amakhala Emoyeni, Dassiesfontein/Klipheuwel, Rheboksfontein, AB, Dorper, Suurplaat, Gouda, Riverbank, Oyster Bay, Walker Bay, De Aar, Loeriesfontein, Noupoort, Prieska, Deep River, West Coast, Happy Valley, Canyon Springs, Tsitsikamma WEF, West Coast One, Karoo and Project Blue.
- Full Noise Impact Studies for a number of mining projects, including: Skychrome (Pty) Ltd (A Ferro-chrome mine), Mooinooi Chrome Mine (WCM), Buffelsfontein East and West (WCM), Elandsdrift (Sylvania), Jagdlust Chrome Mine (ECM), Der Brochen, Apollo Brick (Pty) Ltd (Clay mine and brick manufacturer), Arthur Taylor Expansion project (X-Strata Coal SA), Klipfontein Colliery (Coal mine), Imbabala Coal, AurexGold, Sephaku Limestone Mine, Sekoko Railway Siding, Verkeerdepan Expansion, Schoongezicht Coal, WPB Colliery, Landau Expansion project (Coal mine).
- A number of smaller Noise Impact Assessments, Noise Monitoring Projects, Scoping Reports as well as Screening Investigations.

MENCO are independent consultants to the project and the Client. The company declares that it:

- Does not and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations;
- Has no, and will not engage in conflicting interests in the undertaking of the activity;
- Undertakes to disclose all material information collected, calculated and/or findings, whether favourable to the developer or not; and
- Ensures that all information containing all relevant facts have been included in this report.

6 REFERENCES

In this report reference was made to the following documentation:

1. Norton, M.P. and Karczub, D.G., 2003. *Fundamentals of Noise and Vibration Analysis for Engineers*. 2nd ed.
2. Standards South Africa, 2008. *SANS 10103:2008 The measurement and rating of environmental noise with respect to annoyance and to speech communication*. 6th ed.
3. Standards South Africa, 2004. *SANS 10210:2004 Calculating and predicting road traffic noise*. 2.2 ed.
4. Standards South Africa, 2004. *SANS 10357:2004 The calculation of sound propagation by the Concave method*. 1.2 ed.
5. USEPA, 1971. *Effects of Noise on Wildlife and other animals.* 1971
6. World Health Organization, 2009. *Night Noise Guidelines for Europe.*
7. World Health Organization, 1999. *Protection of the Human Environment; Guidelines for Community Noise.*
8. Titze, I.R.). *Principles of Voice Production, Prentice Hall*.1994
9. F. Alton Everest & Ken C. Pohlmann 2009. *Master Handbook of Acoustics*. 5th ed.
10. J.C Hartley, 1991. *A Paradoxical Problem in Insect Communication. Can bush crickets discriminate frequency?*
11. Colin O' Donnell and Jane Sedgeley, 1994. *An Automatic Monitoring System for Recording Ba Activity*. Series No. 5.
12. H.C Bennet-Clark, 2002. *The Scaling of song Frequency in Cicadas.*

APPENDIX A

Photos taken during Site Investigations

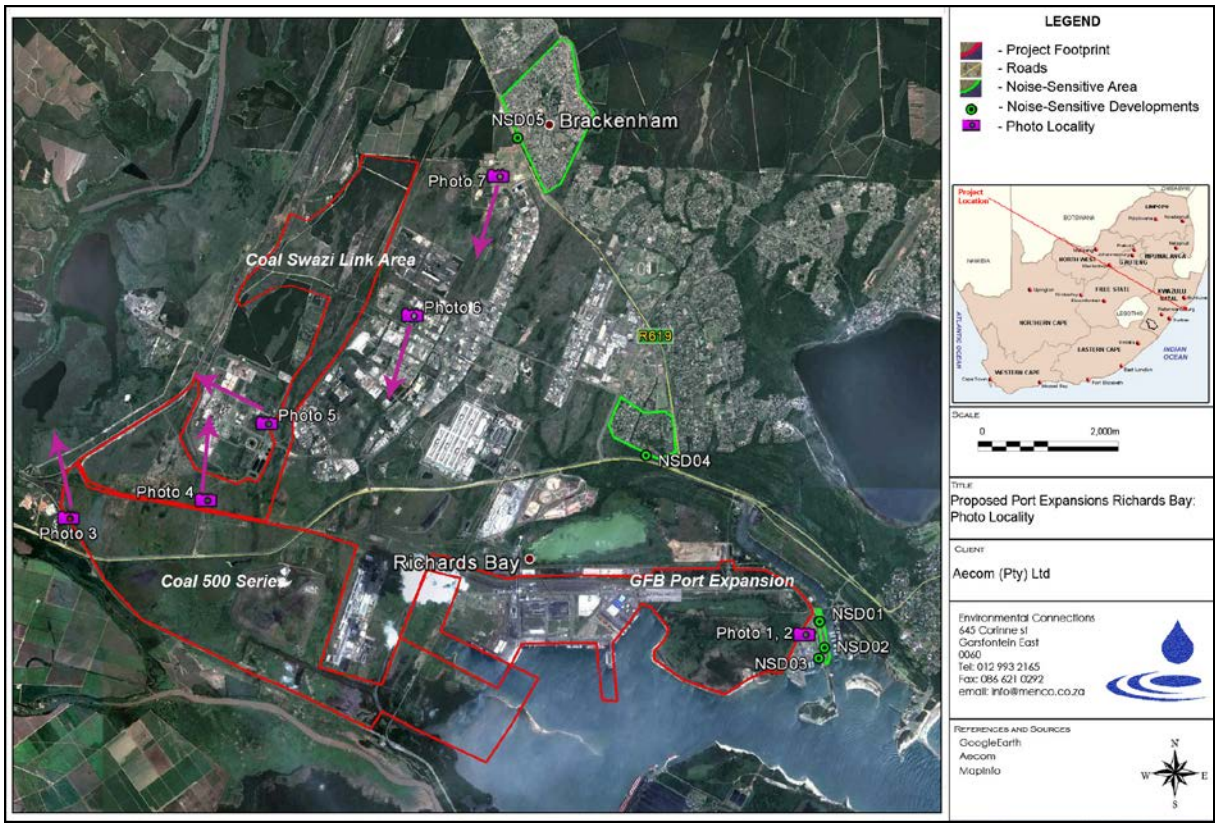

Photo locality map

Photo 1: RP02 Measurement Location (Lat. 28°47'30.23"S, Long. 32° 4'42.46"E)

Photo 2: RP01 Measurement Location (Lat. 28°47'30.23"S, Long. 32° 4'42.46"E)

Photo 3: Industrial Area on Proposed Project Footprint (Lat. 28°46'36.59"S, Long. 31°58'15.52"E)

Photo 4: Industrial Area on Proposed Project Footprint (Lat. 28°46'18.27"S, Long. 31°59'30.35"E)

Photo 5: Industrial Area on Proposed Project Footprint (Lat 28°45'53.05"S, Long. 31°59'59.75"E)

Photo 6: Industrial Area on Proposed Project Footprint (Lat 28°45'3.41"S, Long. 32° 1'16.22"E)

Photo 7: Industrial Area on Proposed Project Footprint (Lat. 28°43'59.40"S, Long. 32° 2'1.27"E)