APPENDIX I10

ENVIRONMENTAL NOISE REPORT

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Environmental Noise Report

MCWAP Phase 2: Transfer Scheme from the Crocodile River (West) to the Lephalale Area

Abstraction Pumping Station

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EXECUTIVE SUMMARY

A pumping station is proposed to pump water from the Crocodile River through a pipeline to the Lephalale area. It is situated in a largely rural area with the generally low ambient noise levels typical of rural environments. The investigation's purpose was to estimate any potential operational noise impact of the proposed pumping station on the existing ambient noise climate in the surrounding area.

This was achieved by measuring and assessing the noise of a similar pumping station in accordance with the relevant SANS Codes of practice, and as required by the regulations of the DEPARTMENT OF ENVIRONMENTAL AFFAIRS. It is assumed that operations will normally take place at any time of the day or night.

The expected response from the local community to the noise impact, i.e. any increase of predicted operational noise over the original ambient noise, is based on the relevant SANS document, and expressed in terms of the effects of impact, on a scale of 'NONE' to 'VERY HIGH'. This report is an overall assessment designed to predict the collective response of a noise-exposed population and therefore the impact the operation is likely to have on them, and is based on measured and predicted equivalent continuous noise levels according to the relevant SANS code of practice.

The noise impact is generally rated as NONE or LOW during the Operational phase. Methods of mitigation, including barriers, operational and administrative procedures, plant maintenance, and on-site monitoring to ensure that any agreements are adhered to, are discussed.

CONTENTS

1. PURPOSE OF THE INVESTIGATION AND TERMS OF REFERENCE

A proposed pumping station to pump water from the Crocodile River through a pipeline to the Lephalale area, is situated in a largely rural area with the generally low ambient noise levels typical of rural environments. The investigation's purpose was to estimate any potential operational noise impact of the proposed pumping station on the existing ambient noise climate in the surrounding area.

This was achieved by measuring the noise of a similar pumping station in accordance with the relevant SANS Codes of practice, and as required by the regulations of the DEPARTMENT OF ENVIRONMENTAL AFFAIRS. It is assumed that operations will normally take place at any time of the day or night.

2. INVESTIGATIVE METHODOLOGY

2.1 Introduction

The noise impact assessment was achieved by measuring the noise of a similar pumping station and comparing it with the zone limit levels recommended by the relevant SANS Codes of practice, and as required by the regulations of the DEPARTMENT OF ENVIRONMENTAL AFFAIRS. It is assumed that operations will normally take place at any time of the day or night.

The expected response from the local community to the noise impact, i.e. any increase of predicted operational noise over the original recommended zone noise limit levels, is primarily based on the recommendations of the relevant SANS document, and expressed in terms of the effects of impact, on a scale of 'NONE' to 'VERY HIGH'. This report is an overall assessment designed to predict the collective response of a noise-exposed population and therefore the impact the operation is likely to have on them, and is based on measured and predicted equivalent continuous noise levels according to the relevant SANS code of practice.

2.2 Measurement of Operational Noise from a Similar Existing Pumping Station

The approach used in this assessment was to identify a similar pumping station and operations, and to use noise measurements from that site to predict noise levels at the proposed pumping station. This approach has the advantage that realistic noise values representing actual equipment maintenance conditions and actual operating conditions and durations are used in the predictions.

2.3 Quantifying the Noise Impact

The noise impact is quantified as the predicted increase in ambient or zone noise level, in decibels, which can be attributed to the operation of the proposed pumping station appropriate to the proposed operating times. The facility is assumed to be operating continuously, at any time of the day or day of the week.

Existing noise sources include:

Natural sounds of the bush
Livestock and agricultural activity on surrounding land.
Local community domestic noise
Vehicles and other transport serving the local community.
Occasional overflying aircraft

Noise level (dBA)	Source	Subjective description
160-170	Turbo-jet engine	Unbearable
130	Pneumatic chipping and riveting (operator's position)	Unbearable
120	Large diesel power generator	Unbearable
110	Circular saw Blaring radio	Very noisy
90 - 100	Vehicle on highway	Very noisy
80 - 90	Corner of a busy street Voice - shouting	Noisy
70	Voice - conversational level	Quiet
40 - 50	Average home - suburban areas	Quiet
30	Average home - rural areas Voice - soft whisper	Quiet
0	Threshold of normal hearing	Very quiet

Table 1: Typical noise level and human perception of common noise sources

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

e) Central business districts	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50

Table 2: Acceptable rating levels for noise in districts (Ref.1)

NB: Day-time : 06:00 to 22:00, Night-time : 22:00 to 06:00
The appropriate criteria for this assessment are in **bold script** in the above table.

2.4 Assessing the Noise Impact

The expected response from the local community to the noise impact, i.e. the increase of noise over the original ambient, is primarily based on Table 5 of SANS 10103 (ref. 1), but expressed in terms of the effects of impact, on a scale of 'none' to 'very high'.

INCREASE dB	RESPONSE INTENSITY	REMARKS	NOISE IMPACT
0	None	Change not discernible to a person	None
3	None to little	Change just discernible	Very low
3 ≤ 5	Little	Change easily discernible	Low
5 ≤ 7	Little	Sporadic complaints	Moderate
7	Little	Defined by National Noise Regulations as being 'disturbing'	Moderate
7 ≤ 10	Little to medium	Sporadic complaints	High
10 ≤ 15	Medium	Change of 10dB perceived as 'twice as loud' leading to widespread complaints	Very high
15 ≤ 20	Strong	Threats of community/group action	Very high

Table 3: Response intensity and noise impact for various increases over the ambient noise

2.5 Prediction of Noise Levels at the Proposed Site

The values referred to in section 2.2. above formed the basis of calculations to predict the noise levels at specific locations of interest outside the boundaries of the proposed pumping station. Using the point source and attenuation-by-distance model, the following assumptions were made:

1) Acoustically hard ground conditions. This assumes that no attenuation due to absorption at the ground surface takes place. The effects of frequency-dependent atmospheric absorption were also ignored. Both assumptions represent a pessimistic evaluation of the potential noise impact.
2) Meteorological conditions. Neutral weather conditions, i.e. windless and inversionless, and standard conditions of temperature and humidity (20°C and 50%RH) were assumed representing a neutral evaluation of the noise impact.

3) Noise measurements were representative of normal operation. Equivalent continuous A-weighted noise levels, $L_{Aeq,I}$, measured for similar operations are assumed to correctly represent the noise from the operation. Impossible-to-predict (random) single noise events louder than the continuous noise level are not taken into account, although short events which are part of the process, such as the impact noise from material transport, and vehicles, for example, are fully represented in the measurements, representing a neutral to mildly optimistic evaluation of the noise impact.
4) Ambient noise levels. Measured or recommended zone limit levels were assumed typical of the environment, representing a neutral evaluation of the noise impact.
5) Screening effect of temporary stockpiles, buildings and other barriers. The effect of these temporary structures, on the noise climate has been ignored, representing a pessimistic evaluation of the potential noise impact.
6) Current noise control technology is assumed. No allowance is made in the noise level predictions for improvements in noise control techniques which may be incorporated into the proposed project, representing a pessimistic evaluation of the potential noise impact.
7) Worst case operational noise level assumption. The highest noise level of plant was used as the criterion value for the noise predictions at the proposed project, representing a pessimistic evaluation of the potential noise impact.
8) Worst case operational assumption. The assumption has been made that any plant is positioned at the closest point on the site to the assessment point, representing a pessimistic evaluation of the potential noise impact.

3. IMPACT ASSESSMENT

3.1. General

The proposal is a new pumping station which will be operating continuously. A worst case scenario is considered, i.e. that the primary noise sources are positioned at the closest point on the site to the assessment point under consideration, that there is direct line of sight to such equipment, and that there is continuous noise from such equipment.

3.2. Continuous Noise Levels and Individual Noise Events

This report is an overall assessment designed to predict the collective response of a noise-exposed population and therefore the impact the operation is likely to have on them, and is based on measured and predicted equivalent continuous noise levels according to SANS 10103. It will be possible to detect and distinguish individual noise events, even if the noise impact is assessed as NONE, or VERY LOW, i.e. where a person with normal hearing will not be able to detect the predicted increase in ambient noise level attributable to operation of the pumping station, but where an operation may nevertheless be audible to that person at some time.

3.3. Existing Ambient Noise Levels at the Site

The values recommended as the highest acceptable for rural districts according to the relevant section (Table 2 above) of SANS 10103:2008 (see Ref. 1) are as follows:

Type of District	Daytime	Night-time
Rural	45	35

3.4. Predicted Impact of Operation Noise

The noise from a similar operating pump station close to Johannesburg was measured and this value is taken as the noise level expected from the proposed pumping station, 55 dB(A) at a distance of 100m from the pumping station facade. Further measurements are to be made on an identical pumping station currently under construction to confirm these values when available. The investigation shows that the proposed pump station will have a minor impact on the noise climate in the surrounding environment in the operational phase. In the worst case, as described above, with no specific mitigating measures, and using the limit levels in 3.3. above, the impact at various distances from the pump station façade during daytime and nighttime are predicted to be as tabulated below.

Exceedance dB	Noise Impact	Distance-Day	Distance-night
0	None	300m	1000m
3	Very low	250m	700m
3 ≤ 5	Low	200m	600m
5 ≤ 7	Moderate	150m	500m
7 ≤ 10	High	100m	300m
10 ≤ 15	Very high	Less than100m	Less than 300m

Table 4: Distances from the pumping station for certain noise impact for various increases over the recommended ambient noise limit levels

4. MITIGATION AND MANAGEMENT MEASURES

Mitigation Measures:

1. Maintenance of equipment and operational procedures: Proper design and maintenance of silencers on diesel-powered equipment, systematic maintenance of all forms of equipment, training of personnel to adhere to operational procedures that reduce the occurrence and magnitude of individual noisy events.
2. Placement of material stockpiles: Where possible material stockpiles should be placed so as to protect site boundaries from noise from individual operations. If a stockpile is constructed, it should be at a position and of such a height as to effectively act as a barrier to site noise at any sensitive area, if line of sight calculations show this to be practicable. In particular, the erection of suitable earth berms around permanent machinery can significantly reduce the noise by up to 12dB.
3. Equipment noise audits: Standardised noise measurements should be carried out on individual equipment at the delivery to site to construct a reference data-base and regular checks carried out to ensure that equipment is not deteriorating and to detect increases which could lead to increase in the noise impact over time and increased complaints.
4. Environmental noise monitoring: Should be carried out at regularly to detect deviations from predicted noise levels and enable corrective measures to be taken where warranted.

Noise management and mitigation options

Source	Remedial measures
Mobile equipment noise	Select vehicle routes carefully by means of internalising the roads Fit efficient silencers and enclose engine compartments Damp mechanical vibrations Erect bank, screen or barrier
Fixed plant noise	Reduce noise at source damping acoustic treatment, etc. Isolate source by enclosure in acoustic building, room, etc. Carefully select fixed plant site Raise barriers or berms

Table 5. Summary of major sources of noise associated with construction operations, and the possible remedial measures

5. REFERENCES

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