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COMPLIANCE CONSULTANCY

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ENVIRONMENTAL MONITORING REPORT

AIR QUALITY MONITORING AT LEPIDICO Ltd, KARIBIB, ERONGO REGION

PREPARED FOR

LEPIDICO

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DEFINITIONS AND ABBREVIATIONS

ASTM	American Society of Testing and Materials
AQ	Air Quality
ECC	Environmental Compliance Consultancy
EPL	Exclusive Prospecting Licence
MBGLl	Meters Below Ground Level
ML	Mining Licence
ROM	Run of Mine
SANS	South African National Standard

1 INTRODUCTION

1.1 BACKGROUND OF THE PROJECT

Lepidico Ltd (Lepidico) is a global lithium and development company, with offices in Perth, Australia and Toronto, Canada. In Namibia, Lepidico became the operator and 80% owner of the Karibib Lithium Project, located approximately 30 km south-east of Karibib in the Erongo Region (FIGURE 1). Lepidico owns three exclusive prospecting licences (EPLs) EPL 5439, EPL 5718 and EPL 5555. In June 2018, a Mining Licence (ML 204) was granted to Lepidico over EPL 5439 and is valid until June 2028. Lepidico's potential mining project includes the historical Rubicon and Helikon lepidolite pegmatite deposits. The company's strategic objective is to become an integrated business in the production of battery-grade lithium chemical across the globe.

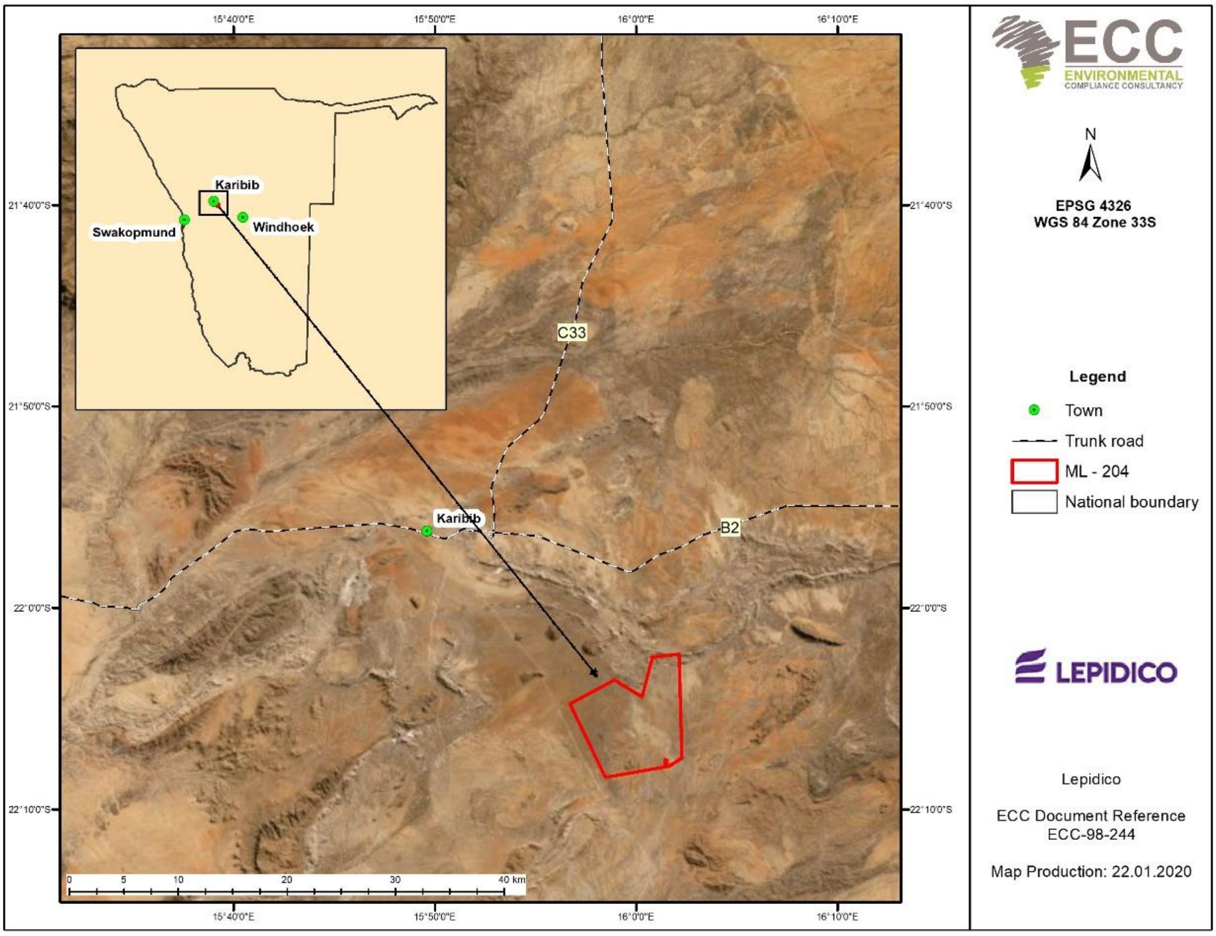

FIGURE 1 – A SATELLITE IMAGE INDICATING THE LOCALITY OF THE LEPIDICO PROJECT NEAR KARIBIB TOWN

Since October 2019, Environmental Compliance Consultancy (ECC) has been conducting different work packages prior to mining, which includes baseline environmental monitoring, specifically air quality and groundwater monitoring. For the air quality component, ECC has deployed eight (8) depositional dust monitoring stations on the 29th of October 2019 at locations indicated in **Error! Reference source not found.** Depositional dust monitoring stations were placed strategically to understand the baseline total dust fallout from the predicted dust sources as indicated in TABLE 1, taking into account prevailing wind directions. For the groundwater monitoring component, ECC measured the groundwater water level of three (3) production boreholes on the 27th January 2020. Wind speed and wind direction are also monitored to add value to the dust monitoring data and determine dust sources more accurately.

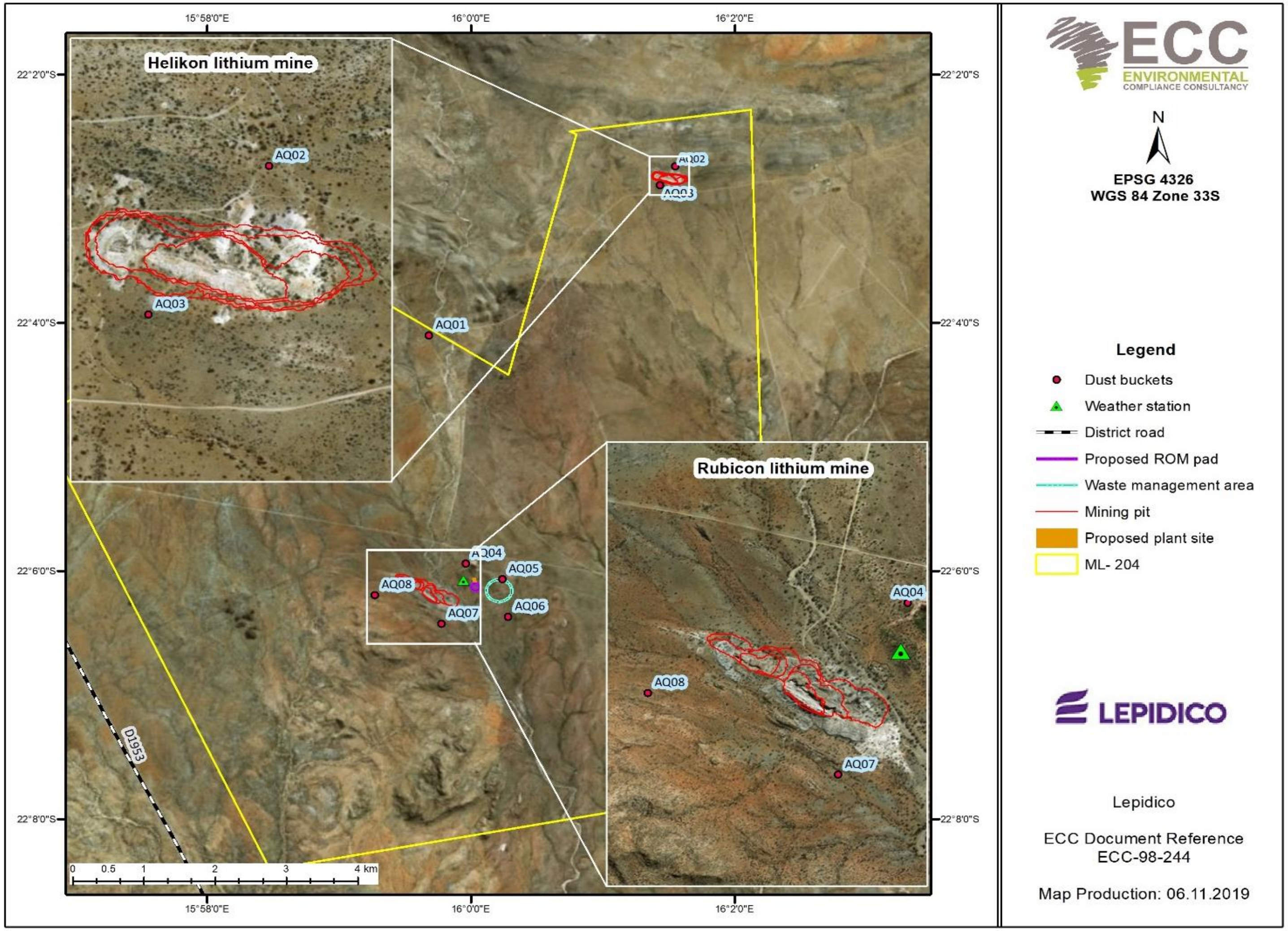

FIGURE 2 – A SATELLITE IMAGE INDICATING THE LOCATION OF THE LEPIDICO AIR QUALITY MONITORING STATIONS (INDICATED BY AQ)

TABLE 1 – SAMPLING LOG FOR THE DEPOSITIONAL DUST MONITORING STATIONS

MONITORING STATION	PREDICTED DUST SOURCE(S)	START DATE	END DATE	NUMBER OF DAYS EXPOSED
AQ-01*	- Main access road	2019-10-29	2019-11-26	28
		2019-11-27	2019-12-28	31
		2019-12-29	2020-01-27	29
AQ-02	- Proposed Helikon pit	2019-10-29	2019-11-26	28
		2019-11-27	2019-12-28	31
		2019-12-29	2020-01-27	29
AQ-03	- Proposed Helikon pit	2019-10-29	2019-11-26	28
		2019-11-27	2019-12-28	31
		2019-12-29	2020-01-27	29
AQ-04	- Proposed plant - Run of Mine (ROM) pad - Proposed Rubicon pit	2019-10-29	2019-11-26	28
		2019-11-27	2019-12-28	31
		2019-12-29	2020-01-27	29
AQ-05	- Proposed waste disposal facility	2019-10-29	2019-11-26	28
		2019-11-27	2019-12-28	31
		2019-12-29	2020-01-27	29
AQ-06	- Proposed waste disposal facility	2019-10-29	2019-11-26	28
		2019-11-27	2019-12-28	31
		2019-12-29	2020-01-27	29
AQ-07	- Proposed Rubicon pit	2019-10-29	2019-11-26	28
		2019-11-27	2019-12-28	31
		2019-12-29	2020-01-27	29
AQ-08	- Proposed Rubicon pit	2019-10-29	2019-11-26	28
		2019-11-27	2019-12-28	31
		2019-12-29	2020-01-27	29

*Air Quality number 01 = AQ-01. Next sampling will be on the 27th January 2020.

1.2 Purpose Of This Report

This is the update on the air quality monitoring results, as part of the baseline data assessment, which can be used for modelling impacts of dust resulting from the proposed mining activities. The overall goal of the project is to establish the baseline dataset before mining and compare it to the results obtained during mining operations. The baseline database will enable the dust depositional trends to be recognised and possible environmental impacts from the activities to be quantified, minimised or mitigated before, during and after the mining operation. Ideally, dust should be monitored throughout the mining lifecycle, for example, during preconstruction, construction, operation, rehabilitation, closure and aftercare stages in order to understand the impact on the environment and the surrounding community.

The results presented are the total fallout dust, sampled during the period between 29th of October 2019 – 27th of January 2020, by using depositional dust monitoring stations (FIGURE 3A). Depositional dust monitoring stations will be monitored every month on a 28 – 32-day cycle. During each monitoring cycle, dust depositional buckets are replaced at each monitoring station (FIGURE 3B). The samples are assayed at the Analytical Laboratory Services in Windhoek. The depositional dust results of each preceding month are presented in the report together with every current month, in a time series analysis.

In the absence of Namibian specific guidelines on ambient air quality standards, the depositional dust monitoring results are compared to the dust fallout limits as provided by the South African National Standard (SANS 1929:2005). The adopted dust deposition limit for residential and light commercial zones of 600 mg/m²/day as an average value over a 28 – 32-day period is applied (TABLE 2).

A B

FIGURE 3 – DEPOSITIONAL DUST BUCKET REPLACEMENT FROM THE STATION (A) AND MONITORING SAMPLE (B)

TABLE 2 – SANS (1929:2005) FOUR-BAND SCALE EVALUATION CRITERIA FOR DUST DEPOSITION

BAND NUMBER	BAND DESCRIPTION	DUST RATE (D) mg/m²/day	COMMENT
1	Residential	D < 600	Permissible for residential and light commercial.
2	Industrial	600 < D < 2400	Permissible for heavy commercial and industrial.
3	Action	1200 < D < 2400	Requires investigation and remediation if two sequential months lie in this band, or more than three occur in a year.
4	Alert	2400 < D	Immediate action and remediation required following the first incidence of dust fallout rate being exceeded. Incident report to be submitted to the relevant authority.

1.3 Environmental Compliance Consultancy

ECC, a Namibian company (registration number 2013/11401), has prepared this report on behalf of Lepidico. As an independent consultancy that operates exclusively in the environmental, social, health and safety fields for clients across Southern Africa in the public and private sector. ECC has no vested or financial interest in the proposed project, except for fair remuneration for professional services rendered.

All compliance and regulatory requirements regarding this assessment document should be forwarded by email or posted to the following address:

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2 BASELINE OF THE RECEIVING ENVIRONMENT

The natural environment is a complex system and it can be affected by anthropogenic interference such as mining. As such, it is crucial to understand the confounding factors and interpret the findings based on the baseline of the receiving environment. The wind vectors, rainfall and topography or terrain (e.g. mountains and valleys) have been identified as the main factor that are likely to affect the air quality of the receiving environment.

2.1 Wind Direction and Speed

Dust particulate matter can be linked with wind direction and speed. Wind direction and speed are the primary factors that affect dust generation and determine where it will be deposited (Patra *et al*., 2016). For the project site, the south-westerly and north-easterly prevailing winds have been identified as the most significant determinants of the direction into which dust gets transported.

The preliminary results for the wind direction, speed and number of events during the periods between 29/10/2019 to 26/11/2019 (**Error! Reference source not found.**) and 27/11/2019 to 19/12/2019 (FIGURE 5) are indicated in wind roses. The results indicate the dominant wind from west and west-south-south-west, with an average speed between 3 – 4 m/s (Figure 6).

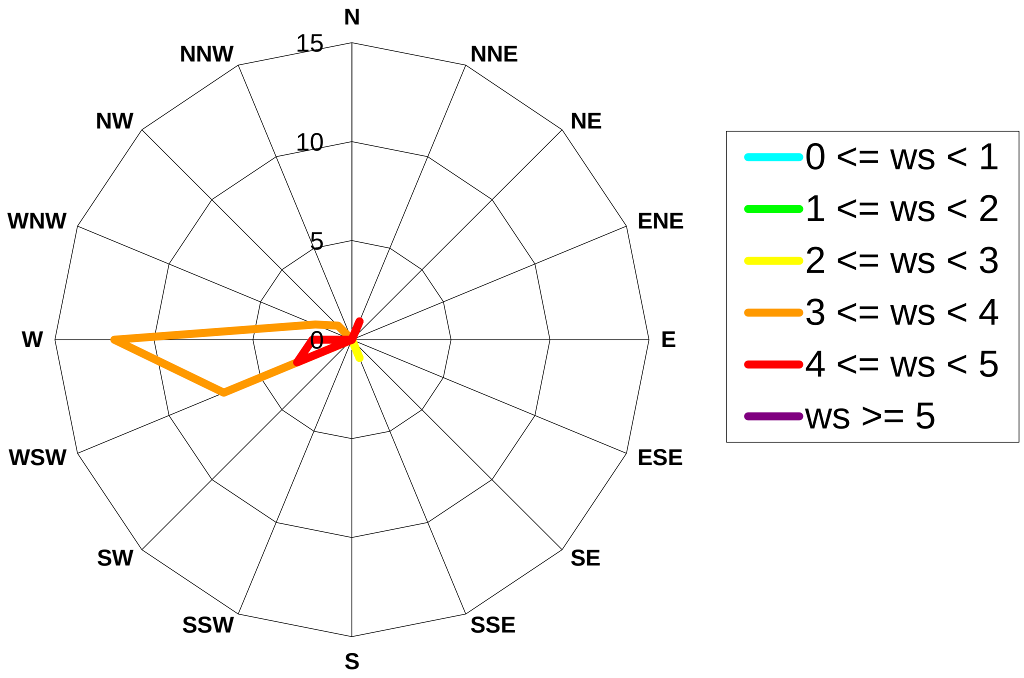

FIGURE 4 – NUMBER OF WIND EVENTS, DIRECTION AND SPEED BETWEEN OCTOBER AND NOVEMBER 2019

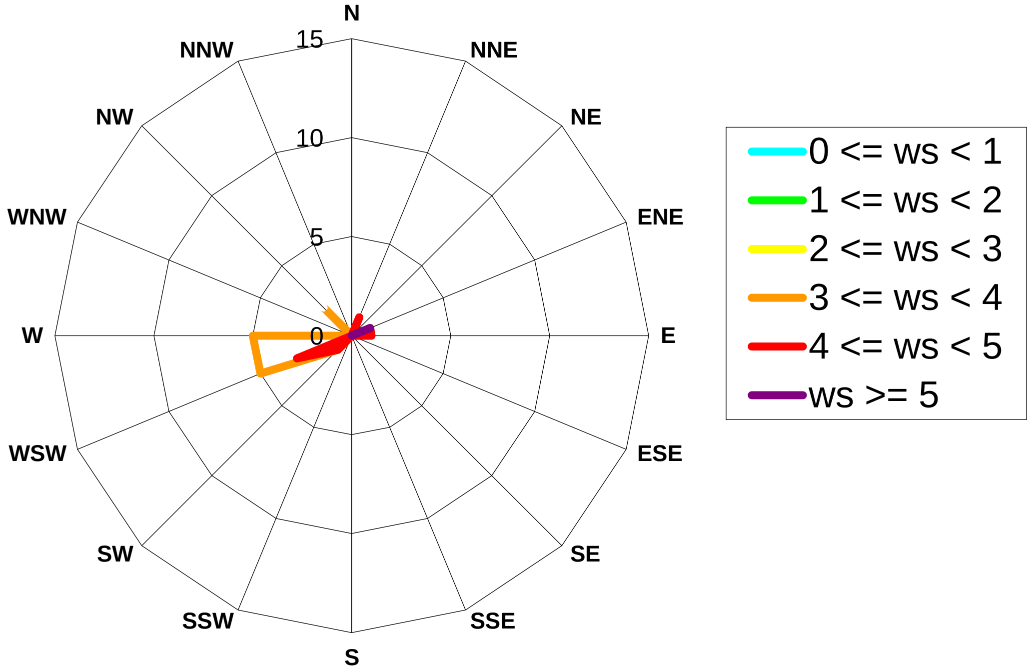

FIGURE 5 – NUMBER OF WIND EVENTS, DIRECTION AND SPEED BETWEEN NOVEMBER AND DECEMBER 2019

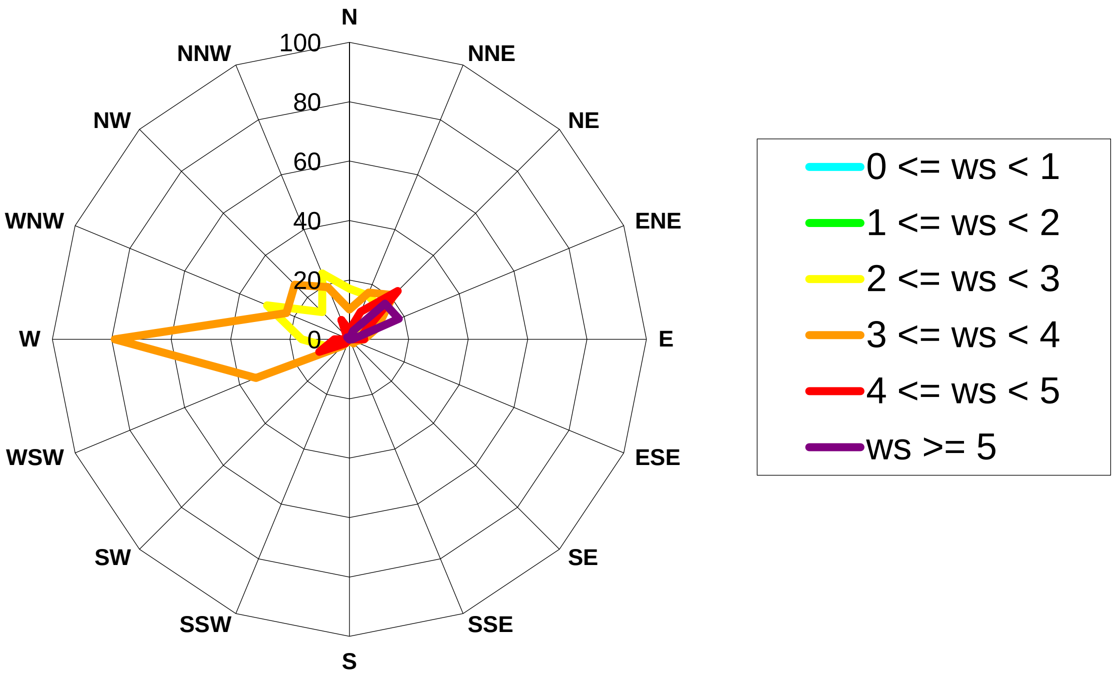

FIGURE 6 – OVERALL WIND SPEED, DIRECTION AND NUMBER EVENTS FROM APRIL 2018 TO DECEMBER 2019

2.2 Rainfall

Rainfall can have a direct positive effect on ambient air quality, for example washing out water-soluble pollutants and particulate matter (Petavratzi *et al*., 2005). It also suppresses dust by wetting dust-generating surfaces, consequently, lower depositional dust is expected during the rainy season and/or events when compared to a dry period.

2.3 Topographic

Topographic features such as slope angle, valley orientation and regional mountains can induce wind speed and direction (Patra *et al*., 2016). For example, the slope of the terrain can have an influence on the anabatic (moving upward) and katabatic winds (moving down-slope). The surrounding environment for Lepidico site has topographic features such as valleys, slopes and mountains (including regional mountains) that could influence the air quality around the area. These topographic features can act as natural funnels and increase wind speed and possibly change the wind direction.

3 ENVIRONMENTAL MONITORING

3.1 Air Quality Monitoring

All of the dust measurements from the depositional dust monitoring stations, as measured between November 2019 and January 2020, was below the SANS dust fallout limit of 600 mg/m²/day, as indicated by the dotted red line (Figure 7). During this period, there are no significant differences in the dust fallout across the monitoring stations over the months. To date, the highest dust fallouts recorded per monitoring period were: 572 mg/m^3/day (AQ-02) for November 2019; 185 mg/m^3/day (AQ-04) in December 2019; and 183 mg/m^3/day (AQ-01) in January 2020. Monitoring of depositional dust will continue, in order to understand the baseline dust emissions and potential main sources of dust emissions across the site over time, which will allow a data set to be compiled for future reference.

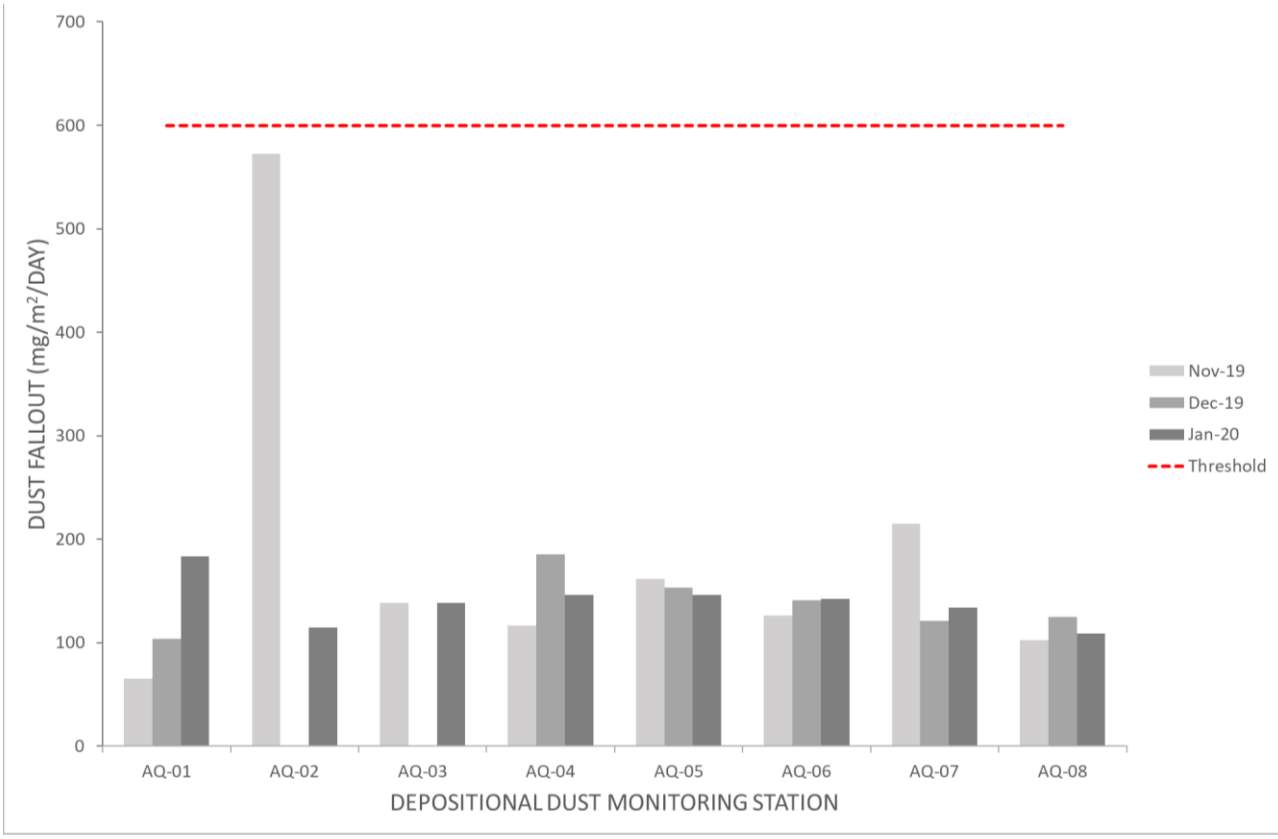

FIGURE 7 – DEPOSITIONAL DUST MONITORING RESULTS UNTIL JANUARY 2020. THE RED DOTTED LINE INDICATES THE RESIDENTIAL THRESHOLD VALUE

3.2 CLIMATIC DATA

ECC has analysed the historical wind data as from April 2018 until December 2019 as indicated in a preliminary wind rose in Figure 6. No data was available for the month of January 2020. ECC will continue to analyse the historical wind data and do an interpretation on monthly basis.

3.3 BOREHOLE WATER LEVEL MONITORING

During this period, the borehole water level for the three production boreholes was measured with a dip meter (Figure 8). The results were as follows: 22.7 m (WW204831), 18.3 m (WW204832) and 21.2 m

(WW204831) below the ground level including the collar height which was 29 cm for all the boreholes. ECC will continue to measure the borehole water level and quality once permission has been granted by the client to continue.

Field observation revealed that the makeshift rope system, currently being used to monitor the borehole water level is time-consuming and could possible contaminate the underground water (FIGURE 9), however, this requires further investigation.

The borehole water consumption data were not received for January. Figure 10 indicates the results from July to December 2019, with high water consumption observed at WW204831 between October to November 2019.

FIGURE 8 – A PHOTOGRAPH SHOWING PERSONNEL FROM ECC MEASURING THE BOREHOLE WATER LEVEL WITH A DIP METER

FIGURE 9 – PHOTOGRAPHS SHOWING THE BOREHOLE WATER LEVEL MEASUREMENT BY USING A MAKESHIFT ROPE STYSTEM

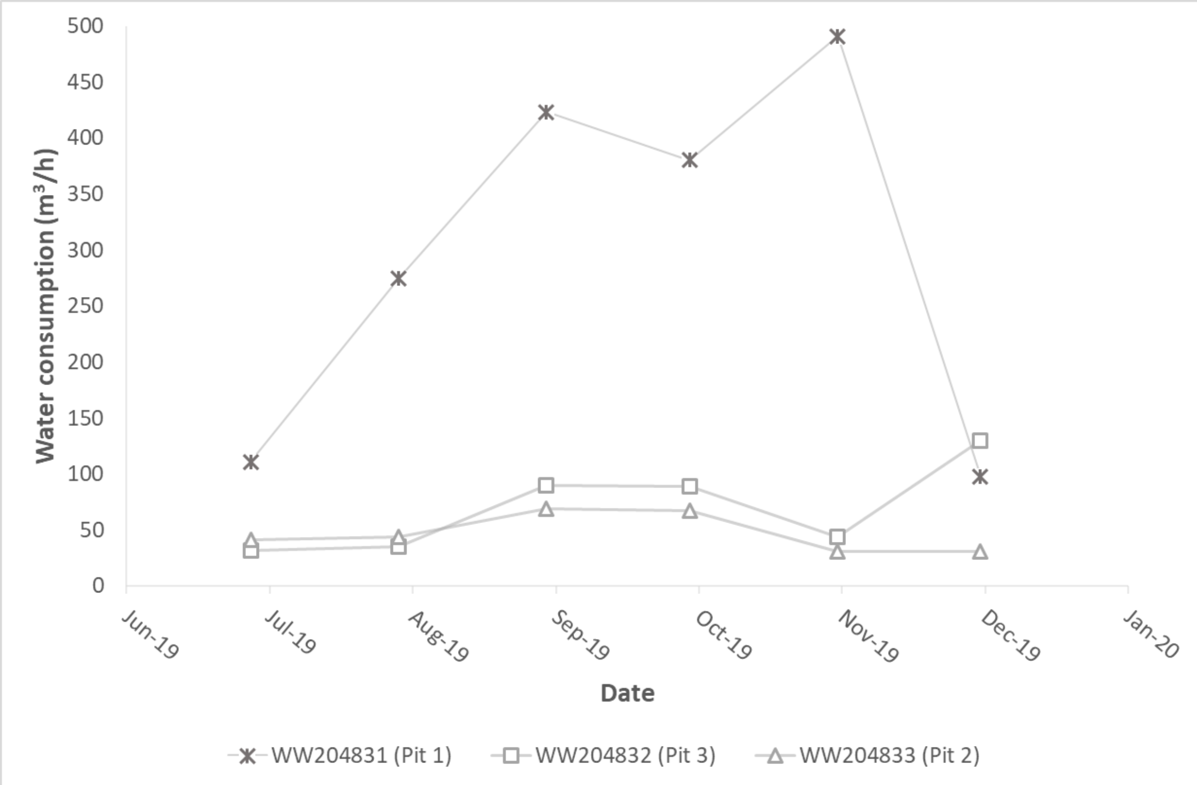

FIGURE 10 – A GRAPH SHOWING THE WATER CONSUMPTION AT LEPIDICO

4 CONCLUSION AND RECOMMENDATION

During the past three (3) months, the dust fallout results from Lepidico did not exceed the SANS dust fallout limits for residential areas. There are no significant differences in dust fallout levels across the dust monitoring stations during this period, when compared to the previous months. However, in November 2019, the dust fallout levels were slightly higher when compared to other months.

The weather data should be submitted to ECC on a monthly basis to ensure proper analyses of the dust fallout data. No weather data was made available for January 2020.

The borehole water levels were measured for the first time during this period, and ECC will continue monitoring the water level and start measuring groundwater quality once the official permission has been granted by the client.

Environmental monitoring will continue every month until March or April 2020, however, we recommend monitoring should continue until October 2020 (and/or beyond) in order to understand the seasonal and spatial environmental variation better.

5 REFERENCES

ASTM D1739-98. (2017), Standard Test Method for Collection and Measurement of Dustfall (Settleable Particulate Matter), *ASTM International*, West Conshohocken, PA, 2017, http://www.astm.org/cgi-bin/resolver.cgi?D1739

Patra, A. K., Gautam, S., & Kumar, P. (2016). Emissions and human health impact of particulate matter from surface mining operation—a review. *Environmental Technology & Innovation*, 5, 233-249.

Petavratzi, E., Kingman, S., & Lowndes, I. (2005). Particulates from mining operations: A review of sources, effects and regulations. *Minerals Engineering*, 18(12), 1183-1199.