



## REPORT

# Noise and Air Quality Impact Assessment

## *Ardmore Phosphate Rock Project - Start-up Operation*

Submitted to:

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25 July 2018



## Executive Summary

Golder Associates Pty Ltd (Golder) has prepared this Noise and Air Quality Impact Assessment Report on behalf of Centrex Metals Limited (Centrex) to support an amendment application to an Environmental Authority (EA). Centrex propose to develop a high-grade phosphate deposit located at Ardmore, approximately 128 km south of the city of Mt Isa and 23 km west of the town of Dajarra in North West Queensland. This is referred to as the Ardmore Phosphate Rock Project.

Centrex was transferred ownership of the Ardmore Mining Lease (ML 5542) in June 2017. ML 5542 is 2,209 hectares, with the target high-grade phosphorite deposit located within two separate areas, the 'Northern Zone' and the 'Southern Zone'. The application is for the Start-up Operation only (referred to as 'the Project'), which is a small-scale pit and demonstration plant to be constructed within the Southern Zone of the Mining Lease 5542 (ML5542). The operation will target to extract up to 70,000 t of ore using shallow open-cut strip mining over a 2 – 3 month period.

Centrex proposes to undertake preliminary, small-scale mining and processing operations (Start-up Operation) prior to a decision to develop a full-scale operation.

As part of the EA application, noise and air quality impact assessments were conducted with objectives for the site determined in accordance with Department of Environment and Heritage Protection (DEHP) Guidelines, *Application requirements for activities with noise impacts* and *Application requirements for activities with impact to air*, respectively.

Sources of noise and dust emission from the proposed Start-up Operation were identified and the potential impacts of these on the nearest sensitive receptor, approximately 15 km from the site, was quantitatively assessed.

The noise and air assessments indicate that there is a low risk of impacts from the site activities at the nearest sensitive receptor and it is expected that the project would comply with the relevant criteria.

Nevertheless, best management practices to mitigate noise and dust impacts have been recommended and it is intended that these be included in an Environmental Management Plan (EMP).

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## 1.0 INTRODUCTION

Golder Associates Pty Ltd (Golder) has prepared this Noise and Air Quality Impact Assessment Report on behalf of Centrex Metals Limited (Centrex) to support an amendment application to an Environmental Authority (EA). Centrex propose to develop a high-grade phosphate deposit located at Ardmore, approximately 128 km south of the city of Mt Isa and 23 km west of the town of Dajarra in North West Queensland (Figure 1). This is referred to as the Ardmore Phosphate Rock Project.

Centrex was transferred ownership of the Ardmore Mining Lease (ML 5542) in June 2017. ML 5542 is 2,209 hectares, with the target high-grade phosphorite deposit located within two separate areas, the 'Northern Zone' and the 'Southern Zone'. The application is for the Start-up Operation only (referred to as 'the Project'), which is a small-scale pit and demonstration plant to be constructed within the Southern Zone of the Mining Lease 5542 (ML5542). The operation will target to extract up to 70,000 t of ore using shallow open-cut strip mining over a 2 – 3 month period.

To proceed with mining activities on ML5542 Centrex must apply for an amendment to the existing Environmental Authority (EA) BRMN0037 under the *Environmental Protection Act 1994* (Qld) (EP Act). This report provides a description of the baseline environment and a technical assessment of potential noise and air quality impacts to support the EA application for the Start-up Operation.

## 2.0 LEGISLATIVE FRAMEWORK

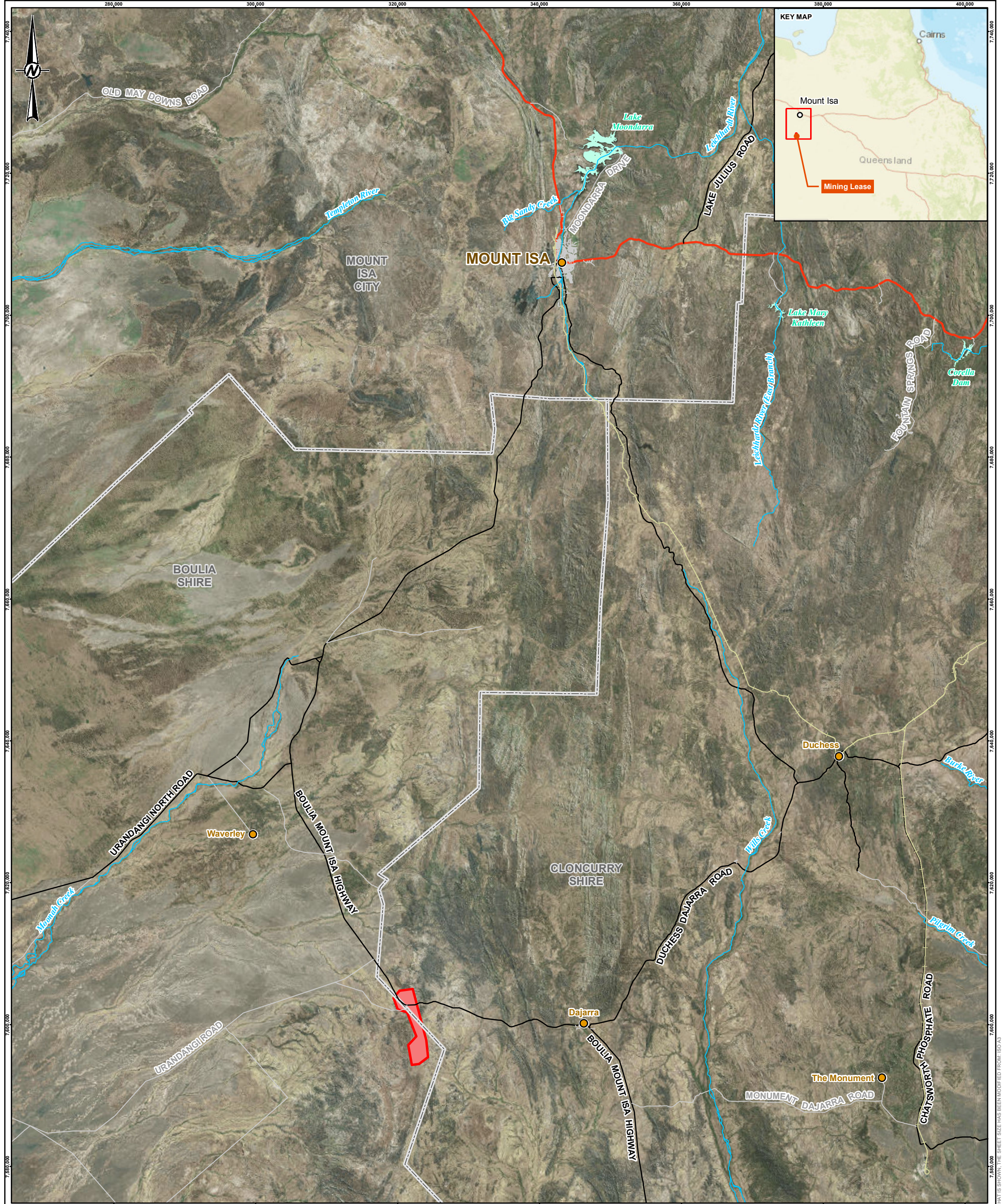
The relevant legislation for the management of noise and air emissions from mining activities on a Mining Lease are provided below.

### 2.1 Noise

In Queensland, activities that are likely to cause noise impacts are regulated under the EP Act, EP Regulation and the Environmental Protection (Noise) Policy 2008 (EPP Noise). This assessment has been conducted in accordance with the requirements of the DEHP Guideline, *Application requirements for activities with noise impacts* (DEHP, updated March 2017).

The EPP Noise identifies the environmental values for the acoustic environment and outlines the acoustic quality objectives for different types of sensitive receptors. The environmental values to be enhanced or protected under this policy are:

- The qualities of the acoustic environment that are conducive to protecting the health and biodiversity of ecosystems; and
- the qualities of the acoustic environment that are conducive to human health and wellbeing, including by ensuring a suitable acoustic environment for individuals to do any of the following:
  - (i) sleep
  - (ii) study or learn
  - (iii) be involved in recreation, including relaxation and conversation; and
- the qualities of the acoustic environment that are conducive to protecting the amenity of the community



LEGEND

- Locality
- Watercourses
- Road Type
  - Highway
  - Major Road
  - Local Road
  - Railway
- Local Government Area
- Reservoirs

Centrex Mining Lease  
ML5542

Coordinate System: GDA 1994 MGA Zone 54  
Projection: Transverse Mercator  
Datum: GDA 1994  
CLIENT  
CENTREX PHOSPHATE PTY LTD



FOR DISCUSSION PURPOSES ONLY  
**DRAFT**

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| 1:500,000 at A3 |            |    |    |    |
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| APPROVED        | JR         |    |    |    |

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REFERENCE(S)  
Locality, Mining Lease: © State of Queensland (DNRM) 2018  
Roads, Watercourses, Local Government Area: © State of Queensland (Department of Natural Resources and Mines - DNRM) 2017  
Reservoirs: © State of Queensland (DNRM) 2016

PROJECT  
CENTREX ARDMORE PHOSPHATE

PROJECT LOCATION

|             |         |      |        |
|-------------|---------|------|--------|
| PROJECT NO. | CONTROL | REV. | FIGURE |
| 1782517     | 015     | A    | 1      |

Table 1 provides the acoustic quality objectives in this EPP Noise relevant to this assessment for the site. EPP Noise does not provide night-time criteria outside of dwellings, which can be useful when screening for noise impacts using noise attenuation calculations. To include an assessment for the health and wellbeing in relation to sleep, an adjustment of 10 dB<sup>1</sup> has been made by Golder to the indoor criteria to allow for noise reduction through a typical dwelling facade. The assessment of potential impacts to terrestrial ecology within protected areas (critical habitat) has not been undertaken as part of this report.

**Table 1: Project noise criteria**

| Sensitive Receptor                                                                                                                                            | Time of day         | Acoustic quality objectives (measured at the receptor) dB(A)                 |                          |                         | Environmental value                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|------------------------------------------------------------------------------|--------------------------|-------------------------|-----------------------------------------------------------|
|                                                                                                                                                               |                     | L <sub>Aeq,adj,1hr</sub>                                                     | L <sub>A10,adj,1hr</sub> | L <sub>A1,adj,1hr</sub> |                                                           |
| Dwelling (for outdoors)                                                                                                                                       | Daytime and evening | 50                                                                           | 55                       | 65                      | Health and wellbeing                                      |
| Dwelling (for indoors)                                                                                                                                        | Daytime and evening | 35                                                                           | 40                       | 45                      | Health and wellbeing                                      |
|                                                                                                                                                               | Night-time          | 30 (+10 dB for outdoor)                                                      | 35 (+10 dB for outdoor)  | 40 (+10 dB for outdoor) | Health and wellbeing, in relation to the ability to sleep |
| Protected area, or an area identified under a conservation plan under the <i>Nature Conservation Act 1992</i> as a critical habitat or area of major interest | Anytime             | The level of noise that preserves the amenity of the existing area or place. |                          |                         | Health and biodiversity of ecosystems                     |

## 2.2 Air

In Queensland, environmental impacts associated with air emissions are regulated under the EP Act, EP Regulation and the Environmental Protection (Air) Policy 2008 (EPP Air). This assessment has been conducted in accordance with the requirements of the DEHP Guideline, *Application requirements for activities with impact to air* (DEHP, updated March 2017).

<sup>1</sup> EPA NSW guideline, *Noise guide for local government* (EPA NSW 2013) recommends an adjustment of 10 dB for attenuation across a building façade with an open window.

The EPP Air identifies the environmental values for the air environment and outlines the air quality objectives for different types of sensitive receptors. The environmental values to be enhanced or protected under this policy are:

- the qualities of the air environment that are conducive to protecting the health and biodiversity of ecosystems; and
- the qualities of the air environment that are conducive to human health wellbeing; and
- the qualities of the air environment that are conducive to protecting the aesthetics of the environment, including the appearance of buildings, structures and other property; and
- the qualities of the air environment that are conducive to protecting agricultural use of the environment.

A dust deposition guideline of 120 mg/m<sup>2</sup>/day is widely used in Queensland to avoid the impacts of nuisance dust. This guideline is not defined in the EPP Air, however it has been recommended by the DEHP as a suitable design objective. The DEHP recommendation is based on the EPA Victoria guideline of 4 g/m<sup>2</sup>/month, as described in *Protocol for Environmental Management: Mining and Extractive Industries* (EPA VIC 2007).

Table 2 provides the Project air quality criteria based on the EPP Air environmental objectives and recommendations from the DEHP for dust deposition.

**Table 2: Project air quality criteria**

| Indicator         | Air quality objective      | Period   | Days             | Environmental value  |
|-------------------|----------------------------|----------|------------------|----------------------|
| PM <sub>10</sub>  | 50 µg/m <sup>3</sup>       | 24 hours |                  | Health and wellbeing |
| PM <sub>2.5</sub> | 25 µg/m <sup>3</sup>       | 24 hours | 5 days each year | Health and wellbeing |
| PM <sub>2.5</sub> | 8 µg/m <sup>3</sup>        | 1 year   |                  | Health and wellbeing |
| Dust deposition   | 120 mg/m <sup>2</sup> /day | 1 month  | NA               | NA                   |

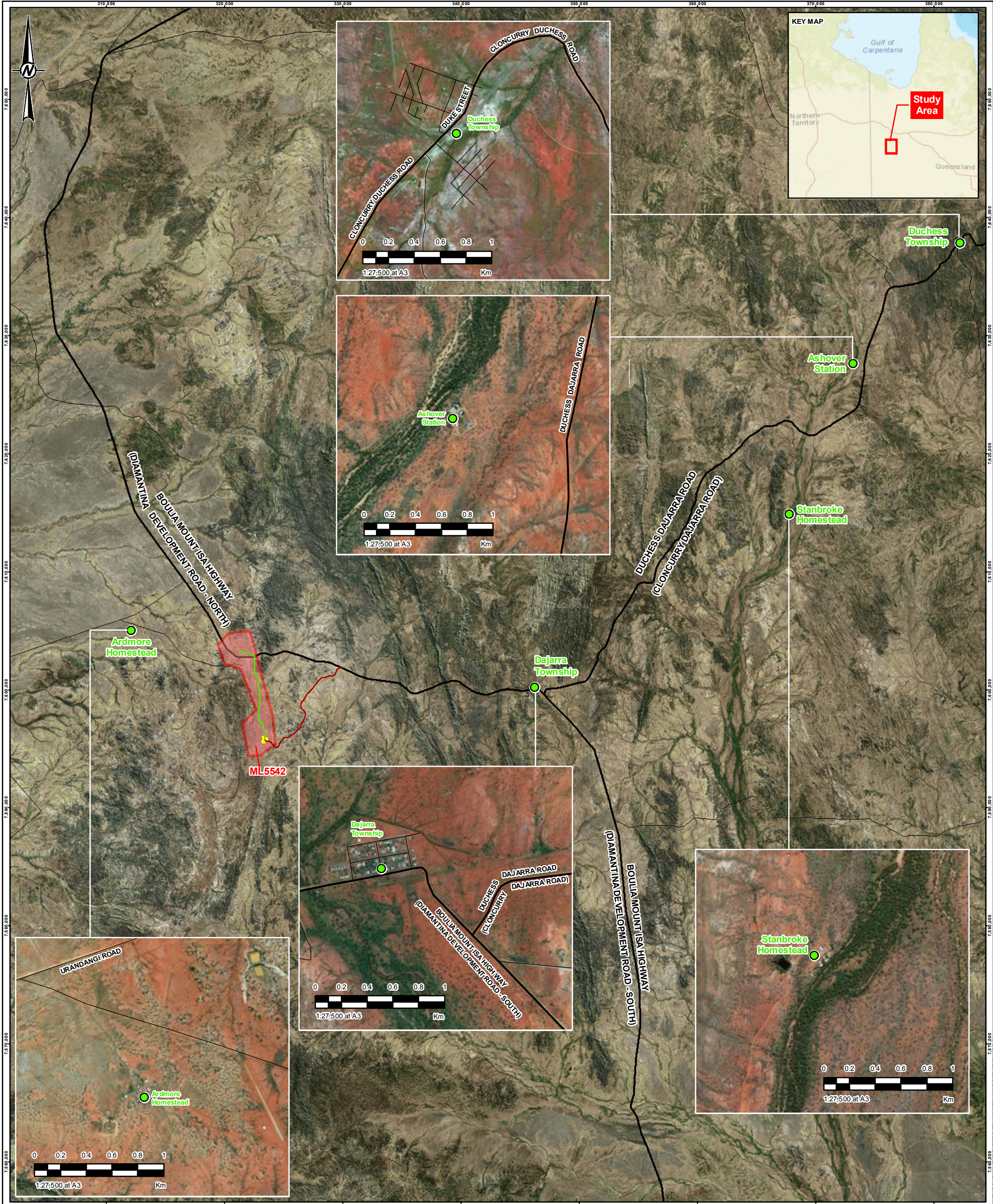
### 3.0 SENSITIVE RECEPTORS

The EPP Noise states that a sensitive receptor is a person, area or structure or environmental value that may be harmed at an exposure point such as a site visitor, dwelling or area used by people, a protected area, or an area identified under a conservation plan as a critical habitat or an area of major interest under the Nature Conservation Act 1992.

The closest sensitive receptor is the Ardmore homestead (Ardmore), located approximately 15 km from the proposed Start-up Operation site. The site is located 23 km west of the town of Dajarra (Figure 2).

### 4.0 PROJECT DESCRIPTION

Centrex propose to undertake a Start-up Operation to process ore on a small scale to obtain phosphate rock concentrate samples for marketing, optimising plant configuration, developing design parameters and enhancing recovery (Figure 3).



- LEGEND**
- Sensitive Receptors
  - Water Pipeline and Access Track
  - Roads
  - Start-up Operation Access Track
  - Start-up Operation
  - Centrex Mining Lease
  - ML5542

Coordinate System: GDA 1994 MGA Zone 54  
Projection: Transverse Mercator  
Datum: GDA 1994

CLIENT

CENTREX PHOSPHATE PTY LTD

CONSULTANT



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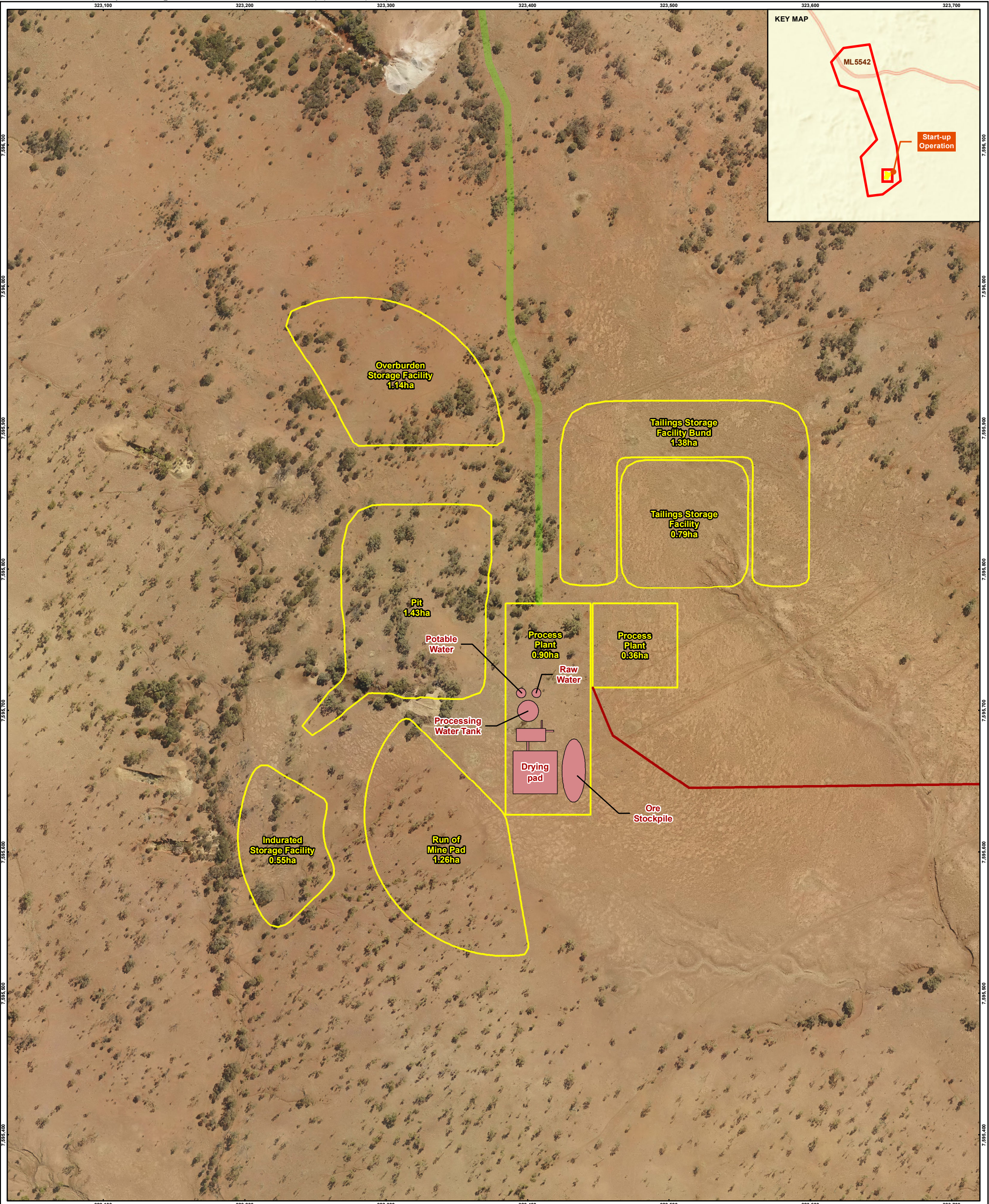
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Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

**REFERENCE(S)**  
Sensitive Receptors: © State of Queensland (Department of Natural Resources, Mines and Energy) 2018  
Roads: © State of Queensland (DNR) 2017.  
Mining Lease: © State of Queensland (DNR) 2018 .  
Start-up Operation, Water Pipeline and Access Track, Start-up Operation Access Track: Provided by Centrex 2018.

PROJECT  
CENTREX ARDMORE PHOSPHATE

TITLE  
**SENSITIVE RECEPTORS**

|             |         |      |        |
|-------------|---------|------|--------|
| PROJECT NO. | CONTROL | REV. | FIGURE |
| 1782517     | 024     | A    | 2      |



LEGEND

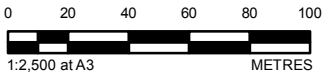
- Water Pipeline and Access Track
- Start-up Operation Access Track
- Start-up Operation
- Centrex Mining Lease
- ML5542
- Processing Plant

FOR DISCUSSION PURPOSES ONLY

DRAFT

Coordinate System: GDA 1994 MGA Zone 54  
Projection: Transverse Mercator  
Datum: GDA 1994

CLIENT  
CENTREX PHOSPHATE PTY LTD



REFERENCE(S)  
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Start-up Operation, Water Pipeline and Access Track, Start-up Operation Access Track: Provided by Centrex 2018.  
Processing Plant: Golder 2018.  
Mining Lease: © State of Queensland (DNRM) 2018

PROJECT  
CENTREX ARDMORE PHOSPHATE

CONSULTANT



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| APPROVED   | JR        |

TITLE  
START-UP OPERATION CONCEPTUAL LAYOUT

|             |         |      |        |
|-------------|---------|------|--------|
| PROJECT NO. | CONTROL | REV. | FIGURE |
| 1782517     | 015     | E    | 3      |

If approved to proceed, the Start-up Operation will extract 70,000 tonnes of ore using shallow open-cut mining over a 2 – 3 month period. The Start-up Operation will include the following:

- Small scale pit
- Overburden storage and indurated storage facility
- Run of Mine (ROM) pad
- Tailings storage facility
- Processing plant (crushing, screening, drying pad)
- Office
- An onsite bore to supply water
- An onsite generator to supply power

The Start-up Operation will require approximately 12 people to be employed on a short-term basis. Concentrate will be loaded onto containers and trucked to Cloncurry for export by rail to Townsville.

## 5.0 LOCAL ENVIRONMENT

The site is located in the semi-arid zone of north-west of Queensland, approximately 128 km south of the city of Mt Isa and 130 km east of the Northern Territory Border and 450 km south of the Gulf of Carpentaria. The Bureau of Meteorology (BOM) weather station at The Monument Airport (ID: 037034) is located approximately 75 km east at the Phosphate Hill mine site and is the closest BOM station to obtain meteorological data. The data from The Monument Airport station is considered a suitable representation of the local meteorology at the site for the purposes of this assessment. A summary of the meteorological conditions (wind speed, wind direction, rainfall and temperature) and existing acoustic and air environment is provided below.

### 5.1 Topography

The Project lies within range country on the eastern margin of the Barkly Tableland. Relief throughout the area is low, though rugged with nearby hills being up to 50 m above the valley bases. The surface overlying both the north and south deposits is relatively flat with the highest point of 350 mAHD being in the southern area and the lowest 310 mAHD in the north.

The region is best described as sparsely vegetated with low, very open woodland on gravelly plains and slightly undulating areas primarily around rock outcrops. Denser vegetation occurs along ephemeral watercourses, however all areas have been significantly impacted by cattle grazing and pest plant species invasion is evident, particularly throughout all riparian areas.

### 5.2 Wind Speed and Direction

The seasonal wind patterns are displayed as wind rose plots (WRP) for each season over a combined four-year period (2012 – 2015). Each WRP details the wind speed and direction that occurred in that particular period (Figure 4).

A summary of the meteorological data measured is presented below:

- The prevailing wind direction for Autumn, Winter and Spring is south to south easterly.
- The prevailing wind directions for Summer are north east and southerly.
- The average wind speed varies marginally across the seasons from a low of 3.7 m/s in winter to a high of 4.3 m/s in summer.

- Strong winds (above 8.8 m/s) are infrequent and more likely to occur in Summer.
- Calm winds occur at a low frequency of 1.5% in Summer and peak in Winter at 4.1%.

The wind rose plot indicates that the prevailing wind condition is blowing from a south, south-easterly direction, towards the nearest sensitive land use.

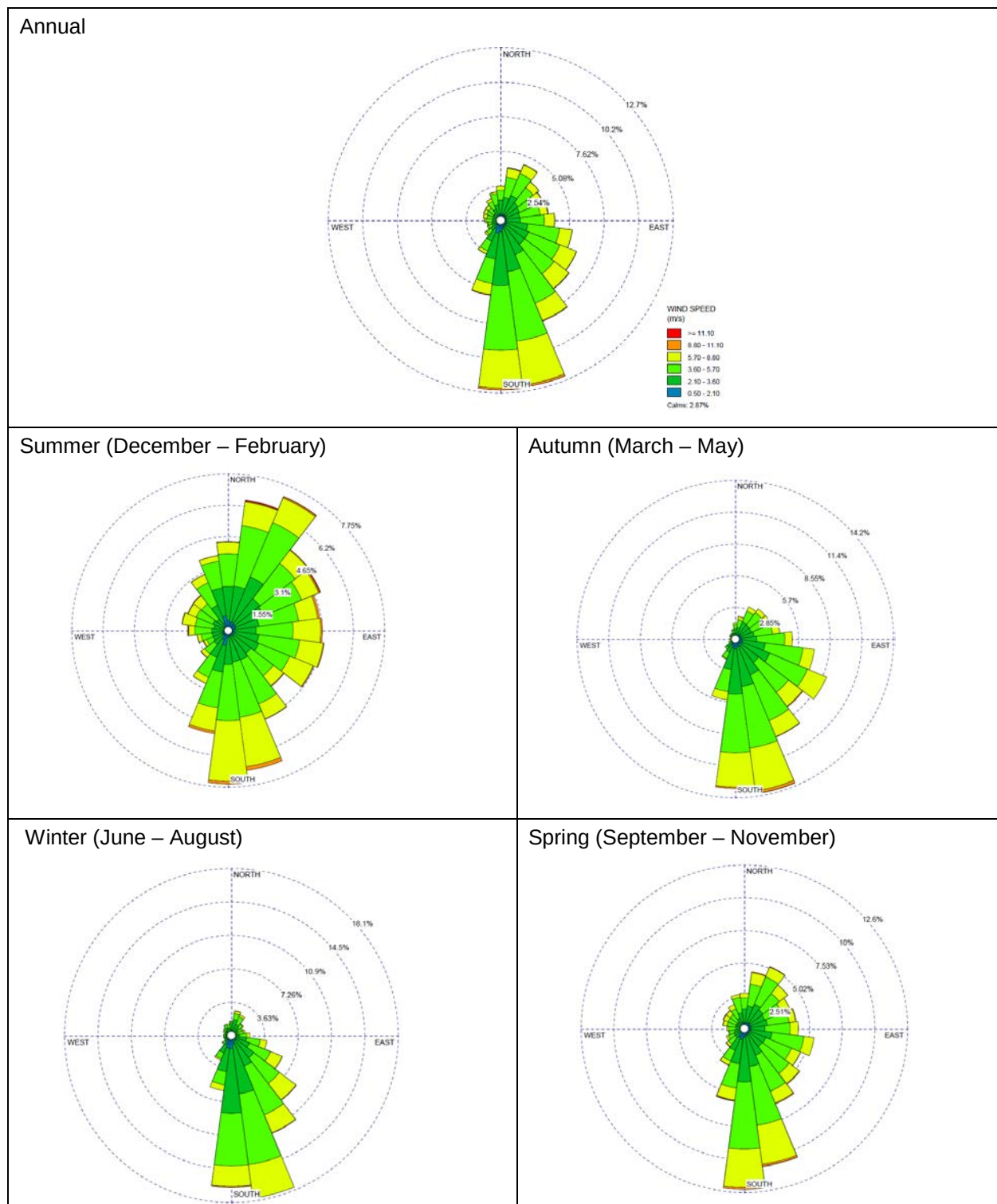


Figure 4: Wind rose plots - BOM Monument Airport Station (2012 – 2015)

### 5.3 Rainfall

The hourly rainfall data obtained from the BOM Station (ID: 037034) over a four-year period (2012 – 2015) was consolidated into monthly totals for each year. The monthly rainfall data is presented in Figure 5.

The data show heaviest rainfalls occurring between November and March of each year with an average of over 30 mm in every month. December averaged the highest monthly rainfall of 84 mm over the four-year period.

June through to October had consistently low rainfall across the four years of data, with each of these months recording zero rainfall at least once between 2012 and 2015. The lowest average rainfall month was August with 0.8 mm.

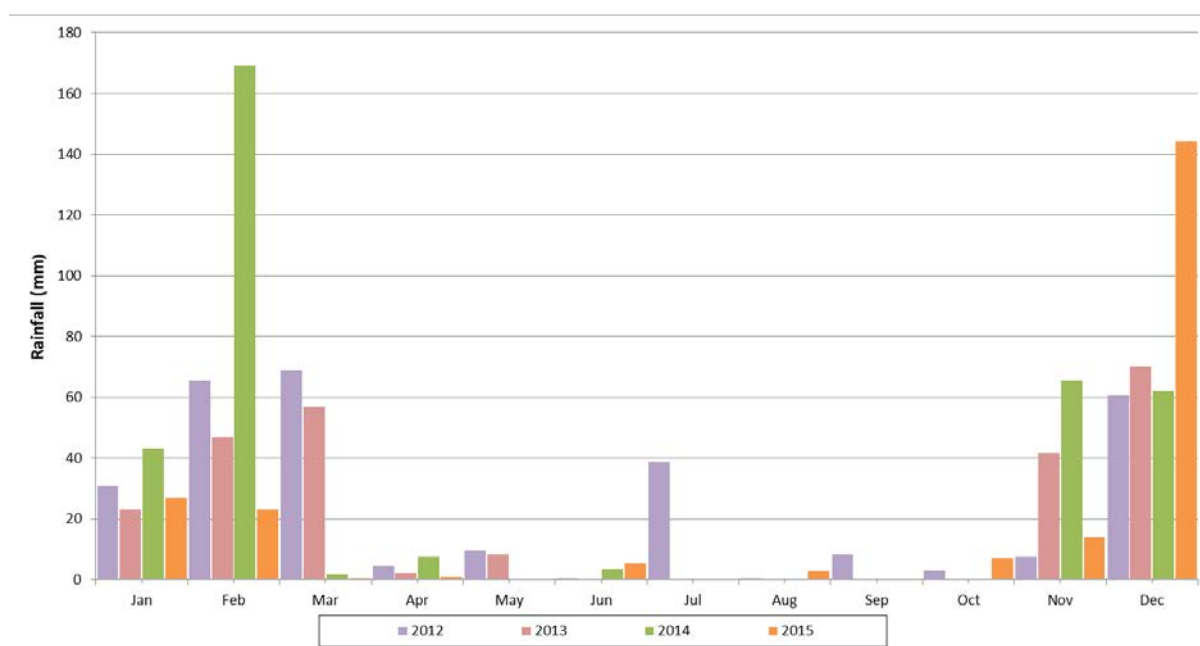


Figure 5: Rainfall statistics - BOM Monument Airport Station (2012 – 2015)

### 5.4 Temperature

The hourly temperature data obtained from the BOM Station (ID: 037034) over a four-year period (2012 – 2015) was consolidated into monthly averages, maximums and minimums. This is presented in Figure 6.

The warmest average monthly temperatures were found from November to February, all above 30°C. January was consistently warmest month over the four-year data period, averaging 31.8°C.

The winter months of June, July and August had the lowest temperatures during 2012 to 2015, averaging 16.5°C, 15.9°C and 18.0°C respectively.

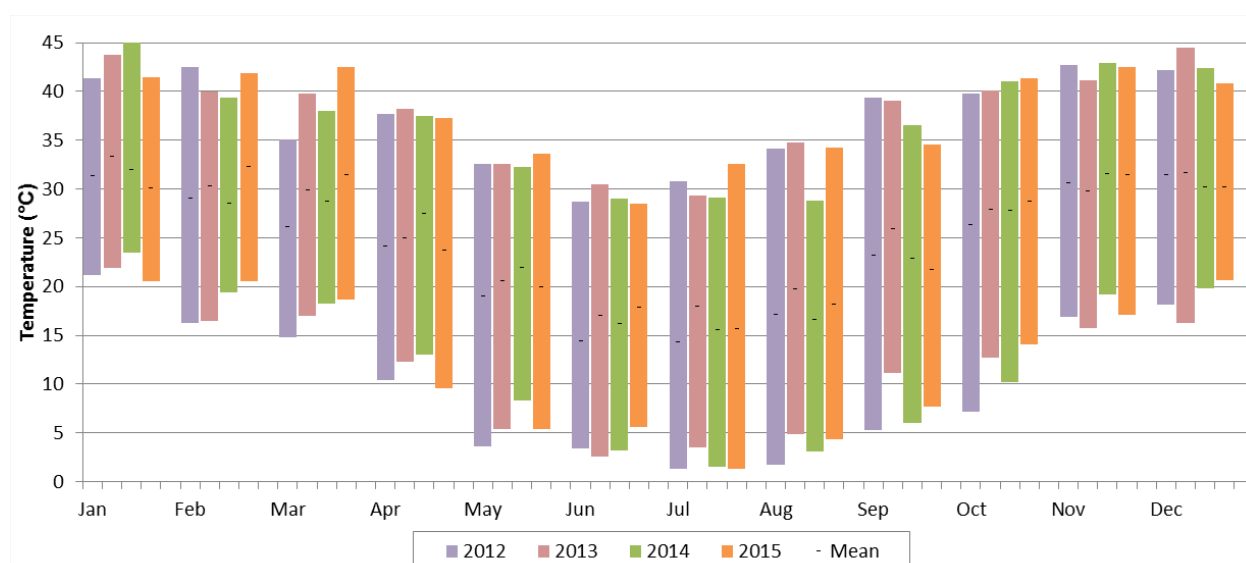


**Figure 6: Temperature statistics - BOM Monument Airport Station (2012 – 2015)**

## 5.5 Acoustic Environment

The site is located in a remote rural area and no significant sources of existing noise have been identified for the Project. The Diamantina Development Road ('Highway') traverses the northern section of the Mining Lease area, however traffic on this road is not considered a significant source of existing noise at the site. Vegetation in the area is sparse, and ecological noise (i.e., birds, insects) is likely to be minimal.

The closest sensitive receptor is the Ardmore homestead (Ardmore), located approximately 15 km from the proposed Start-up Operation site. Noise sources that may contribute to existing noise at Ardmore include the adjacent airstrip (1.5 km west), and general anthropogenic activities within and surrounding the homestead.

Due to the remote location of the Project, background noise monitoring and noise modelling has not been considered necessary for this assessment, as was verbally agreed with DEHP Cairns (personal communication: Robert Pettit, on 18 July 2017). Background noise measurements were recorded at Ardmore however the results were corrupted after monitoring took place. No background measurements from Ardmore are provided in this report.

Representative background noise measurements for the assessment have been sourced from the publicly available environmental impact assessment for the Jemena Northern Gas Pipeline, being constructed between Tennant Creek and Mount Isa (Jemena 2016). Background noise monitoring was conducted for two weeks by Air Noise Environment (ANE), in accordance with Australian Standard 'AS 1055 Acoustics – Description and Measurement of Environment Noise,' and at locations along the proposed pipeline (MP1 – MP7). Measurement locations were taken at remote sensitive receivers along the proposed Jemena pipeline, from Tennant Creek to Mount Isa.

Table 3 provides the results of the noise monitoring programme in the Tennant Creek to Mount Isa area, measured during April – May 2016. Noise levels in Table 3 are typical of rural areas with low background noise and are considered a suitable representation of background noise levels for the Ardmore Start-up Operation.

**Table 3: Summary of background noise levels (representative locations)**

| Location                                                  | Median $L_{A90}$ , 1 hour |                      |                    |
|-----------------------------------------------------------|---------------------------|----------------------|--------------------|
|                                                           | Day (7am – 6pm)           | Evening (6pm – 10pm) | Night (10pm – 7am) |
| MP1                                                       | 21                        | 27                   | 18                 |
| MP2                                                       | 22                        | 29                   | 33                 |
| MP3                                                       | 27                        | 49                   | 28                 |
| MP4                                                       | 29                        | 34                   | 29                 |
| MP5                                                       | 33                        | 37                   | 30                 |
| MP6                                                       | 29                        | 34                   | 31                 |
| MP7                                                       | 34                        | 39                   | 38                 |
| <b>Average</b>                                            | <b>30</b>                 | <b>42</b>            | <b>32</b>          |
| Start-up Operation<br>Project Criteria (refer to Table 1) | 50                        | 50                   | 40                 |

## 5.6 Air Environment

Existing air quality is considered to be characteristic of a remote rural area, with no significant anthropogenic or ecological sources of air quality emissions at the site. Due to the semi-arid climate, wind-blown dust is expected to be generated from exposed surfaces typical of the local area.

Bushfires are regarded as exceptional events and their potential influence on existing air quality has not been included in the assessment.

The closest sensitive receptor is the Ardmore homestead (Ardmore), located approximately 15 km from the Start-up Operation. Air emission sources that may contribute to the air environment at this location include wind-blown dust from exposed surfaces and general anthropogenic activities within and surrounding the homestead.

Due to the remote location of the Project, dispersion modelling has not been considered necessary for this assessment, as was verbally agreed with DEHP Cairns (personal communication: Robert Pettit, on 18 July 2017). However, some background deposited dust concentration has been collected to characterise existing baseline conditions at the site.

### 5.6.1 Deposited Dust

Deposited dust is considered a good indicator of nuisance dust, and high concentrations are frequently associated with dust complaints from sensitive places. Site-specific deposited dust monitoring was conducted by Golder from September 2017 – March 2018.

Monitoring sites were selected in accordance with the requirements of Australian/New Zealand Standard AS/NZS 3580.1.1:2007 "Methods for Sampling and Analysis of Ambient Air. Part 1.1: Guide to Siting Air Monitoring Equipment". Monitoring locations are presented in Figure 7 and were selected to represent the

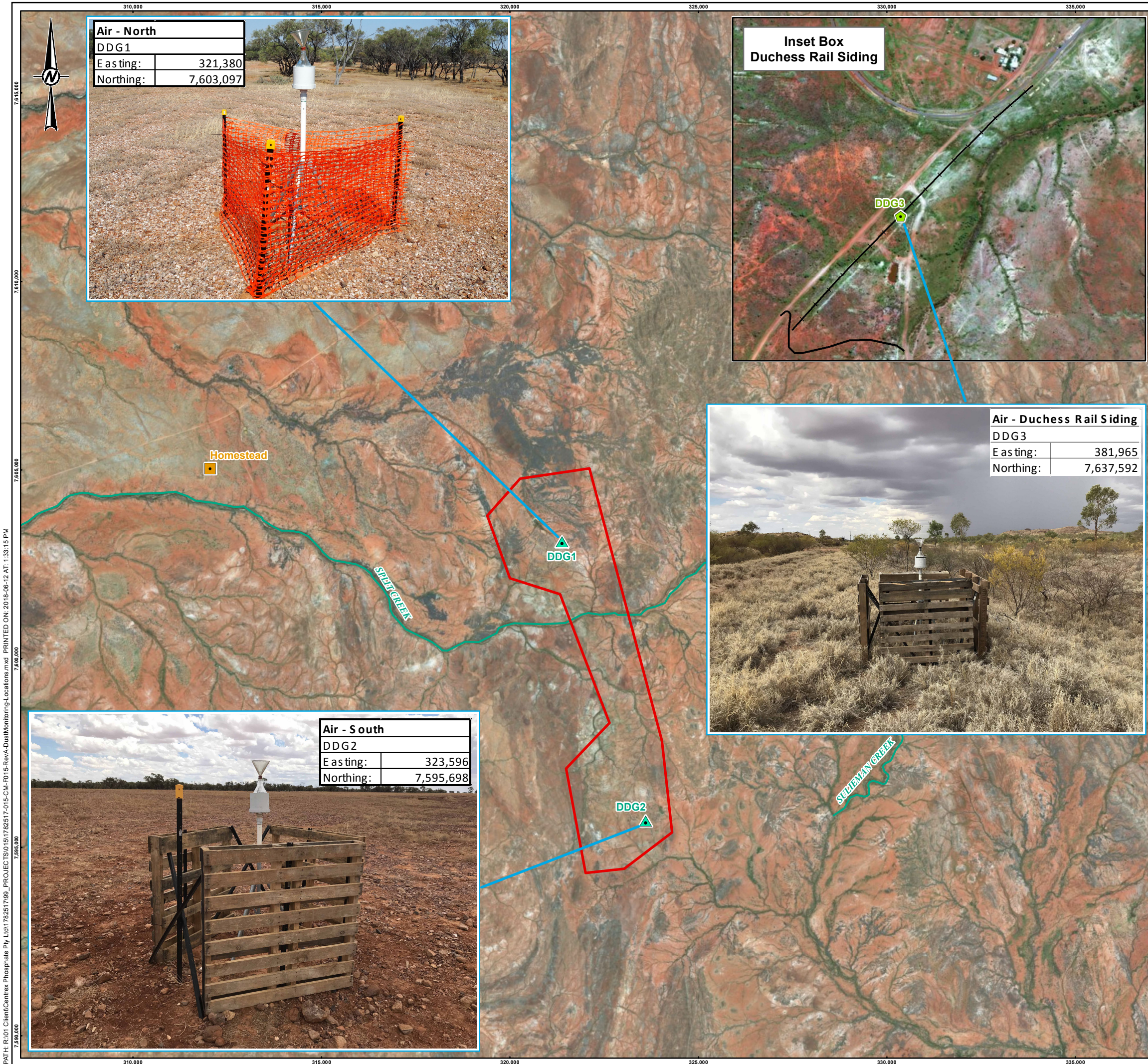
northern and southern zone mining areas. Monitoring was also conducted near the township of Duchess, at the rail siding line.

Sampling and analysis was conducted in accordance with Australian/New Zealand Standard AS/NZS 3580.10.1 "Determination of Particulate Matter - Deposited Matter - Gravimetric Method". Analysis was conducted by ALS Environmental (NATA Accreditation No. 825).

The results of the dust monitoring programme are presented in Table 4. Average dust concentrations were similar at each location and were measured between 20 – 30 mg/m<sup>2</sup>/day.

**Table 4: Dust deposit gauge results**

|                          | Start date | End date   | Insoluble solids (mg/m <sup>2</sup> /day) | Project criteria (mg/m <sup>2</sup> /day) |
|--------------------------|------------|------------|-------------------------------------------|-------------------------------------------|
| DDG 1<br>(Ardmore North) | 20/10/2017 | 21/11/2017 | 13                                        | 120                                       |
|                          | 22/11/2017 | 20/12/2017 | 17                                        |                                           |
|                          | 20/12/2017 | 19/1/2018  | 17                                        |                                           |
|                          | 19/01/2018 | 20/2/2018  | 57                                        |                                           |
|                          | 20/2/2018  | 21/3/2018  | 17                                        |                                           |
| DDG 1 (Average)          |            |            | <b>23</b>                                 |                                           |
| DDG 2<br>(Ardmore South) | 20/9/2017  | 20/10/2017 | 13                                        |                                           |
|                          | 20/10/2017 | 21/11/2017 | 3.3                                       |                                           |
|                          | 22/11/2017 | 20/12/2017 | 30                                        |                                           |
|                          | 20/12/2017 | 19/1/2018  | 33                                        |                                           |
|                          | 19/01/2018 | 20/2/2018  | 13                                        |                                           |
|                          | 20/2/2018  | 21/3/2018  | 20                                        |                                           |
| DDG 2 (Average)          |            |            | <b>20</b>                                 |                                           |
| DDG 3<br>(Duchess)       | 20/10/2017 | 21/11/2017 | 20                                        |                                           |
|                          | 22/11/2017 | 20/12/2017 | 27                                        |                                           |
|                          | 20/12/2017 | 19/1/2018  | 73                                        |                                           |
|                          | 19/01/2018 | 20/2/2018  | 27                                        |                                           |
|                          | 20/2/2018  | 21/3/2018  | 3.3                                       |                                           |
| DDG 3 (Average)          |            |            | <b>30</b>                                 |                                           |



**KEY MAP**

**LEGEND**

- Air Monitoring Locations
- Duchess Rail Siding Air Monitoring Location
- Homestead Noise Monitoring Location
- Watercourse

**Duchess Rail Siding Line**

- Proposed Rail Diversion Track
- Duchess Road Diversion
- ML 5542

Coordinate System: GDA 1994 MGA Zone 54  
Projection: Transverse Mercator  
Datum: GDA 1994

**NOTE(S)**  
SERVICE LAYER CREDITS: CONTENT MAY NOT REFLECT NATIONAL GEOGRAPHIC'S CURRENT MAP POLICY. SOURCES: NATIONAL GEOGRAPHIC, ESRI, GARMIN, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, INCREMENT P CORP.  
SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY

**REFERENCE(S)**  
Watercourses: © State of Queensland (Department of Natural Resources and Mines - DNRN) 2017  
Proposed Rail Diversion Track, Duchess Road Diversion: Provided by Centrex 2018  
Mining Lease: © State of Queensland (DNRN) 2018

**CLIENT**  
CENTREX PHOSPHATE PTY LTD

**PROJECT**  
CENTREX ARDMORE PHOSPHATE

**TITLE**  
DEPOSITED DUST MONITORING LOCATIONS

|            |            |            |
|------------|------------|------------|
| CONSULTANT | YYYY-MM-DD | 12/06/2018 |
|            | DESIGNED   | SD         |
|            | PREPARED   | SD         |
|            | REVIEWED   | DP         |
|            | APPROVED   | DP         |

|             |         |      |        |
|-------------|---------|------|--------|
| PROJECT NO. | CONTROL | REV. | FIGURE |
| 1782517     | 015     | A    | 7      |

PATH: R:\01 Client\Centrex Phosphate Pty Ltd\1782517-015-015-RevA-DustMonitoringLocations.mxd PRINTED ON: 2018-06-12 AT: 1:33:15 PM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ISO A3

### 5.6.2 Particulate Matter (PM<sub>10</sub> and PM<sub>2.5</sub>)

Particulate matter (PM) with an aerodynamic diameter of less than 10µm (PM<sub>10</sub>) is small enough to be inhaled into the lower respiratory tract. Epidemiological studies have demonstrated that both PM<sub>10</sub> and PM<sub>2.5</sub> have public health impacts for both short and long term exposures.<sup>2</sup>

Representative background concentrations of particulate matter at the site are not available. The closest publicly available data is from The Gap ambient air quality monitoring station (AQMS), operated by the Department of Science, Information Technology and Innovation (DSITI) and located in the township of Mount Isa.

The Gap AQMS is situated approximately 100 km from the site in an industrial/residential area. Using data from this station to represent the site is considered conservative, as the Project area is located in a remote rural area surrounded by less emission sources than found in Mount Isa. Site specific data is not a requirement of the DEHP guidelines, however, in the absence of any other data, The GAP AQMS has been used.

Table 5 represents a summary of PM<sub>10</sub> concentration data from this station in 2016 (DSITI 2017). The 75<sup>th</sup> percentile concentration of PM<sub>10</sub> at The GAP AQMS in 2016 (19.5 µg/m<sup>3</sup>) has been used to characterise the existing air environment at the Project area.

PM<sub>2.5</sub> concentrations have not been recorded at The GAP AQMS, however the assessment has used a PM<sub>10</sub>/PM<sub>2.5</sub> ratio of 0.15 for estimating emission rates using the NPI emission estimation technique manual for mining and processing of non-metallic minerals (Environment Australia, 2014).

**Table 5: The GAP AQMS – Summary of results for PM<sub>10</sub> in 2016**

| Monitoring Station | Maximum (µg/m <sup>3</sup> ) | PM <sub>10</sub> Concentration percentiles (µg/m <sup>3</sup> ) |                  |                  |                  |                  |                  | Project criteria (µg/m <sup>3</sup> ) |
|--------------------|------------------------------|-----------------------------------------------------------------|------------------|------------------|------------------|------------------|------------------|---------------------------------------|
|                    |                              | 99 <sup>th</sup>                                                | 98 <sup>th</sup> | 95 <sup>th</sup> | 90 <sup>th</sup> | 75 <sup>th</sup> | 50 <sup>th</sup> |                                       |
| The Gap            | 351                          | 43                                                              | 41               | 32               | 27               | 20               | 15               | 50                                    |

## 6.0 NOISE IMPACT ASSESSMENT

An assessment of potential noise impacts from the site on the local environment was undertaken. There is the potential for noise emissions to occur from the site during extraction and processing activities, and haulage of concentrate on road trains from the process plant to the existing Highway.

### 6.1 Source Identification

For a description of site activities, please refer to Section 4.0. Major noise sources at the site are expected to include mobile plant engines (during acceleration and extraction) and the crushing of raw material in the process plant. Extraction activities include face shovel extraction, loading and unloading of dump trucks, movement of mobile plant along haulage routes, site clearing (using bulldozer) and rock breaking (using an excavator). Blasting is not proposed at the site and is not included in this assessment.

Potential noise generating activities at the process plant include primary crushing, material screening, slurry water pumps, generators and front-end loaders..

<sup>2</sup> WHO Air Quality Guidelines (Global Update 2005, World Health Organization (WHO), 2006).

Haulage of concentrate is proposed using triple road trains along a 7 km road from the process plant to the Highway. Haulage will be undertaken during the day shift only following the on-site road speed limit of 40 km/h. Potential noise sources have been identified and are shown in Table 6.

**Table 6: Potential noise sources**

| Equipment              | Plant Type | Model     | Quantity                           |
|------------------------|------------|-----------|------------------------------------|
| 85 t excavator         | Mobile     | CAT 385 C | 1                                  |
| Bulldozer              | Mobile     | CAT D10   | 1                                  |
| 40 t ejector truck     | Mobile     | CAT       | 3 - 4                              |
| Front end loader       | Mobile     | NA        | 1                                  |
| Grader                 | Mobile     | NA        | 1                                  |
| Water truck (40,000 L) | Mobile     | NA        | 1                                  |
| Service truck          | Mobile     | NA        | 1                                  |
| Light vehicles         | Mobile     | NA        | 4                                  |
| Site generator         | Stationary | NA        | 1                                  |
| RO Plant               | Stationary | NA        | 1                                  |
| Process plant          | Stationary | NA        | 1                                  |
| Road trains            | Mobile     | NA        | 6 - 7 per day over a 6-week period |

## 6.2 Noise Levels

To assess potential sources of noise, sound pressure levels (SPL) for representative noise sources were estimated using the Golder internal noise database, and the Department for Environment Food and Rural Affairs (DEFRA) database (DEFRA 2006). This database is widely used in Australia to estimate noise from mining and construction sites, where measured data is not available. Representative sound pressure levels for identified noise sources are shown in Table 7.

**Table 7: Estimated Sound Power Levels**

| Noise Source                    | Octave Band Sound Power Levels (Hz) |     |     |     |      |      |      |      | A-weighted Sound Power Level, $L_{Aeq}$ dB |
|---------------------------------|-------------------------------------|-----|-----|-----|------|------|------|------|--------------------------------------------|
|                                 | 63                                  | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 |                                            |
| Excavator (382 kW, 89 t)        | 114                                 | 118 | 106 | 102 | 103  | 98   | 90   | 88   | 108                                        |
| Bulldozer (250 kW, 35 t)        | 105                                 | 114 | 103 | 103 | 110  | 108  | 101  | 95   | 113                                        |
| Dump Truck (287 kW, 40 t) x 4   | 121                                 | 118 | 113 | 112 | 111  | 109  | 105  | 97   | 116                                        |
| Front End Loader (597 kW, 94 t) | 116                                 | 116 | 115 | 113 | 114  | 111  | 105  | 98   | 118                                        |

| Noise Source                                                                            | Octave Band Sound Power Levels (Hz) |     |     |     |      |      |      |      | A-weighted Sound Power Level, $L_{Aeq}$ dB |
|-----------------------------------------------------------------------------------------|-------------------------------------|-----|-----|-----|------|------|------|------|--------------------------------------------|
|                                                                                         | 63                                  | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 |                                            |
| Grader (205 kW, 25 t)                                                                   | 116                                 | 115 | 111 | 107 | 112  | 106  | 102  | 93   | 115                                        |
| Water Truck (discharging)                                                               | 108                                 | 109 | 103 | 107 | 101  | 102  | 98   | 93   | 109                                        |
| Service Truck (242 kW, 32 t)                                                            | 114                                 | 122 | 109 | 105 | 108  | 105  | 103  | 97   | 113                                        |
| Road Truck (x2)                                                                         | 116                                 | 114 | 108 | 106 | 103  | 101  | 104  | 96   | 110                                        |
| Diesel Generator (45 KVA, 30 kW)                                                        |                                     |     |     |     |      |      |      |      | 95 <sup>1</sup>                            |
| Diesel generator (600 KVA, 450 kW)                                                      |                                     |     |     |     |      |      |      |      | 102 <sup>2</sup>                           |
| Process Plant, including:                                                               |                                     |     |     |     |      |      |      |      |                                            |
| Crusher (310 kW, 90 t)                                                                  | 119                                 | 119 | 116 | 115 | 113  | 111  | 106  | 96   | 118                                        |
| Electric water pump (120 kW) x 6 (representing tailings and water pumps, hydrocyclones) | 111                                 | 104 | 98  | 101 | 102  | 100  | 93   | 86   | 106 <sup>3</sup>                           |
| Screen stockpiler (17 t) x 2                                                            | 112                                 | 110 | 107 | 107 | 102  | 102  | 99   | 92   | 109                                        |
| Field conveyor (rollers) x 2                                                            | 86                                  | 80  | 80  | 71  | 71   | 70   | 75   | 75   | 81                                         |

## Notes:

- 1 Specification for Paramac GSW45P-PFL 45 kVA, 36 kW suggest an A weighted sound power level of 95 dB.
- 2 Specification for Volvo GSW660V 600 KVA, 480 kW suggest an A weighted sound power level of 102 dB.
- 3 Diesel water pump power levels used to conservatively represent electric water pump

Noise sources were assessed for the following characteristics:

- Tonality: containing a prominent frequency and characterised by a definite pitch.
- Low frequency: containing major components within the low frequency range (20 Hz–250 Hz) of the frequency spectrum.
- Impulsiveness: having a high peak of short duration or a sequence of such peaks.
- Intermittency: the level suddenly drops to that of the background noise several times during the assessment period, with a noticeable change in noise level of at least 5 dB.
- Duration: applied where a single event noise is continuous for a period of less than two and a half hours in any 24-hour period.

Identified noise sources are not expected to produce any of the above characteristics at the nearest sensitive receptor. Across a distance of 15 km, significant noise attenuation (energy loss of sound), including atmospheric and ground adsorption will occur. Consequently, no adjustments to the estimated sound power levels have been made.

### 6.3 Noise Attenuation

As a screening assessment, noise attenuation at the nearest sensitive receptor (15 km) from the site was calculated. The calculated noise level of each source and the total from all noise sources are presented in Table 8.

**Table 8: Estimated Sound Power Levels at nearest sensitive receptor (15 km)**

| Noise Source                                                                            | A-weighted SPL,<br>L <sub>Aeq</sub> dB @ 15 km | Project Criteria (L <sub>Aeq</sub> dB) |                      |                    |
|-----------------------------------------------------------------------------------------|------------------------------------------------|----------------------------------------|----------------------|--------------------|
|                                                                                         |                                                | Day (7am – 6pm)                        | Evening (6pm – 10pm) | Night (10pm – 7am) |
| Excavator (382 kW, 89 t)                                                                | 20                                             | 50                                     | 50                   | 40                 |
| Bulldozer (250 kW, 35 t)                                                                | 15                                             |                                        |                      |                    |
| Dump Truck (287 kW, 40 t) x4                                                            | 25                                             |                                        |                      |                    |
| Front End Loader (597 kW, 94 t)                                                         | 21                                             |                                        |                      |                    |
| Grader (205 kW, 25 t)                                                                   | 21                                             |                                        |                      |                    |
| Water Truck (discharging)                                                               | 14                                             |                                        |                      |                    |
| Service Truck (242 kW, 32 t)                                                            | 22                                             |                                        |                      |                    |
| Road Truck (x2)                                                                         | 20                                             |                                        |                      |                    |
| Process Plant, including:                                                               | 30                                             |                                        |                      |                    |
| Diesel Generators (45 KVA, 30 kW and 450 kW, 600 kVA)                                   | 11                                             |                                        |                      |                    |
| Crushers (310 kW, 90 t) x 2                                                             | 24                                             |                                        |                      |                    |
| Electric water pump (120 kW) x 6 (representing tailings and water pumps, hydrocyclones) | 16                                             |                                        |                      |                    |
| Screen stockpiler (17 t) x 2                                                            | 17                                             |                                        |                      |                    |
| Field conveyor (rollers) x 2                                                            | 10                                             |                                        |                      |                    |
| <b>Total (including background)</b>                                                     | <b>35</b>                                      |                                        |                      |                    |

The total estimated noise level 15 km from the site is 35 dB, which is below the Project criteria for day, evening and night time noise levels.

The estimated noise levels have been calculated using geometric distance noise attenuation (including atmospheric adsorption), and are considered conservative for the following reasons:

- All equipment and plant were operating continuously 24 hours per day.
- All equipment and plant were operating simultaneously.

- No separation between equipment and plant noise sources (single point calculation).
- Attenuation of noise by natural and artificial noise barriers (buildings, stock piles, topographical features) was not considered.
- Attenuation of noise by ground adsorption was not considered.
- Noise mitigation measures have not been considered.

## 6.4 Discussion

The noise impact assessment has used information provided by Centrex, and a description of the local environment to assess the risk of potential noise impact on the environmental values of the site.

The site is located in a remote rural area with no significant sources of existing noise and the closest sensitive receiver approximately 15 km away (Ardmore). Representative background noise measurements are typical of rural areas and are much lower than the noise criteria outlined in the EPP Noise.

Prevailing wind conditions favour the dispersion of noise towards Ardmore homestead, however the large separation distance and considerable associated noise attenuation indicates that it is unlikely that there will be any significant noise impact from the proposed site activities.

This was demonstrated by using representative sound pressure levels for identified noise sources to conduct a screening assessment using noise attenuation calculations. The results of these calculations estimated the noise impact from the site to be 35 dB (including background), below the Project criteria.

This screening assessment used a conservative approach, and it is likely that a detailed modelling assessment would predict considerably lower noise impacts for the Project at the nearest sensitive receiver.

Based on the information provided by Centrex and the outcomes of this assessment, the risk of potential noise impacts on the environmental values identified for the site is considered low.

## 6.5 Proposed Management Practices

Although the risk of noise impact on the environmental values is low, it is recommended that best practice noise mitigation measures be used to minimise noise emissions in accordance with the noise management hierarchy outline in the EPP (Noise). This is also important for workplace health and safety for workers at the site. To the extent that it is reasonable to do so, noise must be dealt with in the following order of preference:

- a) Firstly-avoid;
- b) Secondly – minimise, in the following order of preference –
  - (i) firstly - orient an activity to minimise noise;
  - (ii) secondly – use best available technology;
- c) thirdly – manage.

As discussed, the Project is not located near a sensitive receiver and consequently the risk of noise impacts is expected to be avoided. The mobilisation of road trains are proposed to occur during the day shift only, minimizing the potential noise impact during sleeping hours along the proposed truck route.

Centrex intends to employ best practice noise mitigation measures where practicable and appropriate, documented in an environmental management plan for the project. Golder recommends the following noise mitigation measures during operation of the site:

- Reduce vehicle speed on site.
- Mobile equipment is turned off when not in use.
- Equipment maintenance in accordance with manufacturer's specifications.

- Use of mufflers on mobile plant.
- Maintenance of haul roads on the ML.

## 6.6 Conclusion

The noise impact assessment indicates a low risk of noise impacts from site activities at nearby sensitive receptors and it is expected that the project would comply with noise criteria outlined in the EPP (Noise).

Best management practices to mitigate noise impacts have been recommended and should be included in an environmental management plan (EMP).

## 7.0 AIR QUALITY ASSESSMENT

An assessment of potential impact of air emissions from the site on the local environment was undertaken. There is the potential for air emissions to occur from the site during extraction and processing activities, and haulage of concentrate on road trains from the process plant to the existing Highway.

### 7.1 Source Identification

For a description of site activities, please refer to Section 4.0. Site activities will result in particulate matter emissions to air from mining, stockpiling, transporting, crushing and processing and from combustion (fuel consumption) in vehicles/machinery and electrical generators. Blasting is not proposed at the site and is not included in this assessment.

Products of combustion typically include oxides of nitrogen, carbon monoxide, carbon dioxide, particulate matter, sulphur dioxide, polycyclic aromatic hydrocarbons (PAH) and volatile organic compounds. Although products of combustion will contribute to the Start-up Operation activity air emissions, the dominant emission will be airborne dust from the movement of vehicles on unpaved roads (wheel generated dust or WGD), windblown dust from exposed areas and emissions from the uplift and deposit of material through bulldozer action, loaders and stockpile creation. As products of combustion emissions are considered minor and the Start-up Operation is proposed to be operating for a relatively short time period (10 -12 weeks), products of combustion are not considered further in this assessment.

The key air quality indicators identified for the project are related to dust emissions and are listed below:

- Deposited dust
- Particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>)

Potential dust sources have been identified and are shown in Table 9.

**Table 9: Potential source of dust**

| Source                                  | Plant Type | Model     | Quantity |
|-----------------------------------------|------------|-----------|----------|
| 85 t excavator                          | Mobile     | CAT 385 C | 1        |
| Bulldozer                               | Mobile     | CAT D10   | 1        |
| 40 t ejector truck<br>(dumping and WGD) | Mobile     | CAT       | 3 - 4    |
| Front end loader                        | Mobile     | NA        | 1        |

| Source                          | Plant Type | Model | Quantity          |
|---------------------------------|------------|-------|-------------------|
| Grader                          | Mobile     | NA    | 1                 |
| Service truck                   | Mobile     | NA    | 1                 |
| Light vehicles                  | Mobile     | NA    | 4                 |
| Site generator                  | Stationary | NA    | 1                 |
| Process Plant                   | Stationary | NA    | 1                 |
| Road Trains (triple)            | Mobile     | NA    | 6 -7 per day      |
| Exposed Surfaces (wind erosion) | Stationary | NA    | Refer to site map |

## 7.2 Separation Distances and Sensitive Land Uses

The Queensland State Planning Policy, *mining and extractive resources* (DILGP 2016) provides guidance in determining appropriate separation distances between extractive resource processing areas and sensitive land uses (i.e. residence, schools etc.). The minimum separation distance recommended by the guideline are 1000 metres where the extraction or processing of the extractive resource involves blasting or crushing.

To further support this recommendation, EPA Victoria publication 1518, *Recommended separation distance for industrial residual air emissions*, (EPA VIC 2013) prescribes recommended minimum separation distances with the purpose of minimising air quality impacts (dust or odour) at off-site sensitive land uses from 'industrial residual air emissions' (IRAE) i.e. unintended or upset industrial emissions that may occur intermittently. Unintended emissions are defined in the guideline as 'emissions emanating from an industrial site as a result of non-routine events, including equipment failure, accidents or abnormal weather conditions'.

The recommended separation distances that may be relevant for the Project in this guideline are as follows:

- Open cut coal mine (harvesting, crushing, screening, stockpiling and conveying of coal) – 1000 m
- Mine for other materials (crushing, screening stockpiling and conveying of other minerals) – 250 m

The nearest sensitive land use to the Project is located approximately 15 km from the site.

## 7.3 Emissions Inventory

The emission inventory is a listing of atmospheric contaminant emission factors for each of the identified activities and processes which generate emissions to air. The Project specific parameters used to calculate the emissions inventory are detailed in the following sections.

### 7.3.1 Operating Parameters

Project specific operating parameters used to develop the emission inventory are presented in Table 10. The approximate dimensions for each vehicle type were included in emission rate calculations. All parameters have been derived from information provided by Centrex.

**Table 10: Operating parameters**

| Parameter                                       | Quantity                     |
|-------------------------------------------------|------------------------------|
| Operating hours (time)                          | 24 operational hours per day |
| Extraction rate (tonnes per hour)               | 70                           |
| Product (concentrate) handled (tonnes per hour) | 46                           |
| Tailings handled (tonnes per hour)              | 24                           |
| Site speed limit (km/hour)                      | 40                           |
| Truck movements per day                         | 7                            |
| Road Width                                      | 3 m                          |

## 7.3.2 Environmental Parameters

### 7.3.2.1 Geology

Particulate matter emission factors include values for moisture and silt content of materials handled, worked or subject to wind erosion. The moisture content of excavated material has been provided by Centrex. Silt content has been selected from measurements recorded at a number of industry sites and road types as published in United States Environmental Protection Agency (USEPA) Guideline, *AP-42 Section 13.2.2. Unpaved Roads* (USEPA 2006).

A summary of geological parameters included in the emission inventory is presented in Table 11.

**Table 11: Emissions Inventory: Geology**

| Parameter            | Quarry and surface material |
|----------------------|-----------------------------|
| Silt Content (%)     | 8                           |
| Moisture Content (%) | 4                           |

### 7.3.2.2 Meteorology

Rainfall events are a source of natural mitigation for particulate matter. For dust generated from unpaved roads, the number of rainfall events above 0.25 mm may be taken into consideration<sup>3</sup>. Average wind speeds are used to calculate emission factors for erosion from stockpiles.

Project specific meteorological parameters used in the emission inventory development are presented in Table 12, obtained the Bureau of Meteorology (BOM) weather station located at The Monument Airport (ID: 037034) from 2012 – 2015.

<sup>3</sup> USEPA 42 Section 13.2.2. Unpaved Roads (Updated November 2006)

**Table 12: Emission Inventory: Meteorological Parameters**

| Parameter                                                  | Emission Inventory Assumption |
|------------------------------------------------------------|-------------------------------|
| Mean wind speed (m/s)                                      | 4.0                           |
| Number of days per year with rainfall greater than 0.25 mm | 36                            |

### 7.3.3 Emission Inventory Parameters

Emission factors were applied together with the project specific operating parameters, meteorological data and geology to estimate emission rates. The NPI Emission Estimation Technique Manuals for Mining and Mining and Processing of Non-Metallic Minerals were used to calculate emission rates for particulate matter emissions to air (Australian Government 2012 and 2014). The selected equations from the NPI and adopted control measures used in the inventory are summarised in Table 13.

**Table 13: Emission Inventory Equations**

| Emission Source                  | Emission Factor                                                                                         | Adopted Control Measures                                                                                                                                                                    |
|----------------------------------|---------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Excavators and front-end loaders | Excavators/front end-loaders working overburden                                                         | Water spraying to keep raw material wet equal to a 50% reduction in dust emissions<br><br>Pit retention where applicable equal to a 5% reduction for PM <sub>10</sub> and PM <sub>2.5</sub> |
| Bulldozers                       | Bulldozers working overburden                                                                           | No controls assumed                                                                                                                                                                         |
| Trucks dumping                   | Trucks dumping overburden                                                                               | Water sprays equal to a 70% reduction in dust emissions                                                                                                                                     |
| Graders                          | Graders working overburden                                                                              | Water sprays equal to a 50% reduction in dust emissions                                                                                                                                     |
| Unpaved roads                    | Unpaved roads (wheel generated dust)                                                                    | Level 1 watering (2 l/m <sup>2</sup> /h) equal to a 50% reduction in dust emissions<br><br>The factor also incorporates natural dust mitigation by rain                                     |
| Crushing Plant                   | Crushed stone processing including primary and secondary crushing, screening, and handling and transfer | Controlled sources emission factors used (based on moisture content of quarry material and wet suppression)<br><br>Water sprays equal to a 50% reduction in dust emissions                  |

| Emission Source | Emission Factor              | Adopted Control Measures                                                                                                                                         |
|-----------------|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Wind Erosion    | Wind erosion from stockpiles | Water sprays equal to a 50% reduction in dust emissions<br><br>Pit retention where applicable equal to a 5% reduction for PM <sub>10</sub> and PM <sub>2.5</sub> |

### 7.3.4 Emissions Inventory Results

The emission inventory for the Project is presented in Table 14. The total estimated PM<sub>10</sub> and PM<sub>2.5</sub> emission rate from the site (including haulage route) is 30 and 3.7 kg/hr respectively.

Emission rate calculations included water spray and pit retention control measures and used the following conservative assumptions:

- All equipment and heavy plant operating continuously 20 hours per day.
- The total surface area of the test pit, ROM pad and overburden storage facility was assumed to be exposed.

The relative contribution of each type of emission source is presented in Figure 8 (hourly) and Figure 9 (daily).

**Table 14: Emission inventory**

| Item             | Emission rates (g/s) |        | Model information and assumptions                                                                            |
|------------------|----------------------|--------|--------------------------------------------------------------------------------------------------------------|
|                  | PM10                 | PM2.5  |                                                                                                              |
| Excavator        | 0.11                 | 0.017  | CAT 385 C 85 t excavator handling 70 tonnes/hour                                                             |
| Bulldozer        | 0.31                 | 0.15   | CAT D10 bulldozer working at 100% capacity                                                                   |
| Ejector truck x3 | 0.025                | 0.0039 | CAT Ejector trucks 40 t handling 70 tonnes/hour each                                                         |
| Front end loader | 0.11                 | 0.017  | Front end loader handling 70 tonnes/hour                                                                     |
| Grader           | 0.058                | 0.0042 | Grader working at 100% capacity (assumed to be travelling on average, 5 km in a 1-hour period over 24 hours) |
| Service truck    | 0.089                | 0.0081 | 100% capacity (assumed to be travelling on average, 2.5 km in a 1-hour period over 24 hours)                 |
| Light vehicles   | 0.044                | 0.0042 | Intermittent use (50% capacity, assumed to be travelling on average, 5 km in a 1-hour period over 24 hours)  |

| Item                        | Emission rates (g/s)      |                           | Model information and assumptions                                                                                                                                                  |
|-----------------------------|---------------------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                             | PM10                      | PM2.5                     |                                                                                                                                                                                    |
| Road Train x 2              | 2.3                       | 0.23                      | Road trains (double or triple) (assumed to be travelling on average 9 km in a 1-hour period over 24 hours on unpaved roads. 10 x 11 km trips per 12-hour shift)                    |
| Process Plant               | 0.31                      | 0.072                     | Handling 70 tonnes/hr and includes: <ul style="list-style-type: none"> <li>Primary crusher</li> <li>Screens for crushers</li> <li>Conveyors (handling and transferring)</li> </ul> |
| Test Pit                    | 2.6E-06/m <sup>2</sup> /s | 4.0E-07/m <sup>2</sup> /s | Total surface area of 1.4 ha (Pit retention)                                                                                                                                       |
| ROM Pad                     | 2.8E-06/m <sup>2</sup> /s | 4.2E-07/m <sup>2</sup> /s | Total surface area of 1.26 ha                                                                                                                                                      |
| Overburden Storage Facility | 5.3E-06/m <sup>2</sup> /s | 7.9E-07/m <sup>2</sup> /s | Total surface area of 1.26 ha                                                                                                                                                      |
| <b>Total (kg/hr)</b>        | <b>30</b>                 | <b>3.7</b>                |                                                                                                                                                                                    |
| <b>Total (kg/day)</b>       | <b>396</b>                | <b>55</b>                 |                                                                                                                                                                                    |
| <b>Total (tpa)</b>          | <b>145</b>                | <b>20</b>                 |                                                                                                                                                                                    |

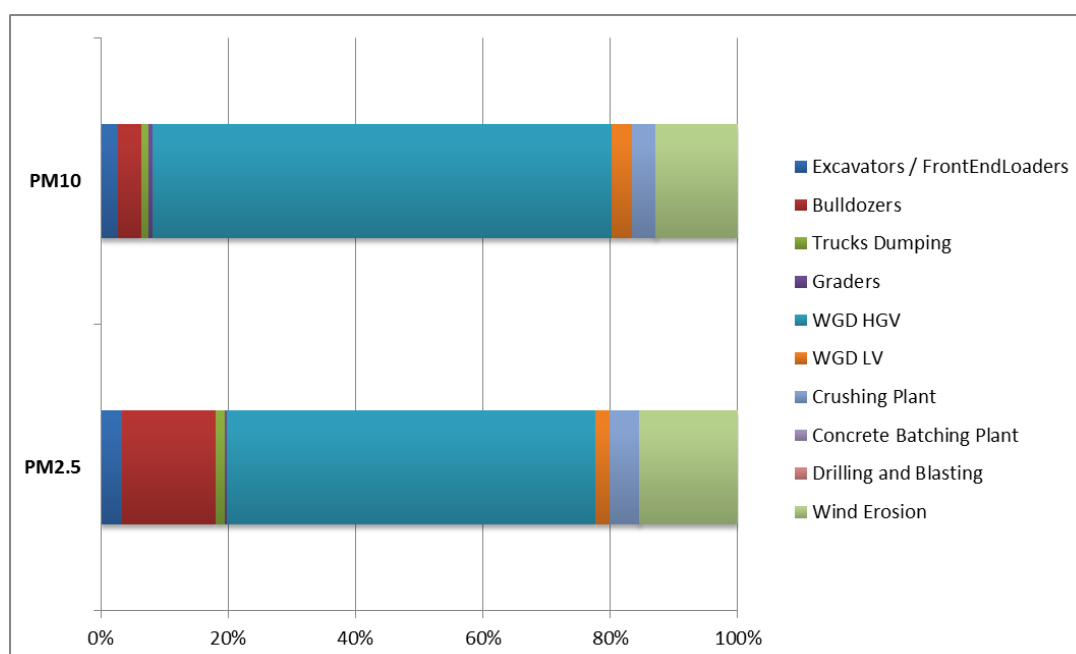


Figure 8: Relative contribution of emission sources (hourly)

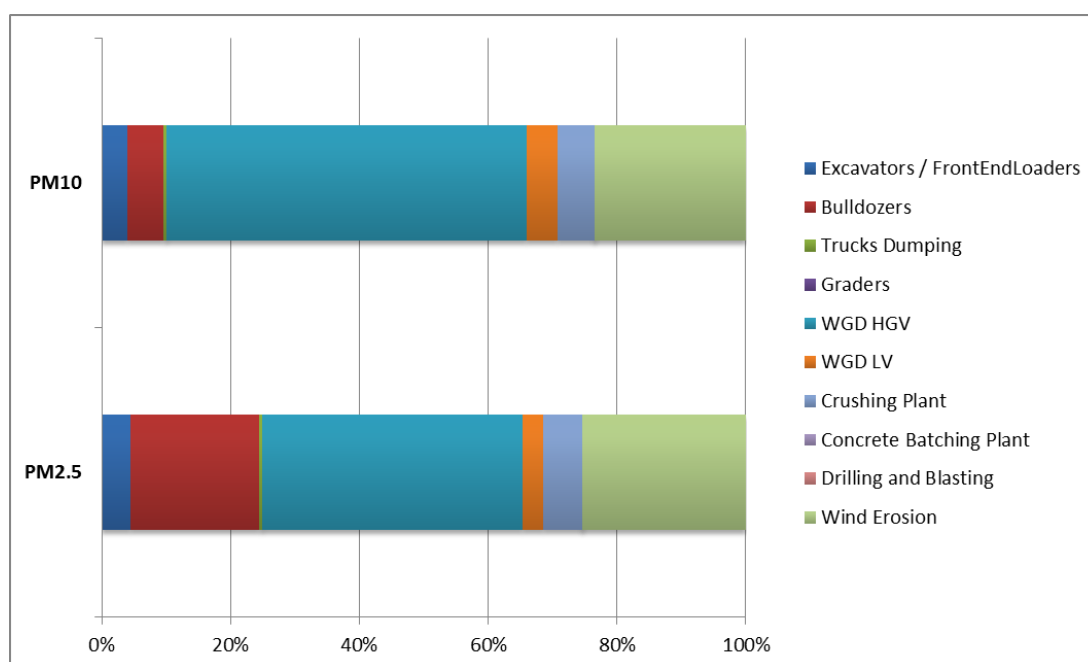


**Figure 9: Relative contribution of emission sources (daily)**

As a screening assessment, the AUSPLUME model was used to predict the ground level concentration (GLC) of PM<sub>10</sub> at the nearest sensitive receptor (Ardmore). AUSPLUME is a steady-state Gaussian dispersion model, and was run in regulatory mode using the estimated emission rate for the site of 30 kg/hr. As a conservative measure, worst-case meteorological data-set was used and emission sources (including the haulage route) were not separated (single-point calculation). The results of this screening assessment are presented in Table 15.

**Table 15: Maximum Predicted PM<sub>10</sub> GLC Concentration at Receptor (AUSPLUME)**

| Averaging Period | Distance from Source (m) | Background Concentration (µg/m <sup>3</sup> ) | Predicted contribution from Project (µg/m <sup>3</sup> ) | Project Criteria |
|------------------|--------------------------|-----------------------------------------------|----------------------------------------------------------|------------------|
| 1 hour           | 15 000                   | 19.5                                          | Nil                                                      | 50               |

The PM<sub>10</sub> screening assessment predicted no impacts from mining operations at the sensitive receptor.

## 7.4 Discussion

The air quality impact assessment has used information provided by Centrex, and a description of the local environment to assess the risk of potential air impact on the environmental values of the site.

The site is located in a remote rural area with some wind-blown dust from the natural environment due to the semi-arid climate and limited vegetation. No other significant existing air emission sources have been identified. The average deposited dust concentration at the site (two locations) and at the nearby town of Duchess measured were well below the Project criteria of 120 mg/m<sup>2</sup>/day. Based on the results of the monitoring programme, nuisance dust generated from the Project is unlikely to result in cumulative impacts that are in exceedance of the criteria.

Prevailing wind conditions favour the dispersion of air emissions towards Ardmore, however this is not considered significant given the large separation distance between the two locations. Rainfall statistics

demonstrate natural dust mitigation effects from November – February, with the highest risk of dust impacts from March – October, when conditions are dry.

An assessment of separation distance guidelines suggests that a distance of 1000 m between the site and sensitive receptors may be considered acceptable, and given the distance to Ardmore is 15 km, with no further assessment it is likely that the risk of air quality impacts from the site is low.

In accordance with the DEHP guidelines for assessing impacts to air, the proposed sources of emissions were identified and emission rates were estimated based on NPI calculations. The results of the emission inventory indicated that WGD from heavy vehicle use is predicted to provide the greatest contribution to dust generated from site activities. This result was predicted as dust control measures were not proposed for road trains travelling along the 7 km of unsealed road between the Start-up Operation and the Highway. In practice, as this dust source covers a large distance, dispersion of dust would be spread along the haulage route and dust impacts limited to the area immediately surrounding the road.

The other major dust source predicted from the inventory was wind blow dust generated from exposed surfaces and stockpiles. It is likely the inventory overestimated this contribution, as it was assumed that all active areas at the site handling dry material (overburden, extracted material) were 100% utilised and exposed surfaces, which is in practice unlikely to be the case.

The proposed process plant uses a wet circuit following primary and secondary crushing, and as a result, the relative contribution of processing activities to dust impacts is less than may be expected otherwise. Level 1 (2 l/hr) watering of the crushing plant, stockpiles, and mobile plant on-site was assumed and reduced the emission rate from these dust sources by 50%.

To provide a comparison to the air quality objectives of the EPP Air, the total emission rate estimated for the site was used in a screening assessment, which estimated no contribution of PM<sub>10</sub> GLC's at the nearest sensitive receptor (15 km). This screening assessment used a conservative approach, and is likely that a detailed modelling assessment would also predict no impacts from the Project at a distance of 15 km.

Based on the information provided by Centrex and the outcomes of this assessment, the risk of potential air quality impacts on the environmental values identified for the site is considered low.

## 7.5 Proposed Management Practices

Although the risk of air quality impacts on the environmental values is low, it is recommended that best practice noise mitigation measures be used to minimise air emissions in accordance with the air management hierarchy outlined in the EPP Air. To the extent that it is reasonable to do so, noise must be dealt with in the following order of preference:

- a) Firstly-avoid;
- b) Secondly – recycle;
- c) thirdly – minimise;
- d) fourthly – manage.

As discussed, the Project is not located near a sensitive receptor and consequently the risk of air impacts is expected to be avoided. Centrex intends to employ best practice dust mitigation measures where practicable and appropriate, documented in an environmental management plan for the project. Golder recommends the following dust mitigation measures during operation of the site:

- Reduce vehicle speed on site.
- Water spraying on crushing plant, stockpiles, and mobile plant on-site when appropriate to reduce fugitive dust emissions.

- Stripping of topsoil limited to the immediate area to be extracted.
- Stockpiles limited to 2 m in height to reduce wind-blown dust.
- Overburden stockpiled separately for future use.
- Regular repair of haul roads during mining operations.
- Covered truck loads, stockpiles etc. where appropriate.

## 7.6 Conclusion

The air quality assessment indicates a low risk of air emission impacts from site activities at nearby sensitive receivers and it is expected that the project would comply with air criteria outlined in the EPP (Air).

Best management practices to mitigate air quality impacts have been recommended and should be included in an EMP.

## 8.0 REFERENCES

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## Signature Page

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