SAFETECH

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ENVIRONMENTAL IMPACT ASSESSMENT

for the proposed

Namport Expansion of the Walvis Bay Container Terminal

SPECIALIST STUDY ON NOISE IMPACTS

Health and Welfare Sector Education and Training Authority
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HW592PA0600140

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Amendment History

Version 1	Original	28/08/2009
Version 2	Removed discussion regarding blasting activities	19/09/2009
Version 3	Re-rated impacts	28/09/2009
Version 4	Reworded the use of the 5th Road entrance	03/11/2009
Version 5	Added the noise barrier position in Appendix C	25/11/2009

INFORMATION PAGE

CLIENT NAME	CSIR Stellenbosch
PROJECT	Namport Extension of the Walvis Bay Container Terminal
CONTACT PERSON	Mr. H. Fortuin
TYPE OF SURVEY	Noise Specialist Study as part of the Environmental Impact Assessment
DATE OF SURVEY	28th August 2009
SURVEY CONDUCTED BY	Brett Williams
TECHNICAL REVIEW BY	Brett Williams
QUALITY REVIEW BY	Michael Bell (Quality Manager)

This report only pertains to the conditions found at the above site at the time of the survey. This report may not be copied electronically, physically or otherwise, except in its entirety. If sections of the report are to be copied the approval of the author, in writing, is required.

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B WILLIAMS

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M BELL
QUALITY ASSURANCE

EXECUTIVE SUMMARY

Safetech were appointed to conduct a specialist study for an environmental impact assessment for an extension to the Walvis Bay Container Terminal which is operated by the Namibian Port Authority (Namport).

The study considered the site location as described in the Scoping Report (CSIR Report CSIR/CAS/EMS/ER/2009/0017/A). Baseline monitoring was done of the ambient noise levels at and adjacent to the site.

The results of the study indicate that the following conclusions can be drawn:

- There will be a short term increase in noise in the vicinity of the site during the construction phase as the ambient level will be exceeded.
- The piling and drilling impact during the construction phase will difficult to mitigate.
- The long term noise impact from the port extension will most likely be from the increased vehicle traffic.
- The highest noise sources during the operational phase are from the containers being dropped and the spreader connecting onto the containers.

The following is recommended:

Construction Activities

a) All construction vehicles should use routes through the industrial areas of the town as much as possible at night. It is not recommended that heavy construction vehicles use the 5th Road entrance continuously during night time construction.

b) It is recommended that vehicles with low noise emissions be used during the construction phase and that these vehicles at least comply with the Namibian Road Traffic Regulations for noise level emissions.

c) It is recommended that if pile operations are needed, a quieter method such as augur drilling be used as opposed to impact pile driving. If impact pile driving is to be conducted, then the impact portion of the piling rig must be attenuated to decrease the noise, especially during night time activities. If impact piling is conducted it is highly recommended that an additional survey be conducted at night to determine the zone on influence as well as the actual efficacy of the attenuation measures.

Operational Activities

Given that it is not possible to eliminate all noise during the operational phase, the following general recommendations are made:

a) The International Finance Corporation guidelines for noise reduction in new developments should be implemented. These include:
   - Selecting equipment with lower sound power levels.
   - Installing suitable mufflers on engine exhausts and compressor components.
   - Installing acoustic enclosures for equipment to stop noise at source.

Specific noise reduction measures that should be considered are:

b) Ensuring that staff is given "noise sensitivity" training. This should include the operational techniques to ensure that excessively rough handling of the spreaders is limited and that containers are not "dropped" onto the ground, especially when empty.

c) All vehicles should use a route through the industrial areas and then the shortest possible route out of the town. The most appropriate route should be identified in conjunction with the local authority.

d) All level crossings within the port area should be constructed in such a manner that the containers on the trailers do not "bump" when crossing the railway tracks. There should be a smooth transition over the railway tracks where these cross roads. The existing railway crossing in 18th Road is very uneven and is the cause of significant "impact" type noise. It is recommended that Namport approach the municipality to fix this crossing.

e) The possible use of a rubber absorbent mix with the asphalt should be considered when constructing or upgrading the truck routes.

f) A sound barrier must be constructed between the port and 5th Road and the port and Atlantic Street to reduce the amount of truck noise that will be generated along the internal transport route. The exact engineering detail of the sound barrier must be determined when the detailed road design is complete. Where there are gaps in the barrier to facilitate traffic access, the open portion should have an overlapping interior barrier (see Appendix C).

g) Due to anticipated changes in traffic patterns along 18th Road, it is recommended that Namport approaches the municipality to consider amending the zoning regulations to allow the residential premises in this area to be used for business or commercial purposes.

h) The efficacy of the mitigation measures must be measured once the operational phase has commenced. This should be done by conducting an environmental noise survey.

Brett Williams

GLOSSARY OF TERMS & DEFINITIONS	
Ambient noise	Totally encompassing sound in a given situation at a given time, and usually composed of sound from many sources, both near and far. **Note:** Ambient noise includes the noise from the noise source under investigation.
Annoyance	General negative reaction of the community or person to a condition creating displeasure or interference with specific activities
A-weighted sound pressure level (L_{pA} and $L_{Aeq,T}$)	A-weighted sound level L_{pA} which is the sound pressure level at specific frequencies and is given using the following equation: $L_{pA} = 10\text{Log}\left(\frac{P_A}{P_O}\right)^2$ **Where:** P_A = is the root-mean-square sound pressure, using the frequency weighting network A P_O = is the reference sound pressure (P_O = 20 µPa). A-weighted sound pressure level is expressed in decibels dBA **Note:** For clarity in this study L_{pA} shall equal $L_{Aeq,T}$
dBA	The decibel is the unit used to measure sound pressure levels. The human ear does not perceive all sound pressures equally at all frequencies. The "A" weighted scale adjusts the measurement to approximate a human ear response.
Equivalent continuous day/night rating level ($L_{R,dn}$)	Equivalent continuous A-weighted sound pressure level ($L_{Aeq,T}$) during a reference time interval of 24 h, plus specified adjustments for tonal character, impulsiveness of the sound and the time of day; and derived from the following equation: $L_{R,dn} = 10Log\left[\left(\frac{d}{24}\right)10^{\frac{L_{Req,d}}{10}} + \left(\frac{24-d}{24}\right)10^{\frac{L_{Req,n}+k_n}{10}}\right]$dB **Where:** $L_{R,dn}$ is the equivalent continuous day/night rating level; d is the number of daytime hours; $L_{Req,d}$ is the rating level for daytime; $L_{Req,n}$ is the rating level for night-time; K_n is the adjustment of 10 dB added to the night-time rating level.
High-energy impulsive sound	Sound from one of the following categories of sound sources: quarry and mining explosions, sonic booms, demolition and industrial processes that use high explosives, explosive industrial circuit breakers, military ordnance (e.g. armour, artillery, mortar fire, bombs, explosive ignition of rockets and missiles), or any other explosive source where the equivalent mass of TNT exceeds 25 g, or a sound with comparable characteristics and degree of intrusiveness

GLOSSARY OF TERMS & DEFINITIONS	
Highly impulsive sound	sound from one of the following categories of sound sources: small arms fire, metal hammering, wood hammering, drop-hammer pile driver, drop forging, pneumatic hammering, pavement breaking, or metal impacts of rail yard shunting operations, or sound with comparable characteristics and degree of intrusiveness
Impulsive sound	Sound characterised by brief excursions of sound pressure (acoustic impulses) that significantly exceed the residual noise
Low frequency noise	Sound which predominantly contains sound energy at frequencies below 100 Hz
Reference time interval	Representative duration of time periods that are regarded as typical for sound exposure of the community within a period of 24 h: – Daytime: 06:00 to 22:00 – Night-time: 22:00 to 06:00
Residual noise	Totally encompassing sound in a given situation at a given time, and usually composed of sound from many sources, both near and far, excluding the noise under investigation
Specific noise	Component of the ambient noise which can be specifically identified by acoustical means and which may be associated with a specific source **Note:** Complaints about noise usually arise as a result of one or more specific noises.

1.0 INTRODUCTION AND METHODOLOGY

1.1 Introduction

The Namibia Ports Authority is intending to construct an extension to the existing port to increase the container handling capacity. The planned extension will impact on the environment in a number of ways and this study only addresses the noise impact. The study was requested by the CSIR as part of the overall Environmental Impact Assessment for the project.

1.2 Methodology

The methodology used in the study consisted of two approaches to determine the noise impact from the proposed plant and associated infrastructures:

- A desktop study to model the likely noise emissions from the site; and
- Field measurements of the existing ambient noise at different locations in the vicinity of the port.

1.2.1 Desktop study methodology

The desktop study was done using the available literature on noise impacts as well as numerical calculations using the method described in SANS 10357:2004 version 2.1 (The calculation of sound propagation by the Concawe method). The numerical results were then used to produce a noise map (using Manifold software - release 8) that visually indicates the extent of the noise emissions from the site. The sound emissions were modelled from the proposed extension and not the existing container quay.

Two wind directions were used in the study, the prevailing wind from the west south-west (WSW) and an east north-east (ENE) wind. The summer and winter conditions that were used in the modelling are presented in Table 1. These parameters are chosen from the modeling data set and are thus approximations of the site conditions.

Table 1 - Meteorological parameters used in modelling

	Temperature	Relative Humidity	Wind Direction
Summer Condition 1	20^{0}C	50%	WSW
Summer Condition 2	20^{0}C	50%	ENE
Winter Condition 1	10^{0}C	100%	WSW
Winter Condition 2	10^{0}C	100%	ENE

1.2.2 Field Study

A field study was conducted on the 13^{th} to 15^{th} July 2009. Eight ambient monitoring points were chosen outside of the port boundary fence. Measurements were also taken of various pieces of equipment within the port. The location of the ambient measurement positions are as follows:

Table 2 – Location of ambient measurement points

#	Position	Description
Point 1	South 22°57'37.58 East 14°29'0.16	Atlantis Street – near hotel
Point 2	South 22°57'30.45 East 14°29'16.15	Corner of Atlantis and 5^{th} Road – Entrance to port
Point 3	South 22°57'37.90 East 14°29'23.15	5^{th} Road
Point 4	South 22°57'42.34 East 14°29'28.26	Corner of 5^{th} Street and 5^{th} Road
Point 5	South 22°57'30.54 East 14°29'42.98	5^{th} Street
Point 6	South 22°57'21.20 East 14°29'55.05	5^{th} Street
Point 7	South 22°56'49.51 East 14°30'45.48	18^{th} Road at railway crossing with Sixth Street East
Point 8	South 22°57'7.13 East 14°31'1.42	Top of 18^{th} Road near circle

Figure 1 - Locations of ambient measurement Points 1-6

Figure 2 - Locations of ambient measurement Points 1-8

The ambient measurement point locations were chosen as they are at sensitive residential locations. The topography is relatively flat.

A number of measurements were taken by placing the noise meter on a tripod and ensuring that it was at least 1.2 m from floor level and 3.5 m from any large flat reflecting surface.

All measurement periods were at least over 10 minutes, except where indicated. The noise meter was calibrated before and after the survey. At no time was the difference more than one decibel (If the difference is more than 1 decibel the meter is not calibrated properly and the measurement is discarded). The weighting used was on the A scale and the meter placed on impulse correction, which is the preferred method as per Section 5 of SANS 10103:2008. No tonal correction was added to the data. Measurements were taken during the day and night-time. The meter was fitted with a windscreen, which is supplied by the manufacturer. The screen is designed so as to reduce wind noise around the microphone and not bias the measurements.

The test environment contained the following noise sources:

- Vehicular traffic that included trucks and cars.
- Birds.
- Wind.
- Pedestrians talking when passing the measurement point.

The instrumentation that was used to conduct the study is as follows:

- Rion Precision Sound Level Meter (NL32) with 1/3 Octave Band Analyzer.
    - Serial No. 00151075
    - Microphone (UC-53A) Serial No. 307806
    - Preamplifier (NH-21) Serial No. 13814

All equipment was calibrated in January 2009 (see Appendix A)

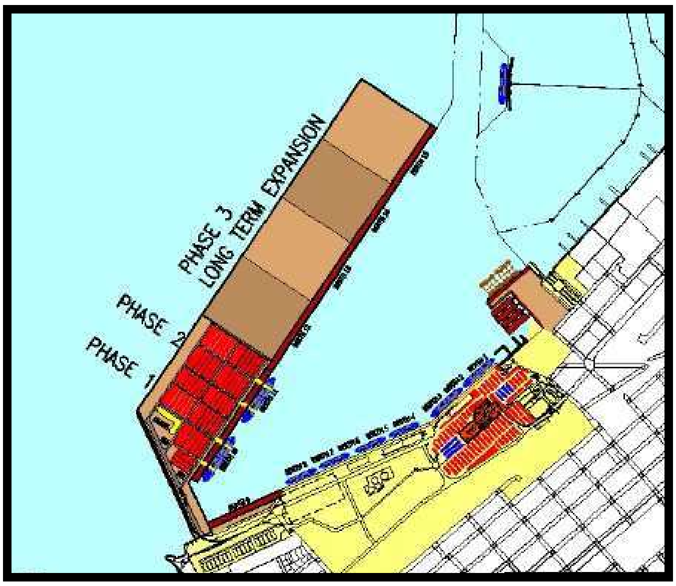
2.0 PROJECT DESCRIPTION

Namport intends to construct a new container port facility on reclaimed land inside current port limits, just northwest of the current Berths 1 to 8. This will alleviate increasing pressure on the existing container terminal facility, and provide ample room for future expansion of throughput volumes.

2.1 Site Location

The extension of the harbour will take place in a northerly direction as described in the scoping reports. The figure below shows the extension.

Figure 3 - Extension of Harbour



2.2. Potential Noise Sources - Construction Phase

Noise pollution will be generated during the construction phase as well as the operational phase.

2.2.1 Potential Noise Sources (General Equipment and Vehicles)

The construction phase could generate noise during different activities such as:

- Site remediation and earthworks.
- Building construction using mobile equipment, cranes, concrete mixing and pile driving equipment.
- Vehicle use and movement.
- Quay construction will include pile driving, drilling.

The number and frequency of use of the various types of vehicles has not been determined but an indication of the type and noise generated is presented below.

Table 3 – Typical types of vehicles and equipment to be used on site (Construction Phase)

Type	Description	Typical Sound Power Level (dB)
Bus to Transport Workers	60 seater	95
Passenger Vehicle	Passenger vehicle or light delivery vehicle such as bakkies	85
Trucks	10 ton capacity	95
Cranes	Overhead and mobile	109
Mobile Construction Vehicles	Front end loaders	100
Mobile Construction Vehicles	Excavators	108
Mobile Construction Vehicles	Bull Dozer	111
Mobile Construction Vehicles	Dump Truck	107
Mobile Construction Vehicles	Grader	98
Mobile Construction Vehicles	Water Tanker	95
Stationary Construction Equipment	Concrete mixers	110
Compressor	Air compressor	100
Compactor	Vibratory compactor	110

Source: GCDA 2006

The estimated number of trips per day that the construction vessels will take is shown in Table 5 below.

Table 4 – Estimated construction vehicle movements per day

Type	Movements per Day
Trucks to transport rock	400 round trips per day at maximum during the 2nd to 6th month after the commencement of the works,
Trucks to transport cement, concrete aggregates etc.	40 round trips per day

Source: JICA Study Team 2009

2.2.2 Potential Noise Sources – Construction Phase (Drilling & Piling)

Dredging and drilling and piling may produce low frequency noise emissions under water that can travel over considerable distances underwater. Under water construction machinery emits sound waves mainly in the low frequency range. Dredging systems typically emit sound waves in the frequency range between 20 Hz and 1 kHz with sound levels of 150 to 180 dB (the reference pressure (i.e. corresponding to 0 dB) for under water sound is 1 micro Pascal (µPa) whereas in air 20 µPa) (UNEP 2008).

It is has been determined that blasting will not be done during the construction phase and is therefore not discussed in this chapter.

2.3 Potential Noise Sources – Operational Phase

The container handling process will entail the use of mobile cranes as well as vehicles. The operational phase could typically generate noise from the following sources:

- Vehicles (See Table 5 below)
- Container handling equipment
- Sirens or warning devices

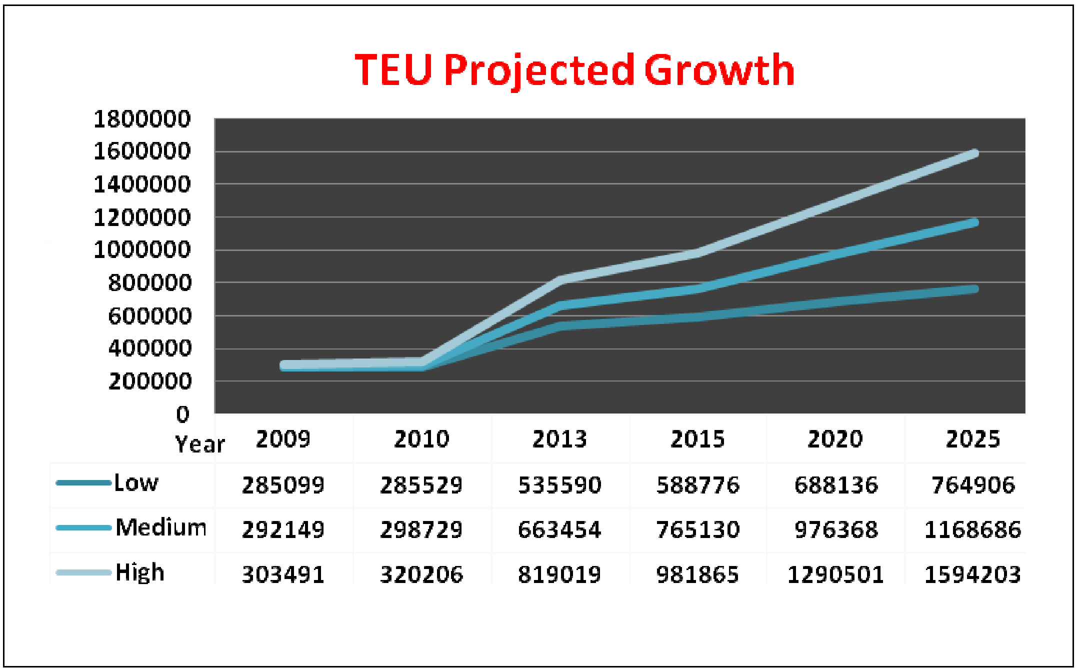
Table 5 - Types of Vehicle and equipment to be typically used on site (Operational Phase)

Type	Possible Number of Units
Quay Gantry Crane	3
Rubber Tyre Gantry Crane (RTG)	8
Tractor (Head)	17
Yard Type Chassis (Trailer)	20
Forklifts	3
Reach Stacker	3
Side Lift Forklifts	2

Source: JICA Study Team

The growth in container traffic is estimated in the graph below. This data will be used to predict the increase in traffic.

Figure 4 - Prediction of growth in # of TEU's per annum



Source: CSIR Scoping Report 2009

Table 6 – Estimated operational vehicle movements per day (out of Port)

Year	Movements per Day
2009	198
2010	199
2013	261
2015	285
2020	347
2025	412

Source: R. Bowman – Traffic Impact Study

3.0 DESCRIPTION OF THE AFFECTED ENVIRONMENT

The proposed quay extension is located within Walvis Bay. There appears to be an existing noise problem as indicated in comments from the interested and affected parties (Appendix D Draft Scoping Report). The potential sensitive receptors are discussed below. The main noise sensitive receptors that could be impacted by noise pollution are the marine animals, the avifauna and human receptors.

3.1 Sensitive Receptors

3.1.1 Human Sensitive Receptors

The port is bounded by residential areas along the southern and western borders. The port is also bounded by a hotel at the southern western boundary and a yacht / small craft area with a number of restaurants to the west.

The main transport routes to the port are through a mixture of commercial and residential areas. A result of the port expansion will be an increase in the traffic volumes entering and leaving the port.

The locations of the various sensitive receptors are indicated in the figure below.

Figure 5 – Sensitive Receptors

3.1.2 Natural Environment Receptors

The bay is formed by the Walvis Bay Peninsula protecting it with a long narrow sand spit up to Pelican Point in the north, about 10 km from the Port. A 7 km long lagoon with approximately 10 km^2 of wetland conditions is a Ramsar-protected site in the southern part of the bay. It is home to a large population of flamingos and is a migration point for thousands of wading, resident and migratory birds.

3.2 Results of the Field Study

3.2.1 Ambient Noise

The ambient noise was measured at eight locations as described in the above methodology (Section 1.2) and results thereof are contained in the table below.

Table 7 - Ambient Noise Level Measurements

Location	Start Time	Duration (minutes)	Average Wind km/h	Average Temperature (° Celsius)	$L_{Req.T}$ dB(A)	Comments
13th July						
Point 1	16:00	10	30	18	68.3*	Wind South West – 4 cars
Point 2	16:15	10	30	18	66.6*	2 cars
Point 3	16:30	10	30	18	71.2*	3 cars
Point 4	16:45	10	30	18	70.9*	3 cars
Point 5	17:00	10	30	18	73.5*	4 cars
Point 6	17:15	10	30	18	72.1*	3 cars
Point 7	17:30	10	30	18	78.6*	8 cars 6 Trucks
Point 8	17:45	10	30	18	81.1*	14 cars 8 Trucks
13th July						
Point 1	22:30	10	14	11	64.3*	Wind South – very little activity on oil rig in port
Point 2	22:42	10	14	11	59.6*	2 cars
Point 3	22:55	10	14	11	59.1*	1 car
Point 4	23:10	10	14	11	58.2*	-
Point 5	23:25	10	14	11	61.2*	-
Point 6	23:40	10	14	11	60.8*	-

Location	Start Time	Duration (minutes)	Average Wind km/h	Average Temperature (° Celsius)	$L_{Req.T}$ dB(A)	Comments
Point 7	23:59	10	14	11	64.3*	1 car
Point 8	00:20	10	14	11	58.7*	1 car
14th July						
Point 1	05:30	10	9	7	42.1	Wind South East – no cars
Point 2	05:42	10	9	7	45.9*	1 car
Point 3	05:55	10	9	7	46.8*	2 cars
Point 4	06:10	10	9	7	52.6	4 cars
Point 5	06:25	10	9	7	50.4	1 car
Point 6	06:40	10	9	7	51.4	1 car
Point 7	06:55	10	9	7	77.2 *	6 cars 4 trucks
Point 8	07:10	10	9	7	82.8*	7cars 5 trucks 1 train

* = Exceeds SANS 10103:2008 Guidelines (See Table 8)

4.0 IDENTIFICATION OF KEY ISSUES

The key issues regarding the noise impact are as follows:

- What is the current noise ambient noise in the vicinity of the plant?
- What is the noise impact during construction and operation of the plant and associated infrastructure, by day and night?
- Where are local sensitive human receptors located? (e.g. closest residential areas)?
- What are the potential noise impacts on avifauna? This issue has been addressed in Impacts on birds Specialist Study.

5.0 APPLICABLE LEGISLATION & STANDARDS

Namibia does not have any directly applicable noise legislation or standards that could be applied to the project. The draft scoping report has identified that the applicable environmental legislation places a general onus on the developer to ensure that the environment is not affected negatively by any development.

In view of the absence of specific noise legislation the following standards have been used to aid the study and guide the decision making process with regards noise pollution:

- South Africa - GNR.154 of January 1992: Noise control regulations in terms of section 25 of the Environment Conservation Act (ECA), 1989 (Act No. 73 of 1989).
- South Africa - GNR.155 of 10 January 1992: Application of noise control regulations made under section 25 of the Environment Conservation Act, 1989 (Act No. 73 of 1989).
- South Africa - SANS 10103:2008 Version 6 - The measurement and rating of environmental noise with respect to annoyance and to speech communication.

- South Africa - SANS 10210:2004 Edition 2.2 – Calculating and predicting road traffic noise.
- South Africa - SANS 10357:2004 Version 2.1 - The calculation of sound propagation by the Concawe method.
- United Nations Environment Programme - 2008 Desalination Resource and Guidance Manual for Environmental Impact Assessments.
- International Finance Corporation – 2007 General EHS Guidelines: Environmental Noise.

SANS 10103:2008 provides typical rating levels for noise in various types of districts, as described in Table 8 below.

Table 8 - Typical rating levels for noise in various types of districts

Type of District	Equivalent Continuous Rating Level, LReq.T for Noise					
	Outdoors (dB(A))			Indoors, with open windows (dB(A))		
	Day-night	Daytime	Night-time	Day-night	Daytime	Night-time
Rural Districts	45	45	35	35	35	25
Suburban districts with little road traffic	50	50	40	40	40	30
Urban districts	55	55	45	45	45	35
Urban districts with one or more of the following: Workshops; business premises and main roads	60	60	50	50	50	40
Central business districts	65	65	55	55	55	45
Industrial districts	70	70	60	60	60	50

SANS 10103:2008 defines Daytime as 06:00 to 22:00 hours and night time as 22:00 to 06:00 hours. The rating levels in Table 8 above indicate that in urban districts the ambient noise should not exceed 45 dB(A) at night and 55 dB(A) during the day. These levels can thus be seen as the target levels for any noise emissions from an industrial operation. As can be seen from the results table, the influence of the road traffic noise as part of the ambient noise exceeds the recommended rating levels in Table 8 above. A further complication is that the outdoor levels to be used a guideline will be a mixture of urban districts - 55dB(A), central business districts - 65dB(A) and industrial districts - 70dB(A) as all three types of land use border the existing Port.

Furthermore the South African noise control regulations describe a disturbing noise as **any** noise that exceeds the ambient noise by more than 7dB. This difference is usually measured at the complainants location should a noise complaint arise. Therefore if a new noise source is introduced into the environment, irrespective of the current noise levels, and the new source is louder than the existing ambient environment by more than 7dB, the complainant will have a legitimate complaint.

6.0 NOISE IMPACT ASSESSMENT

6.1. Predicted Noise Levels for the Construction Phase

6.1.1 Construction Equipment

The construction noise at the Areva Desalination plant which is situated to the north of Swakopmund was measured to determine comparable or typical construction noise. The types of equipment used at the Areva site are similar to those that will be used at the port. The results are presented in Table 9 below.

Table 9 – Typical Construction Noise

Location	Start Time	Duration (minutes)	Wind	Temperature (^{o} Celsius)	$L_{Req.T}$ dB(A)	Comments
Areva 1	16:05	10	SSW	21	**67.9**	CAT 320D Excavator measured at approximately 50 m.
Areva 2	16:20	12	SSW	21	**69.6**	Mobile crane on jetty measured at approximately 70 m
Areva 3	16:35	11	SSW	21	**72.6**	Drilling rig / Pile Driver on jetty measured at approximately 70 m

The test method as described in SANS 10103:2008 was not deviated from when measuring the ambient noise. The frequency characteristics of the construction noise are important to determine the possible impact on the avifauna if any, and are described in Table 10 below.

Table 10 - Frequency Analysis Construction Equipment (dB)

Frequency (Hertz) ↓	CAT 320D Excavator	Mobile Crane on Jetty	Drilling Rig on Jetty
12.5	22.6	9	12.6
16	23.4	8	18.3
20	22.6	11.8	19
25	23	26.5	18
31.5	23.6	23.5	27.5
40	25.6	27.5	30.5
50	33.9	43.3	34.1

Frequency (Hertz) ↓	CAT 320D Excavator	Mobile Crane on Jetty	Drilling Rig on Jetty
63	30	44.1	34.3
80	37.8	58.8	58
100	49.6	45.1	56.6
125	34.7	50.5	49.6
160	39.7	52.1	55.3
200	43.7	52.7	59.7
250	50.7	51.5	56.5
315	50.4	54.5	55.4
400	42.9	57.7	56.8
500	46	54.4	57.9
630	46.6	51.5	54.3
800	47.2	52.1	60.2
1000	47.6	51.7	57.2
1250	48.9	52.1	57.7
1600	47.5	50.3	58.7
2000	47	51.1	57.5
2500	50.1	53.2	65.1
3150	46.4	49.9	64.8
4000	46.8	49	61.9
5000	44.7	47	58.1
6300	39.6	43.3	52.8
8000	35.8	38.7	48.8
10000	33	34.3	40.8
12500	27.7	26.9	31.9
16000	24.7	18.2	21.4

(See Appendix C for charts of the above Table and a short explanation)

The impact of the construction noise that can be expected at the proposed site can be extrapolated from *Table 3.* As an example if a number of pieces of equipment are used simultaneously, the noise levels can be added logarithmically and then calculated at various distances from the site to determine the distance at which the ambient level will be reached (refer to *Tables 11 & 12*). The construction noise could not be fully modelled using the Concawe method as the combined individual frequencies that are needed as inputs into the model were not available.

Table 11 - Combining Different Construction Noise Sources – High Impacts (Worst Case)

Description	Typical Sound Power Level (dB)
Overhead and mobile cranes	109
Front end loaders	100
Excavators	108
Bull Dozer	111
Total*	**114.4**

*The total is a logarithmic total and not a sum of the values.

Table 12 - Combining Different Construction Noise Sources – Low Impacts

Description	Typical Sound Power Level (dB)
Front end loaders	100
Excavators	108
Truck	95
Total	**111.8**

The information in Table 11 can now be used to calculate the attenuation by distance. Noise will also be attenuated by topography and atmospheric conditions such as temperature, humidity, wind speed and direction etc. but this is ignored for this purpose. Therefore, the distance calculated below would be representative of maximum distances to reach ambient noise levels.

The table below gives an illustration of attenuation by distance from a noise of 114dB(A) measured at the source.

Table 13 – Attenuation by Distance for the construction phase (worst case)

Distance from noise source (metres)	Noise level dB(A)
10	86
20	80
40	74
80	68
160	61
320	54
640	47
1280	37

What can be inferred from the above table is that if the ambient noise level is at

42dB(A) as measured at Point Number 1 in the morning, the construction noise will be similar to the ambient level at approximately **640m** from the noise source, if the noise characteristics are similar. The noise from the site will thus have an impact within **640m** as it will be higher than the ambient noise. Beyond this distance, the noise level will be below the ambient noise and will therefore have little impact.

The above only applies to the construction noise for the quay construction. As the construction advances north as the quay gets longer, the noise will have less of an impact.

6.1.2 Construction Vehicle Movement

The impact of the vehicle movements in and out of the Port needs to be calculated as this will affect all residents along the routes the vehicles use. The types of vehicle use are divided as follows as per the JICA Study Team:

- The trucks transporting rock to construct the quay (400 per day – 50 per hour)
- The trucks transporting cement, aggregate etc. (40 per day – 5 per hour)

SANS 10210:2004 was used to calculate the Basic Noise Level which was corrected for vehicle speed (60km/h) and percentage of heavy vehicles (100%). The results are presented in the table below.

Table 14 - Expected Construction Vehicle Traffic Noise

Details	Noise dB(A)
Trucks transporting rock and trucks transporting other loads such as cement etc. (45 trucks per hour based on an 8 hour shift) Corrected for 60 km/h and 100% heavy vehicles	**62.8**

6.2. Predicted noise levels for the Operational Phase

The likely extent of the operational noise pollution was modelled according to the Concawe method (with the lowest frequency used being 63 Hertz). Low frequency noise below 20 Hertz, potentially generated by on site machinery, is therefore not considered as part of this modelling; however it should not be overlooked. The effects of low frequency noise include sleep disturbance, nausea, vertigo etc. These effects are unlikely to impact upon residents due to the distance between the plant and the nearest communities. Sources of low frequency noise also include wind, train movements and vehicular traffic, which are all sources that are closer to the residential areas.

6.2.1 Predicted noise levels for the Container Handling Equipment

A number of measurements were made at the port on existing container handling equipment. Measurements were also made at the Port of Durban on similar equipment that will be used in the port extension. The results are presented below.

Table 15 - Typical noise generated by Container Handling Equipment

Description	Sound Level (dBA)	Comments
LHM 500 ship to shore crane	109	Connecting spreader onto the container (3m from container)
LHM 500 Ship to shore crane	100	Dropping full container onto the ground (3m from container)
Reach stacker	106	Connecting spreader onto the container (3m from container)
Reach stacker	88	Dropping empty container onto concrete (10m from container)
LHM 500 ship to shore crane	98	Crane alarm at 30m from source while the crane is working (most of the noise is at 1250 hertz)
Kalmar RTG (Durban)	81	Measurement taken at 5m from the RTG
Kalmar RTG (Durban)	90	Crane alarm at 5m from source while the crane is working (most of the noise is at 3150 hertz)
Truck and trailer (Durban)	80	Measurement taken at 5m from the truck as it passes the measurement point
Straddle Carrier (Durban)	75	Measurement taken at 5m from the carrier as it passes the measurement point

The sound power levels that were chosen to graphically model were taken from measurements of the LHM 500 ship to shore crane. The sound power levels used are presented in the table below and are taken when the carne “connects” the spreader to the container. This is the loudest noise during the handling of a container.

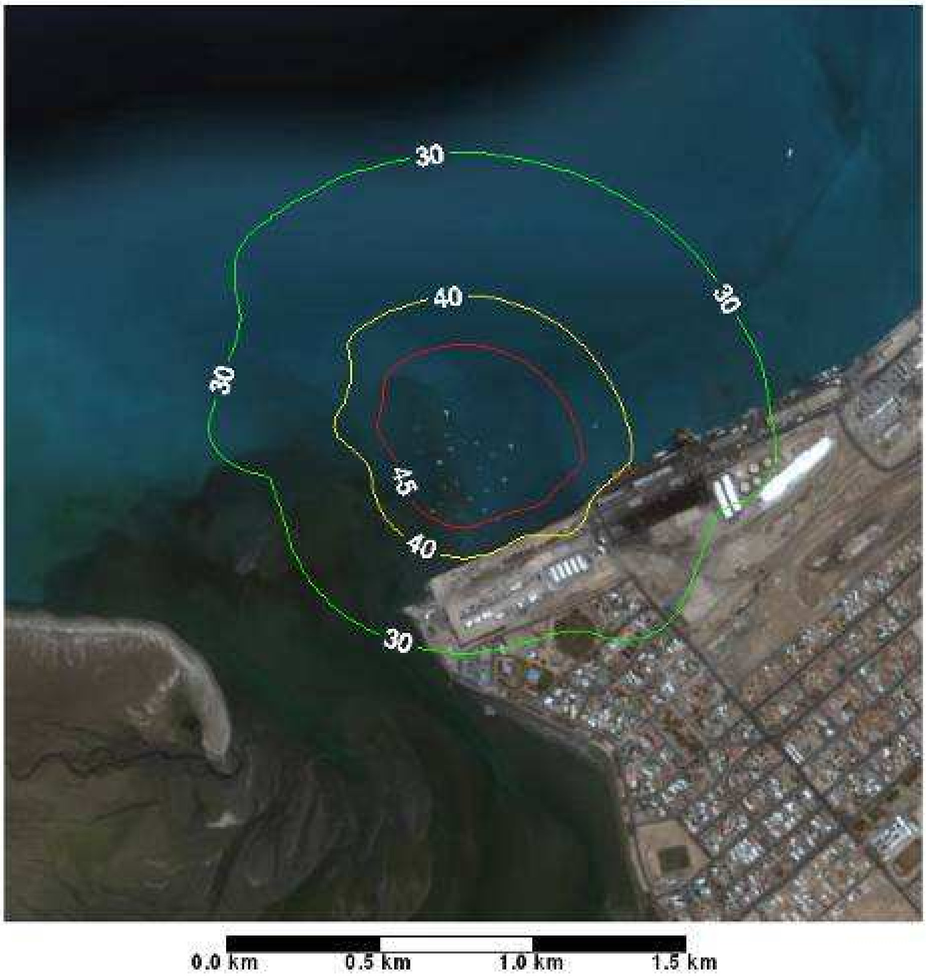
Table 16 - Sound Power Levels used for Container Handling Equipment

Frequency (Hertz)	63	125	250	500	1000	2000	4000
Sound Power (dB)	65	78	78	90	11	105	107

The results of the modelling are presented in the figures below. The centre of the modelling is the approximate centre of the new quay extension.

Figure 6 – Modelling Results in Decibels - Summer (Westerly Wind)

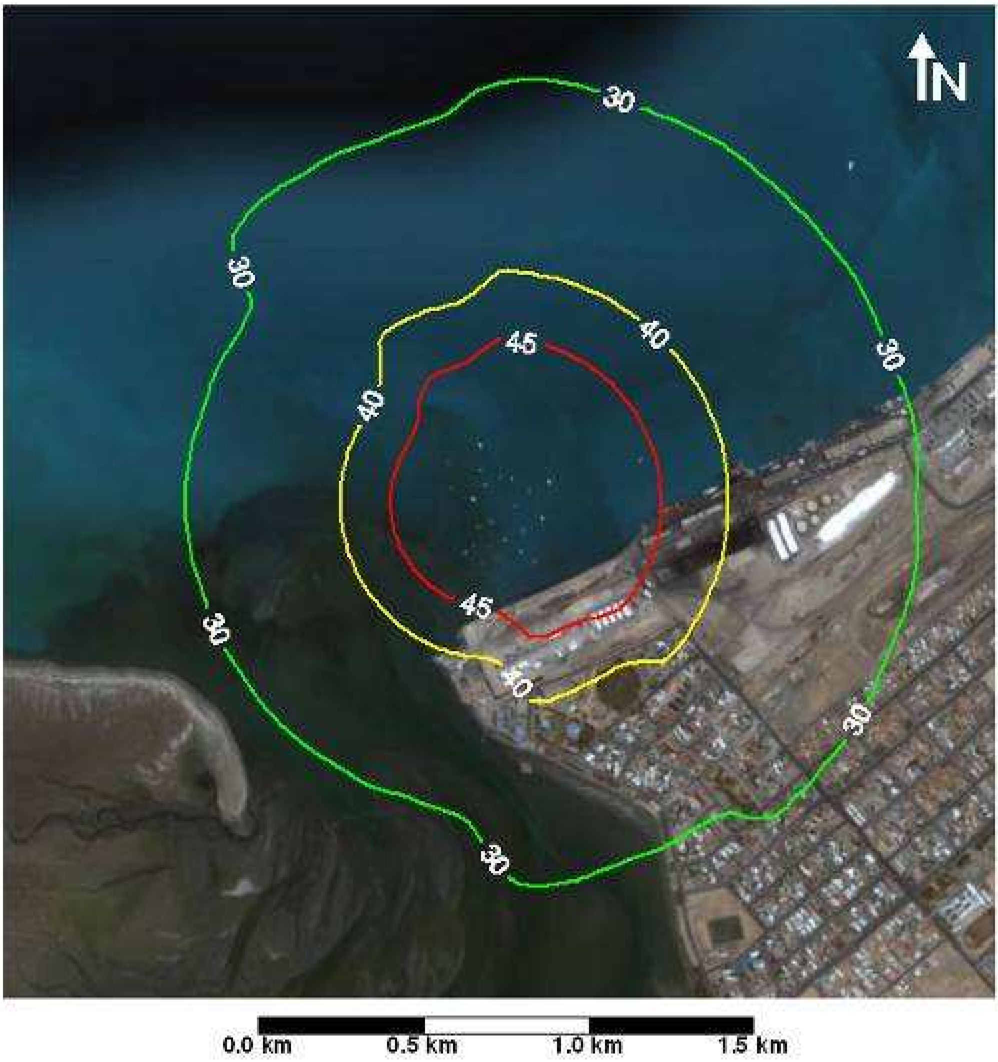
Condition 1	Summer 20deg C 50% RH Wind 248deg WSW Wind 1.5m/s
Activity	Connecting spreader onto container



The figure shows the noise is dissipated further to the northern side of the new quay. It is not anticipated that the operational noise will impact on the sensitive receptors.

Figure 7 - Modelling Results in Decibels - winter (Westerly Wind)

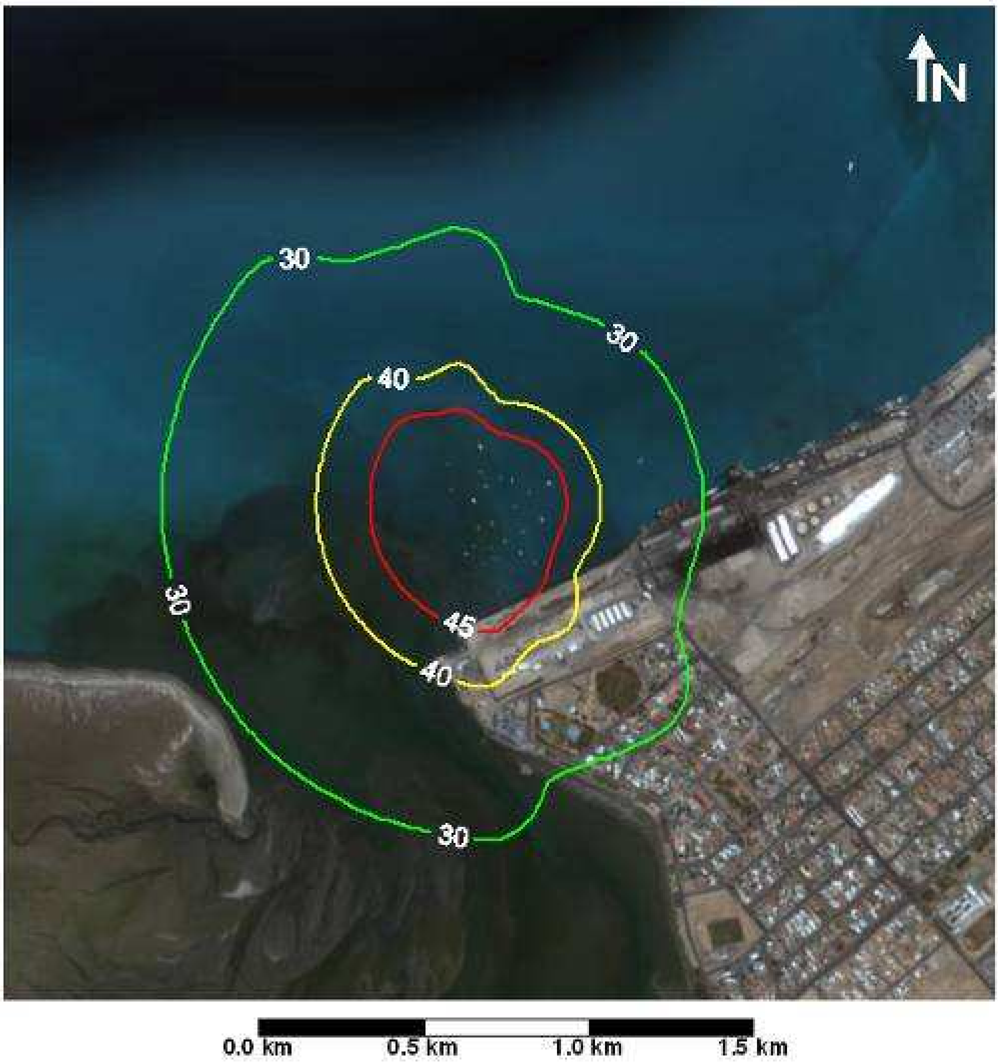
Condition 2	Winter 10deg C 100% RH Wind 248deg WSW Wind 1.5m/s
Activity	Connecting spreader onto container



The figure shows the noise is dissipated to the northern side of the new quay. It is anticipated that the operational noise will impact on the sensitive receptors, namely the hotel and the residents of Atlantic and 5th Road.

Figure 8 – Modelling Results in Decibels - Summer (Northerly Wind)

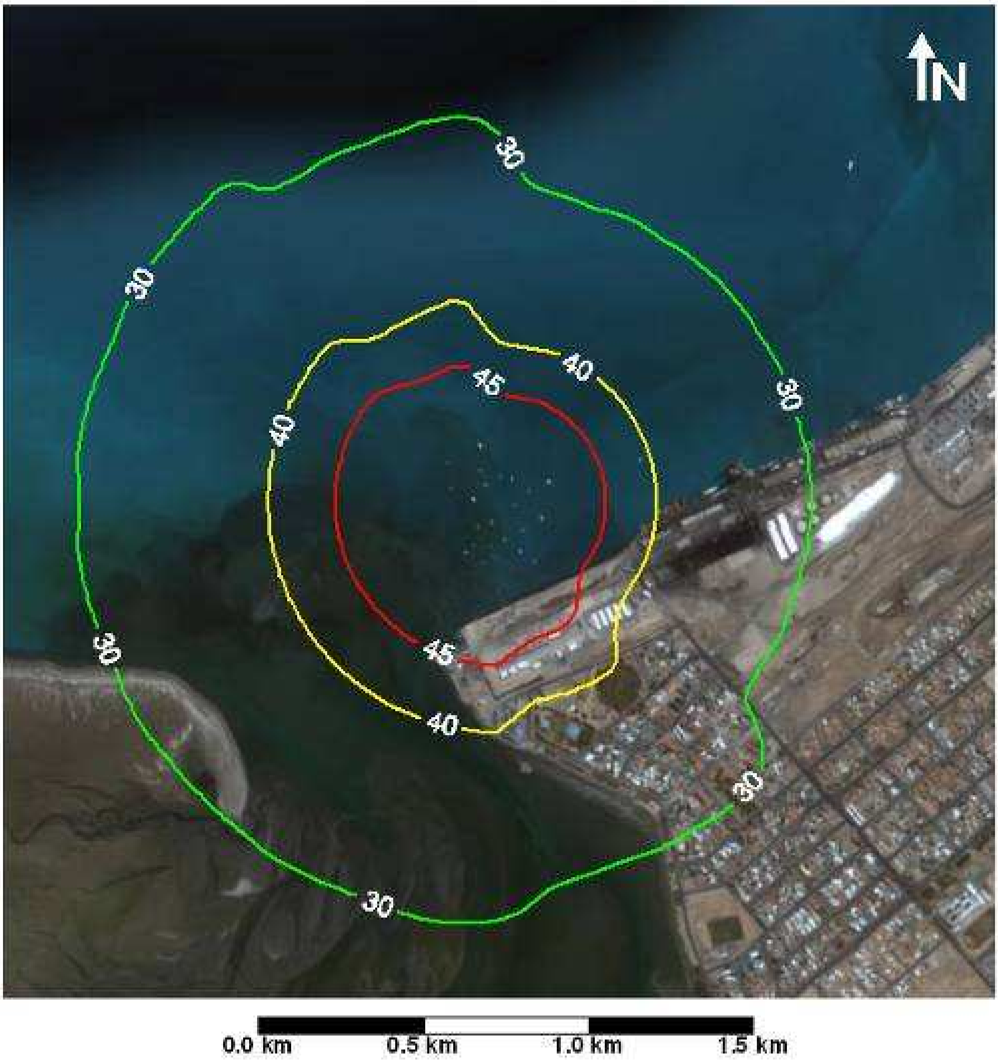
Condition 3	Summer 20deg C 50% RH Wind 68deg ENE Wind 1.5m/s
Activity	Connecting spreader onto container



The figure shows the noise is dissipated further to the southern side of the new quay. It is not anticipated that the operational noise will impact on the sensitive receptors.

Figure 9 – Modelling Results in Decibels - Winter (Northerly Wind)

Condition 4	Winter 10deg C 100% RH Wind 68deg ENE Wind 1.5m/s
Activity	Connecting spreader onto Container



The figure shows the noise is dissipated further to the southern side of the new quay. It is anticipated that the operational noise will impact on the sensitive receptors, namely the hotel and the residents of Atlantic and 5th Road.

An important consideration is that the noise energy dissipates in the air by 6 decibels as the distance doubles.

6.2.2 Predicted noise levels from the increase in Vehicular Traffic

The expected increase in traffic noise is presented in the table below. SANS 10210:2004 was used to calculate the Basic Noise Level which was corrected for vehicle speed (60km/h) and percentage of heavy vehicles (100%). The results are presented in the table below.

Table 17- Expected Operational Traffic Noise (Container Trucks only)

Year	Movements per Day	Movements per Hour (12 hour shift)	Expected Noise dB
2009	198	17	**58.6**
2025	412	34	**61.6**

It must be noted that the levels above are based on a formula that assumes the receiver is ten metres from the noise source. At some locations along the route the trucks use the residences are less than ten metres from the centre line of the passing vehicle. The noise could thus be higher at these locations. The above figures are in addition to the existing noise levels. It is highly likely that the residents along 18th Road will be affected by the increased truck noise. It is also likely that with the increase in vessels using the port facilities, the number of salt trucks using 5th Road will also increase, although this could not be determined definitively. Furthermore the residents along the bottom end of 5th Road will also be affected by the noise emanating from the vehicles on the port's internal roads. This is especially case on the corner of Atlantic Street and 5th Road.

6.3 Impact Assessment Summary

The impact of the noise pollution that can be expected from the site during the construction and operational phase will largely depend on the climatic conditions at the site. The prevailing wind is a south westerly wind will direct noise away from the sensitive areas. Under very stable atmospheric conditions, a temperature inversion or a light wind from the north, the noise will not be readily dissipated.

The results indicate the following:

Operational Phase

a) The quay side port operational activities may impact on the sensitive receptors if a wind from the north is blowing. The ambient noise levels during the night will most likely be exceeded.
b) It is not envisaged that there will be any impact with a southerly wind.
c) The increased vehicular traffic will have an effect on sensitive receptors as the proposed vehicle routes along 18th Road and 5th Road passes through residential areas.
d) The existing ambient noise exceeds the recommended rating values in SANS 10103 due to the number of vehicles passing the residential areas.

Construction Phase

a) There will be an impact on the immediate surrounding environment from the construction activities, especially the pile driving (if non-augur methods are used such as impact pile driving). The area surrounding the construction site will be affected for approximately 640 m in all directions, should a number of main pieces of equipment be used simultaneously.
b) The number of construction vehicles that will convey rock to the site will add to the existing ambient levels and will most likely cause a disturbing noise.

The noise impact assessment tables are presented below:

Table 18- Noise impact rating table

Nature of impact	Status (Negative or positive)	Extent	Duration	Intensity	Probability	Significance (no mitigation)	Mitigation/Management Actions	Significance (with mitigation)	Confidence level
Construction									
1.1 Impact of the construction noise on the residents of Walvis Bay	**Negative**	**Local**, given impact is limited to a maximum of 640 m from site	**Temporary**, only for the duration of the construction	**High -** increase of existing ambient noise levels.	**Definite,** based on calculations	**Medium**	Limit the construction times to day time only.	**Medium**	**High**, based on calculations
1.2. **Cumulative Impact from the construction vehicles conveying rock**	**Negative**	**Regional,** given impact is along local and regional roads	**Short,** only for the duration of the construction	**High –** increase of existing ambient noise levels.	**Definite,** based on calculations	**Medium**	Ensure that trucks pass through the industrial areas as much as possible.	**Medium**	**High**, based on calculations
Operational Phase									
1.1 Impact of the operational noise on the residents of Walvis Bay	**Negative**	**Local,** given impact is limited to Atlantis and 5th Road	**Long Term**	**Low,** no change in the environment is expected	**Probable,** based on calculations and background measurements	**Medium**	Worker training	**Medium**	**High**, since based on actual measurements and calculations
1.2. **Cumulative Impact of the increased vehicle noise**	**Negative**	**Regional,** given impact is along local and regional roads	**Long Term**	**High –** increase of existing ambient noise levels.	**Probable,** based on calculations and background measurements	**Medium**	Ensure that trucks pass through the industrial areas as much as possible, ensure level crossings are upgraded, investigate rubber mixture road surface.	**Medium**	**High**, since based on actual measurements and calculations

7.0 RECOMENDATIONS AND CONCLUSION

The results of the study indicate that the following conclusions can be drawn:

- There will be a short term increase in noise in the vicinity of the site during the construction phase as the ambient level will be exceeded.
- The drilling impact during the construction phase will difficult to mitigate.
- The long term noise impact from the port extension will most likely be from the increased vehicle traffic.
- The highest noise sources during the operational phase are from the containers being dropped and the spreader connecting onto the containers.

The following is recommended:

7.1 Construction Activities

d) All construction vehicles should use routes through the industrial areas of the town as much as possible at night. It is not recommended that heavy construction vehicles use the 5th Road entrance continuously during night time construction.

e) It is recommended that vehicles with low noise emissions be used during the construction phase and that these vehicles at least comply with the Namibian Road Traffic Regulations for noise level emissions.

f) It is recommended that if pile operations are needed, a quieter method such as augur drilling be used as opposed to impact pile driving. If impact pile driving is to be conducted, then the impact portion of the piling rig must be attenuated to decrease the noise, especially during night time activities. If impact piling is conducted it is highly recommended that an additional survey be conducted at night to determine the zone on influence as well as the actual efficacy of the attenuation measures.

7.2 Operational Activities

Given that it is not possible to eliminate all noise during the operational phase, the following general recommendations are made:

i) The International Finance Corporation guidelines for noise reduction in new developments should be implemented. These include:
  - Selecting equipment with lower sound power levels.
  - Installing suitable mufflers on engine exhausts and compressor components.
  - Installing acoustic enclosures for equipment to stop noise at source.

Specific noise reduction measures that should be considered are:

j) Ensuring that staff is given "noise sensitivity" training. This should include the operational techniques to ensure that excessively rough handling of the spreaders is limited and that containers are not "dropped" onto the ground, especially when empty.

k) All vehicles should use a route through the industrial areas and then the shortest possible route out of the town. The most appropriate route should be identified in conjunction with the local authority.

l) All level crossings within the port area should be constructed in such a manner that the containers on the trailers do not "bump" when crossing the railway tracks. There should be a smooth transition over the railway tracks where these cross roads. The existing railway crossing in 18th Road is very uneven and is the cause of significant "impact" type noise. It is recommended that Namport approach the municipality to fix this crossing.

m) The possible use of a rubber absorbent mix with the asphalt should be considered when constructing or upgrading the truck routes.

n) A sound barrier must be constructed between the port and 5th Road and the port and Atlantic Street to reduce the amount of truck noise that will be generated along the internal transport route. The exact engineering detail of the sound barrier must be determined when the detailed road design is complete. Where there are gaps in the barrier to facilitate traffic access, the open portion should have an overlapping interior barrier (see Appendix C).

o) Due to anticipated changes in traffic patterns along 18th Road, it is recommended that Namport approaches the municipality to consider amending the zoning regulations to allow the residential premises in this area to be used for business or commercial purposes.

p) The efficacy of the mitigation measures must be measured once the operational phase has commenced. This should be done by conducting an environmental noise survey.

If any further information is required please feel free to contact me.

Assuring you of our best attention at all times.

Thanking you.

Brett Williams

8.0 REFERENCES

CSIR Environmental Impact Assessment for the Proposed Namport Container Terminal Extension – 2009 Draft Scoping Report

Gold Coast Desalination Alliance (GCDA) – 2006 Environmental Impact Assessment Queensland Desalination Plant (Chapter 11).

International Finance Corporation – 2007 General EHS Guidelines: Environmental Noise.

SSI Engineers and Environmental Consultants (Pty) Ltd - 2009. Traffic and Roads Impact Study for the Proposed Extension of the Walvis Bay Container Terminal

South Africa - GNR.154 of January 1992: Noise control regulations in terms of section 25 of the Environment Conservation Act (ECA), 1989 (Act No. 73 of 1989)

South Africa - GNR.155 of 10 January 1992: Application of noise control regulations made under section 25 of the Environment Conservation Act, 1989 (Act No. 73 of 1989)

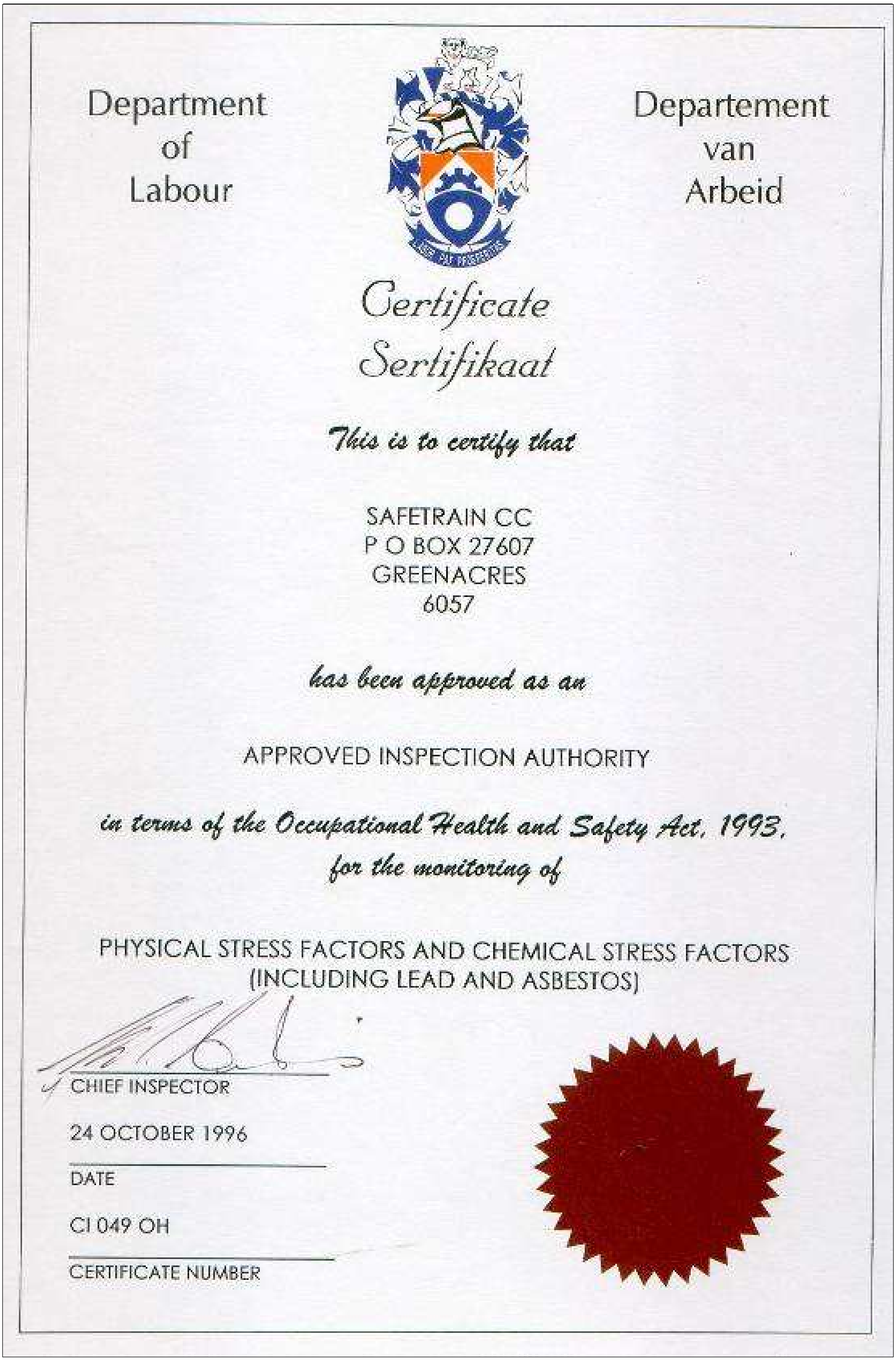
South Africa - SANS 10210:2004 Edition 2.2 – Calculating and predicting road traffic noise

South Africa - SANS 10357:2004 Version 2.1 - The calculation of sound propagation by the Concawe method)

South Africa - SANS 10103:2008 Version 6 - The measurement and rating of environmental noise with respect to annoyance and to speech communication.

United Nations Environment Programme - 2008 Desalination Resource and Guidance Manual for Environmental Impact Assessments.

APPENDIX A - AIA Certificate



Department of Labour

Departement van Arbeid

Certificate

Sertifikaat

This is to certify that

SAFETRAIN CC
P O BOX 27607
GREENACRES
6057

has been approved as an

APPROVED INSPECTION AUTHORITY

in terms of the Occupational Health and Safety Act, 1993, for the monitoring of

PHYSICAL STRESS FACTORS AND CHEMICAL STRESS FACTORS (INCLUDING LEAD AND ASBESTOS)

CHIEF INSPECTOR

24 OCTOBER 1996

DATE

CI 049 OH

CERTIFICATE NUMBER

APPENDIX B - Calibration Certificate

S A N A S

ACCREDITED LABORATORY

140 1302

De Beer Calibration Services

De Beer Calibration Services cc
Registration No. [illegible]/23
VAT No. [illegible]
East Dale P[illegible]
C/o Hans Stry[illegible]
Garsfontein, Pretoria [illegible]
P.O. Box 905-654, Garsfon[illegible]
Tel Int. +27 12 998 2172
Fax Int. +27 12 998 2173

CERTIFICATE OF CALIBRATION

CERTIFICATE NUMBER	2009-035
ORGANISATION	SAFE-TECH
CALIBRATION OF	INTEGRATING SOUND LEVEL METER complete with ½" MICROPHONE and ⅓-OCTAVE/OCTAVE FILTER
CALIBRATED BY	M.W. DE BEER
MANUFACTURER	RION
MODEL NUMBERS	NL-32, UC-53 A and NX-22RT
SERIAL NUMBERS	00151075, 307806 and 00150957 V2.2
DATE OF CALIBRATION	5 JANUARY 2009
RECOMMENDED DUE DATE	JANUARY 2010
PAGE NUMBER	PAGE 1 OF 4

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M.W. DE BEER (SANAS AUTHORIZED SIGNATORY) — 8 January 2009 — DATE OF ISSUE

Director: M.W. de Beer

APPENDIX C – Noise Barrier Position on 5th Road

Barrier Position