

ASX Announcement

15<sup>th</sup> January 2018

# Ardmore Phosphate Rock Project Scoping Study Shows Strong Returns



**CAPTION:** Excavation of bulk phosphate rock sample for crusher test work at Ardmore.

#### Scoping Study Cautionary Statement

The Scoping Study referred to in this announcement has been undertaken to determine the potential viability of an open pit mine and phosphate rock processing plant at the Ardmore Phosphate Rock Project in North West Queensland, in order to provide Centrex Metals Limited confidence on which to continue with its ongoing feasibility studies for the project. It is a preliminary technical and economic study of the potential viability of the Ardmore Phosphate Rock Project. It is based on low level technical and economic assessments that are not sufficient to support the estimation of ore reserves. Further evaluation work including bulk beneficiation, fertiliser conversion test work, and appropriate studies are required before Centrex Metals Limited will be in a position to estimate any ore reserves or to provide any assurance of an economic development case.

The Production Target referred to in this announcement is based on 11% Measured, 88% Indicated, and 1% Inferred Mineral Resources for the mine life. The Company has concluded that it has reasonable grounds for disclosing a Production Target that includes a modest amount of Inferred Mineral Resources. However, there is a low level of geological confidence associated with Inferred Mineral Resources and there is no certainty that further exploration work (including infill drilling) at the Ardmore Phosphate Rock Project will result in the determination of additional Indicated Mineral Resources or that the Production Target itself will be realised.

The Scoping Study is based on the material assumptions outlined below. These include assumptions about the availability of funding. While Centrex Metals Limited considers all of the material assumptions to be based on reasonable grounds, there is no certainty that they will prove to be correct or that the range of outcomes indicated by the Scoping Study will be achieved.

To achieve the range of outcomes indicated in the Scoping Study, funding of in the order of \$A 59-65 million will likely be required. Investors should note that there is no certainty that Centrex Metals Limited will be able to raise that amount of funding when needed. It is also possible that such funding may only be available on terms that may be dilutive to or otherwise affect the value of Centrex Metals Limited's existing shares. It is also possible that Centrex Metals Limited could pursue other 'value realisation' strategies such as a sale, partial sale or joint venture of the project. If it does, this could materially reduce Centrex Metals Limited's proportionate ownership of the project.

Given the uncertainties involved, investors should not make any investment decisions based solely on the results of the Scoping Study.

These materials include forward looking statements. For further information on forward looking statements please refer to the end of this release.

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#### **Scoping Study Highlights**

- Scoping study shows strong returns for the Ardmore Phosphate Rock Project in North West Queensland, one of the few remaining undeveloped high-grade deposits in the world
- An open pit mining operation, with ore being crushed and deslimed to produce approximately 776,000 dry tonne of premium 35% P<sub>2</sub>O<sub>5</sub> and ultra-low cadmium phosphate rock product per annum (approximately 800,000 wet tonnes per annum at 3% moisture)
- Mine life of approximately 10 years based on an 11.1 million tonne conceptual pit inventory (11% Measured, 88% Indicated and 1% Inferred Resources) with life of mine strip ratio of 4.6:1 (1.9:1 in initial Southern Zone), and ability to free-dig the very weak ore and overburden
- Product trucked by triple road trains 90km by existing roads to a siding at Duchess, and railed to the Port
  of Townsville
- Base case for product to be railed and stored in containers with bulk handysize vessels (≈30,000 tonne) loaded through existing rotating container ship-loading facilities
- Product to be shipped around Australia, as well as to New Zealand and India, with Ardmore having a significant freight advantage over current suppliers to most customers
- Product to be sold on CFR terms (shipping organised by Centrex), with the CFR price independently forecast for each target customer by Integer Research every year over the mine life, referenced to their forecast for the Morocco 70-72 BPL (32-33% P<sub>2</sub>O<sub>5</sub>) FOB benchmark
- Weighted average CFR price based on target customers for premium Ardmore 35% P₂O₅ product of \$US 133/t at start of full scale operations, with life of mine average of \$US 158/t in real-terms
- Capital cost range of approximately \$A 55-61 million (\$US 42-46 million)
- Life of mine average CFR cash operating costs including all royalties and overheads of approximately \$A 162 per tonne (\$US 121 per tonne), and FOB all-inclusive of approximately \$A 115 per tonne (\$US 86 per tonne)
- Pre-tax net cash flow of approximately \$A 278-283 million based on assumed 0.75 AUD exchange rate
- Pre-tax NPV10 of approximately \$A 124-129 million and IRR of 39-42% with a 3 year payback period
- Feasibility study already underway and due for completion in mid-2018, with first shipments targeted for 2019

#### **Scoping Study Summary**

Centrex Metals Limited ("Centrex") has completed a Scoping Study for its Ardmore Phosphate Rock Project ("Ardmore") located in North West Queensland. Ardmore is one of the few undeveloped high-grade phosphate rock projects in the world. Since a successful acquisition of the project in June 2017, Centrex has been undertaking a Feasibility Study for the project due for completion in mid-2018. In order to provide conceptual economics on the project to the market at an earlier date, a Scoping Study was undertaken in parallel.

The Scoping Study was based on the recent Mineral Resource update announced by the Company released in December 2017 with total Measured, Indicated and Inferred Mineral Resources of 14.2 million tonnes at 28.7%  $P_2O_5$  using a 19%  $P_2O_5$  grade cut-off (see Table 1).

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#### **TABLE 1:** Ardmore Mineral Resource classification.

| Mineral Resource Category | Million Tonnes | P <sub>2</sub> O <sub>5</sub> % |
|---------------------------|----------------|---------------------------------|
| Measured                  | 1.3            | 29.7                            |
| Indicated                 | 11.0           | 29.0                            |
| Inferred                  | 2.0            | 26.3                            |
| Total Mineral Resources   | 14.2 *         | 28.7                            |

\* Totals may not add precisely due to rounding.

For full details of the Mineral Resource refer announcement 18<sup>th</sup> December 2017;

#### http://www.asx.com.au/asxpdf/20171218/pdf/43q8hp4xygcbh0.pdf

The results were reported under JORC 2012 and Centrex is not aware of any new information or data that materially affects the information contained within the release. All material assumptions and technical parameters underpinning the estimates in the announcement continue to apply and have not materially changed.

The Scoping Study capital cost estimate has been prepared to an accuracy of +/-50% and the operating costs estimates to +/-30%. The study was compiled by Centrex senior management with considerable input from a number of vendors, contractors, and consultants including;

- OreWin Pty Ltd Mineral Resource estimate;
- Golder Associates Mine geotechnical, ground and surface water;
- RBC Environmental Cultural heritage;
- Northern Resource Consultants Flora and fauna studies;
- Optima Consulting & Contracting Mining;
- Bureau Veritas Minerals Pty Ltd Process test work;
- GR Engineering Process plant and mine site infrastructure design and cost estimation;
- Land & Marine Geological Services Limited Tailings storage facility design;
- WSP Road diversions, road upgrades, rail siding ancillary facilities and works;
- Braemar ACM Shipbroking Pty Ltd Freight cost estimates; and
- Integer Research Limited Customer product price forecasts.

As rail is the largest single operating cost for the project, the Scoping Study has assumed production of 776,000 tonnes per annum of premium 35% P<sub>2</sub>O<sub>5</sub> phosphate rock concentrate product. This is equivalent to 800,000 wet tonnes per annum at the target shipping level of 3% moisture. This annual quantum is optimised approximately around two 1km long train consists to maximise rolling stock efficiency while maintaining a reasonable mine life from the available Mineral Resource. The deposit would be selectively mined as is common in phosphate rock deposits to minimise hangingwall and footwall dilution. The selectively mined run of mine ore would be fed to a crushing and deslime circuit to produce the concentrate, meeting customer sizing specifications and removing fine gangue (clays, etc). The concentrate would be dried to 3% moisture and then trucked 90km by existing roads to a rail siding, and then railed to the Port of Townsville for shipping by Centrex.

Level 6, 44 Waymouth Street Adelaide, South Australia 5000 T +61 8 8213 3100 F +61 8 8231 4014 Key Scoping Study assumptions and metrics are provided in Table 2.

| TABLE 2: A | rdmore kev | / assumptions | and metrics. |
|------------|------------|---------------|--------------|
|------------|------------|---------------|--------------|

| Item Approximate Value or Range                            |                                   |                               |  |
|--|-----------------------------------|-------------------------------|--|
| Potential Mine Life  | 10 y                              | rears                         |  |
| First shipments  | 20                                | )19                           |  |
| Full-scale (776ktpa) production reached                    | 2021                              |                               |  |
| Life of mine ("LOM") conceptual pit inventories (dry)      | 11.1 million tonnes               |                               |  |
| LOM in-pit phosphate grade                                 | 29%                               | $P_2O_5$                      |  |
| LOM strip ratio  | 4.                                | 6:1                           |  |
| Selective mining recovery from conceptual pit inventories  | 90                                | )%                            |  |
| Estimated Selectively mined process plant feed grade       | 31%                               | P <sub>2</sub> O <sub>5</sub> |  |
| Annual process plant feed (dry)                            | 1,065,00                          | 0 tonnes                      |  |
| Process plant mass recovery                                | 73%                               |                               |  |
| Annual concentrate production target (dry)                 | 776,000 tonnes                    |                               |  |
| LOM concentrate production (dry)                           | 7.3 million tonnes                |                               |  |
| Concentrate phosphate grade                                | 35% P <sub>2</sub> O <sub>5</sub> |                               |  |
| Exchange rate, LOM (AUD:USD)                               | 0.75                              |                               |  |
| Initial capital cost (inclusive/exclusive contingency)     | \$A 55 - 61 million               | \$US 41 – 46 million          |  |
| LOM sustaining capital (inclusive/exclusive contingency)   | \$A 12 – 13 million               | \$US 9 – 10 million           |  |
| LOM average FOB operating cost (inc. royalties, overheads) | \$A 115/tonne                     | \$US 86/tonne                 |  |
| LOM average freight cost                                   | \$A 45/tonne                      | \$US 34/tonne                 |  |
| LOM average CFR operating cost (inc. royalties, overheads) | \$A 162/tonne                     | \$US 121/tonne                |  |
| CFR sales price at full-scale production being reached     | \$A 177/tonne                     | \$US 133/tonne                |  |
| LOM average CFR sales price                                | \$A 210/tonne \$US 158/ton        |                               |  |
| Pre-tax net cash flow                                      | \$A 278 – 283 million             | \$US 209 – 212 million        |  |
| Pre-tax NPV10  | \$A 124 – 129 million             | \$US 93 – 97 million          |  |
| Pre-tax IRR  | 39%                               | - 42%                         |  |
| Payback period   | 3 years                           |                               |  |

Centrex Managing Director & CEO Ben Hammond commented on the completion of the Scoping Study;

"It's great we have been able to complete the Scoping Study for Ardmore in parallel with our more detailed Feasibility Study which is due to be completed in mid-2018. These interim scoping level results hopefully demonstrate why we are so excited about Ardmore. It is one of the few undeveloped high-grade phosphate rock projects in the world. As can be seen from our study release we have analysed every aspect of the project in considerable detail, and presented comprehensive all-inclusive cost estimates.

We're doing everything we can to get into operation and cash flow as soon as possible. In the meantime given the results, the Directors believe Centrex is considerably undervalued."

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#### 1 Project Background

Ardmore was discovered in the late 1960s and was drilled out in the 1970s, with over 300 holes completed and a Mining Lease granted at that time. The nearby Duchess Phosphate Rock Mine ("Duchess Mine"), 70km to the east of Ardmore was discovered during the same period, and given its significantly larger resource was the focus of jnitial development. The two deposits were held under common ownership within various companies from the time of discovery until Centrex completed the acquisition of Ardmore in June 2017 from the most recent holder Southern Cross Fertilisers Pty Ltd ("SCF"), a subsidiary of fertiliser major Incitec Pivot Limited. The Duchess Mine continues to be operated by SCF and provides the feed to their Phosphate Hill ammonium phosphate fertiliser plant located at the mine site (Australia's only mainland phosphate rock mine, with Christmas Island representing the only other operation).

Ardmore is one of the few remaining undeveloped high-grade phosphate rock deposits in the world. Since acquiring it, Centrex has focused on developing a phosphate rock operation to supply feed to fertiliser plants in Australia (currently reliant on imports), and for export throughout the region.



FIGURE 1: Ardmore location map with Centrex held leases.

Ardmore 's current deposits lie on Mining Lease ML5542 held by Centrex, located 130km by road south of the city of Mount Isa, one of Australia's largest mining hubs (Figure 1). Centrex also holds a granted Exploration License EPM 26551 as well as an Exploration License Application EPM 26568 surrounding the Mining Lease.

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The Mining Lease is subject to a 3% revenue royalty to SCF, as well as a right of first refusal for up to 20% of the phosphate rock off-take at market prices.

The project is located on the Mount Isa-Boulia Highway in remote arid scrubland utilised for cattle grazing. Centrex has landowner agreements in place for mining with the two cattle stations that cross the Mining Lease. The Mining Lease is exempt from Native Title given it was granted prior to 1996. Centrex has undertaken heritage clearances across the project with the relevant traditional owners.



FIGURE 2: RC drilling at Ardmore in 2017.

Upon its acquisition of Ardmore, Centrex commenced a Feasibility Study for the project due for completion in mid-2018. In order to provide the market guidance on the project's conceptual economic returns; in the interim it was decided to complete a Scoping Study in parallel. In the last few months Centrex completed a large infill reverse circulation ("RC") drilling program of 319 holes across the deposits and defined the current Mineral Resources. In addition it completed a 24 hole PQ diamond drilling program to provide samples for bench scale test work completed to support the Scoping Study, and to create a bulk composite for Feasibility level test work currently underway. A large excavation was also undertaken by Centrex to provide bulk sample for crusher vendor test work currently being undertaken. Scoping level engineering designs and cost estimates have been prepared, and a number of marketing tours to likely customers for the phosphate

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rock product have been undertaken. Environmental baseline studies are well advanced and flora and fauna as well as heritage surveys have been completed showing no significant impediments to development.

#### Marketing

#### 2.1 Phosphate Rock Market

Phosphate is one of three essential elements for plant and animal nutrition, the other two being potassium and nitrogen. At a general level it is a catalyst for energy transfer within plants and animals. There are no substitutes for phosphate in agriculture.

Phosphate rock is the only significant source of phosphate for agricultural purposes. There are three types of primary phosphate rock deposits; sedimentary phosphorites, igneous apatites, and guano deposits (bird or bat faeces accumulations). Sedimentary phosphorites such as at Ardmore are the dominant source for phosphate rock production globally at around 80% of the market. Since the advent of industrial fertilisers there has been a strong link between population growth and demand for phosphate rock (Figure 3). As the world's population continues to grow, so too will demand for phosphate rock.



**FIGURE 3:** Link between global phosphate rock consumption and population growth (derived from World Bank 2017A & USGS 2017A).

Global phosphate rock production in 2016 was 261 million tonnes (USGS 2017B). This production was of various grades, with average regional phosphate deposit grades being anywhere from 6% to 38% P<sub>2</sub>O<sub>5</sub>. The

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majority of deposits are processed to produce concentrates >28% P₂O₅ to be used in the production of fertilisers (Figure 4). Around three quarters of phosphate rock is used in the production of phosphoric acid (Van Kauwenbergh 2010), which can in turn be used to produce high quality fertilisers, such as diammonium or monoammonium phosphate ("DAP" or "MAP"). Another major use is in the direct production of single superphosphate ("SSP").



FIGURE 4: Relationship of phosphate rock to fertilisers (adapted from Van Kauwenbergh 2010).

The majority of the world's phosphate rock production is for captive demand to integrated fertiliser production facilities. The export market in 2016 was around 25 million tonnes, with India being the largest importer, and Morocco the largest exporter. Australia and New Zealand together import around 1 million tonnes almost entirely for the production of SSP, and mostly from Morocco. Morocco exports include product mined from the Western Sahara, a disputed territory that has seen some shipments delayed due to legal challenges in 2017. The Scoping Study for Ardmore has assumed 776,000 tonnes of production per annum which represents 3% of the current traded market, and is considered to be able to be accommodated within expected market demand growth or replacing imports to customers within Asia or Australasia from outside the region, where the Ardmore project will have a considerable freight advantage. High cadmium levels in phosphate rock exports are becoming a global health concern with the European Union moving to significantly reduce allowable import limits. Test work to date shows Ardmore to be an ultra-low cadmium product.

The global traded market balance in 2016 is shown in Table 3.

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|   |       | Importer               | '000 tonnes              |
|---|-------|------------------------|--------------------------|
|   |       | India                  |                          |
|   |       | Brazil                 |                          |
| $\gg$   | 5     | Indonesia              |                          |
|   |       | USA                    |                          |
|   |       | Poland                 |                          |
|   |       | Lithuania              |                          |
| $\bigcirc$  |       | Turkey                 |                          |
| $\bigcirc$  |       | Belgium                |                          |
|   |       | Mexico                 |                          |
| 615   |       | Rep. of Korea          |                          |
|   |       | New Zealand            |                          |
| 20  |       | Serbia                 |                          |
| $\bigcirc \bigcirc $ |       | Bulgaria               |                          |
|   |       | Belarus                |                          |
|   |       | Australia              |                          |
|   |       | Rest of World          |                          |
|   |       | Total Imports          |                          |
| (D)   |       |                        |                          |
|   | 2.2   | Ardmore Target M       | larket                   |
|   | Base  | ed on test work to dat | te (discussed in Section |
| ()  | ultra | a-low cadmium produ    | uct. Cadmium has be      |
|   | Men   | nbers of the Europear  | n Parliament in Octob    |
| (())  | limit | s to 60ppm, with furt  | her reductions over t    |
|   | can   | be concentrated in ci  | rops. Ardmore has a c    |

**TABLE 3:** Global phosphate rock trade in 2016 (UN Comtrade 2017).

7,500 1,711

1,693 1.588 1.313 1,281 1.061 864 731 601

> 532 481 480

4.044

24,897

| Exporter           | '000 tonnes |
|--------------------|-------------|
| Morocco            | 7,903       |
| Jordan             | 4,735       |
| Peru               | 3,828       |
| Russian Federation | 2,491       |
| Egypt              | 1,530       |
| Algeria            | 1,138       |
| Israel             | 1,080       |
| Togo               | 846         |
| Senegal            | 473         |
| Kazakhstan         | 388         |
| China              | 278         |
| Netherlands        | 138         |
| Finland            | 126         |
| Belgium            | 23          |
| Pakistan           | 20          |
| Rest of World      | 46          |
| Total Exports      | 25,042      |

#### 2.2 Ardmore Target Market

Based on test work to date (discussed in Section 5) Ardmore would produce a premium grade  $35\% P_2O_5$  (Figure 5) ultra-low cadmium product. Cadmium has become a focus for the phosphate rock industry recently with the Members of the European Parliament in October voting in favour of a resolution to immediately lower import limits to 60ppm, with further reductions over time to an eventual limit of 20ppm. Cadmium is a toxic metal that can be concentrated in crops. Ardmore has a cadmium level of just 1ppm which makes it one of the lowest levels in the world (Figure 6).

Like most bulk commodities freight is a significant cost in delivering a product to market. Ardmore has a significant freight advantage over the main exporters to the Australian, New Zealand, and Indonesian markets. It also has a freight advantage over the majority of exporters to the east coast of India, which accounts for 70% of the total imports to India (IMCI 2017).

Centrex has advanced discussions with all major phosphate rock importers in Australia, New Zealand, and India, and has seen strong interest for off-take from the project. All customers have requested kilogram samples of product to undertake their own fertiliser conversion test work as a next step. Centrex will provide these as part of the current bulk test work program it is undertaking for the feasibility study on the project. Centrex will also undertake its own independent fertiliser conversion test work at KemWorks in the USA.

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FIGURE 5: Typical analyses of imported phosphate rocks (derived from FAI 2010).



FIGURE 6: Comparison of Ardmore cadmium content to other sources (derived from Oosterhuis et al 2000).

From Centrex's meetings with customers their physical import specifications appear generally consistent with 90% of the product to below 2mm, and only 10% of product to be below 75µm. This is another

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advantage of Ardmore over many other proposed phosphate rock developments, as the Ardmore deposit consists of relatively coarse 200µm phosphate (apatite) nodules, and can produce a premium grade product without grinding and creating unwanted ultra-fines. Ardmore also does not need complex flotation to achieve a saleable product like many other proposed developments.

The Ardmore Scoping Study assumed a target customer mix comprising 8 companies, with half the production going to Australia and New Zealand, and the other half going to India. While more than 8 companies showed interest in off-take from Ardmore, the 8 selected were assumed given; the quality of imports they currently purchase, and the relative freight advantage over their current supplier mix. Depending on the outcomes of customer fertiliser conversion test work, it is hoped a greater proportion of the product may be placed in the Australian and New Zealand markets where Ardmore has the largest freight advantage (approximately \$US 20/t lower than from Morocco at present). Investigations for the Indonesian market were still underway at the time of study and this market represents a further market opportunity with large scale fertiliser plants currently being constructed there.

Indian customers generally purchase phosphate rock on a cost and freight ("CFR") basis (seller organising the shipping). It was determined by Centrex selling on a CFR basis to Australian and New Zealand customers would also allow better optimisation of shipping schedules to manage port inventories and allow more frequent customer deliveries by load sharing handysize vessels (around 30,000 tonnes, the common size for the traded phosphate market) on dedicated runs to both regions.

## 2.3 Scoping Study Pricing Forecast

Integer Research ("Integer") were commissioned by Centrex to provide forecast CFR pricing for each of Ardmore's 8 target customers, by year over the life of mine in nominal and real terms. Integer's pricing build-up was based on their long-term forecast of the Morocco 70-72 BPL (32-33% P<sub>2</sub>O<sub>5</sub>) free on board ("FOB") benchmark. For each customer this benchmark was first adjusted, if necessary to the relevant benchmark of their current imports based on historical relationships. For instance a discount for equivalent grade Jordan product was applied if that was the product being imported at present by the specific customer rather than Morocco. From that revised base the freight from their current imports was added to derive a 70-72 BPL CFR price. This was then adjusted to reflect the higher 76 BPL (35% P<sub>2</sub>O<sub>5</sub>) Ardmore product based on historical premiums above the 70-72 BPL benchmark for similar higher grade products. Freight rates were escalated in real terms over the life of mine based on Integer's freight rates forecast, and freight rates for Ardmore in the study have been escalated using the same factors to maintain consistency.

Centrex estimated an average CFR price per year over the life of mine using a weighted average of the Integer CFR pricing by customer for its target customer mix. This resulted in a CFR price of \$US 133 per tonne upon reaching full-scale production (776Ktpa) forecast at the start of 2021, and an average life of mine price of \$US 157 per tonne in real terms. Initial shipments to customers are targeted for 2019. Integer's annual pricing forecasts are available under subscription service only.

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**FIGURE 7:** Comparison of Morocco 72 BPL free alongside (not loaded on the ship like FOB) benchmark (World Bank 2017B), and New Zealand Morocco CFR import pricing in real terms (UN Comtrade 2017, using World Bank deflators to convert to real terms).

## 3 Geology & Mineral Resource

### 3.1 Project Geology

The Georgina Basin, which stretches across Queensland and the Northern Territory is host to Australia's significant phosphate rock deposits. The basin is a northwest-southeast trending extensional basin which covers an area of 325,000km<sup>2</sup>. Middle Cambrian marine sediments (505-515 million years ago) around the edge of the basin are the host to sedimentary phosphorite deposits such as Ardmore (Figure 8).

The Ardmore deposit is located within the Ardmore Outlier. It is block bounded to the east by the large regional north-south orientated Rufus fault zone, a target itself for base metals mineralisation. A lessor fault bounds the deposit to the west.

Phosphate mineralisation is located within the Beetle Creek Formation, a succession of cherts, phosphatic siltstones, phosphate rock and minor shales that outcrops in some areas within the project area (Figure 9). Within the Beetle Creek Formation, the upper Simpson Creek Phosphorite Member hosts high-grade mineralisation (≈25-35% P<sub>2</sub>O<sub>5</sub>) while the underlying Basal Phosphorite Member sub-units have lower grade phosphatic siltstones and shales (≈5-15% P<sub>2</sub>O<sub>5</sub>). The Thorntonia Limestone underlies the Beetle Creek Formation, while the Blazan Shale overlies it.

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FIGURE 8: Location of Ardmore within the Georgina Basin.



FIGURE 9: Local geology of the Ardmore Phosphate Rock Project.

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The phosphate mineralisation within the Simpson Creek Phosphorite Member is overwhelmingly in the form of carbonate-fluorapatite ("francolite") Ca<sub>5</sub>(PO<sub>4</sub>, CO<sub>3</sub>)<sub>3</sub>F, which formed as a chemical precipitate at the sediment-sea floor interface. The francolite occurs as nodules and phophoritised shell fragments around 200µm in diameter, and the unit is on average 4.3m thick across the project. The project is nominally broken into two main deposits by an ephemeral creek; the Northern Zone and Southern Zone. The unit is shallow dipping within these deposits ("zones") however it continues between the two rolling over at moderate to steep dips along the eastern bounding fault.



**FIGURE 10:** Trench section through sedimentary phosphorite within the Simpson Creek Phosphorite Member, unconformably overlain by alluvium.

A thin (10-20cm) collophane (mudstone) marker bed is generally located in the middle of the high-grade phosphorite unit. At the very base of the unit it grades conformably into underlying lower grade phosphatic siltstones and shales with thin (5-10cm) chert bands marking the contact. The unit outcrops in many locations. Where not outcropping it is either unconformably overlain by alluvium on an erosional contact, or conformably overlain by soft shales of the Blazan Shale Formation. The high-grade phosphorite across the majority of the deposit is heavily weathered and leached of primary carbonates. For this reason it is generally very friable, however minor indurated material is found close to surface where in-situ recrystallisation of apatite has occurred, forming an apatite-cement between nodules.

#### 3.2 Mineral Resource

Centrex announced an updated Mineral Resource for the project in December 2017. The estimate was based on 303 historical drill holes (300 percussion, 3 NQ diamond), and 319 RC holes by Centrex.

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The estimate defined total Mineral Resources of 14.2 million tonnes at 28.7% P<sub>2</sub>O<sub>5</sub> (using a 19% P<sub>2</sub>O<sub>5</sub> cut-off). A total of 12.3 million tonnes of the resource is classed as either Indicated or Measured Mineral Resources. A full breakdown is provided in Table 4.

| Mineral Resource Category | Million Tonnes | P <sub>2</sub> O <sub>5</sub> % |
|---------------------------|----------------|---------------------------------|
| Measured                  | 1.3            | 29.7                            |
| Indicated                 | 11.0           | 29.0                            |
| Inferred                  | 2.0            | 26.3                            |
| Total Mineral Resources   | 14.2 *         | 28.7                            |

**TABLE 4:** Ardmore Mineral Resource classification.

\* Totals may not add precisely due to rounding.

For full details of the Mineral Resource refer announcement 18<sup>th</sup> December 2017;

#### http://www.asx.com.au/asxpdf/20171218/pdf/43q8hp4xygcbh0.pdf

The results were reported under JORC 2012 and Centrex is not aware of any new information or data that materially affects the information contained within the release. All material assumptions and technical parameters underpinning the estimates in the announcement continue to apply and have not materially changed.

The target high-grade phosphorite occurs as a single, essentially flat lying unit within two separate designated mining areas, the Northern Zone with a strike extent of approximately 4.0km (N-S) and the Southern Zone with a strike extent of approximately 1.6km (E-W).

Drill holes were mainly (99% of the data) sampled at a nominal 0.5m interval. Historical rotary percussion drill holes were completed using a 6" tri-cone blade. Samples were collected via a venturi system with a rubber seal over a PVC cased hole collar into a cyclone. Sample intervals were split by hand using a 16" pocket splitter and resplit to achieve average sample weights of 1kg. RC drilling was completed with a 4 ¼ inch hammer with a 900 psi compressor, and an auxiliary compressor for sampling below the water table. Samples were split into nominal 1kg lots using a rig mount cone splitter. The sampling method for the three historical diamond core holes has not been verified and these holes were not specifically targeting phosphate but other commodities in the overlying shale.

Assays for both recent and historical programs were by lithium borate fusion followed by ICP. In 2010 93% of historical sample pulps were re-assayed. A total of 21 RC twin holes of historical rotary percussion holes were completed by Centrex to validate the historical sampling technique and results.

From the recently reported PQ diamond drilling program drilling for metallurgical purposes (but not utilised within the Mineral Resource estimate as full intervals were utilised for destructive test work), a total of 98 core samples were sent for laboratory in-situ dry bulk density determination based on the Archimedes method. Based on the results the average in-situ dry bulk density of the mineralised material was 1.91 (g/cm<sup>3</sup>) with a standard deviation of 0.27 (g/cm<sup>3</sup>).

The mineralised zone was represented by interpreted three-dimensional strings and wireframes. These interpretations were used to develop a cellular model and to the flag drill hole samples. Grade estimation was

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undertaken using Ordinary Kriging methods. The kriged estimates were validated by inverse distance estimates. Variography was undertaken for the mineralised zone.

A notional cut-off of 19% P<sub>2</sub>O<sub>5</sub> was used to constrain the interpretation, as generally this was observed to be the natural break (change) in the data distribution, and aligned with lithological logging. No high-grade or low-grade cuts were applied to data as the population distribution did not identify any significant unexplained outliers.

Figure 11 provides the generalised drill spacing for each resource classification with; Measured Mineral Resources at 20m to 40m grid spacing, Indicated Mineral Resources at 80m drilling spacing, and Inferred Mineral Resources at 160m to 240m grid spacing. It should be noted that drill spacing is not the sole determinant of resource classification.

Representative cross sections of the Southern Zone and Northern Zone are provided in Figure 12 and Figure 13 respectively.



FIGURE 11: Plan view of drill hole locations over Mineral Resource area by category.

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**FIGURE 12:** Representative north-south cross section (323,275 mE) through the Southern Zone of the deposit looking east, five times vertical exaggeration.



**FIGURE 13:** Representative east-west cross section (7,603,085 mN) through the Northern Zone of the deposit looking east, five times vertical exaggeration.

## Mining

4

## 4.1 Geotechnical Review

Golder Associates Pty Ltd was commissioned by Centrex to undertake a preliminary geotechnical review to support mine designs. The review included a three day site visit to assess the surface geology and structures, the historical excavations within the deposit, and geotechnical logging of PQ diamond drill core from the recent drilling program. Given the very weak overburden (shale) and phosphorite, no sufficient lengths of representative core were available for laboratory unconfined compressive strength ("UCS") testing and so approximations were determined using a field strength assessment correlated to UCS (AS1726 2017). Average UCS for the overburden shale was estimated at 2.6 MPa and 5.0 MPa for the phosphorite.

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The preliminary recommendations from the review were for maximum overall slope angles of 60 degrees for the eastern pit faces bound by the eastern fault with maximum bench heights of 30m without berms, and 50 degrees for all other faces with maximum bench heights of 15m with 5m berms. In areas where soils exist, recommended maximum overall slope angles were 30 degrees with maximum 3m benches.

Pit Optimisations

Optima Consulting & Contracting ("Optima") were engaged by Centrex to undertake mine design and mining cost estimations based on the Mineral Resource.

Pit optimisations were undertaken in Whittle using the variables in Table 5. The project was optimised in three parts; the Northern Zone, the Southern Zone, and the Central Zone. Given the Central Zone was wholly comprised of Inferred Resources, Optima was directed by Centrex to remove it from consideration in the Scoping Study.

TABLE 5: Open pit optimisation criteria.

| Parameter                   | Value     | Information  |
|-----------------------------|-----------|--|
| Target Mineralised Zone     | 1,184ktpa | Estimate provided by Centrex. 90% to ROM and 10% of      |
| Production                  |           | this value to LG stockpile                               |
| PCAF                        | \$145/t   | Per tonne of product produced provided by Centrex        |
|                             |           | (total CFR cost excepting mining)                        |
| Processing Recovery         | 66%       | Percentage of each resource model tonne that converts    |
|                             |           | into product. Takes into consideration 10% of the        |
|                             |           | material is sent to the low-grade stockpile. Provided by |
|                             |           | Centrex  |
| Cut-Off                     | None      | Calculated by Whittle (19% cut-off already within        |
|                             |           | Mineral Resource)  |
| Revenue                     | \$202/t   | Per tonne of product, provided by Centrex                |
| Exchange Rate USD:AUD       | 0.75      | Provided by Centrex                                      |
| Mill Processing Rate        | 1,065ktpa | Estimate provided by Centrex                             |
| Target Phosphate Production | 800ktpa   | Estimate provided by Centrex                             |

The pit optimisation results for the chosen pit shells from Southern Zone and Northern Zone are provided in Table 6.

| TABLE 6: | Pit  | optimisation | results. |
|----------|------|--------------|----------|
|          | 1 10 | opennoacion  | 10001001 |

|                 | Unit     | Southern Zone | Northern Zone | Total |
|-----------------|----------|---------------|---------------|-------|
| Ore             | Mt       | 6.3           | 5.3           | 11.6  |
| Waste           | Mt       | 12.6          | 38.1          | 50.7  |
| Total Material  | Mt       | 18.9          | 43.4          | 62.3  |
| Grade           | $P_2O_5$ | 29.5          | 28.9          | 29.2  |
| Stripping Ratio | t:t      | 2.0           | 7.2           | 4.4   |

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#### 4.3 Mining Philosophy

Like other phosphate rock operations it was assumed the deposit would be selectively mined to minimise contamination in the product from the overlying shales or alluvium and from the underlying siltstones and cherts. The mining philosophy employed is to strip mine the overburden with a dozer where possible and push the waste into the void left by previous mining. The overburden was assumed to be stripped in this manner down to 1m above the hangingwall contact where practical. From this point to the base of the pit, an excavator (and trucks) would be used to selectively mine the contact and ore material. The excavator would mine down to just below the hangingwall contact and stockpile this material on a "low grade" stockpile (not considered in the study but could be beneficiated at the end of the current mine life), conceding some ore to ensure minimal contamination. The "high-grade" ore would then be mined in two flitches to just above the footwall contact, again conceding some ore to ensure minimal contamination.

The Mineral Resource was based on drilling with regular 0.5m sampling intervals which cross the hangingwall and footwall contacts at arbitrary points, causing dilution to be included in the Mineral Resource that could be selectively mined out in reality. To estimate the recovery and grade of selectively mined ore from the Mineral Resource, a recent PQ diamond drilling program was undertaken by Centrex with all diamond holes twinned to existing resource drill holes. The PQ diamond core was sampled in the same manner as the planned selective mining approach. Both the high-grade ore zone and the low-grade contact zones were weighed and assayed. The weighted average of these intervals was shown to equal the twin hole interval grades used in the Mineral Resource, and so assessment of the grade uplift and mass recovery from the Mineral Resources due to selective mining was able to be made. From this it was estimated selective mining would result in an approximate 4% uplift in  $P_20_5$  grade from the Mineral Resource model at a mining mass recovery of 90%.

A recent bulk excavation by Centrex (and attended by Optima) for a crusher vendor bulk test work sample confirmed the ability to free-dig the deposit and also showed a relatively easy ability to identify and mine to the ore/waste contacts with minimal dilution. This presents some upside in the assumed 90% mining mass recovery and will be investigated further in the Feasibility Study.

## 4.4 Pit Designs

The Mineral Resource model was re-blocked by Optima at 10m x 10m x 1m into a mining model to enable mine design and scheduling at a practical block size. No dilution modelling was required given the dilution already within the Mineral Resource, and instead the 90% mining mass recovery was applied.

Mine design parameters used were;

- 10m bench height with 2m flitches which was around the narrowest width of mineralisation (but due to the free-dig nature of mining, mining height of the mineralised zone is only limited by operator skill and GPS control);
- 52 degrees inter ramp angle;
- Batter angle of 75 degrees;
- Berm width of 5m every 10.0m; and
- Ramp widths of 20m at 10% grade for 90 tonne haul trucks with two way traffic (due to shallow dip angle in Northern Zone and Southern Zones, haul roads can be made along the footwall contact).

Level 6, 44 Waymouth Street Adelaide, South Australia 5000 T +61 8 8213 3100 F +61 8 8231 4014 The pits were staged in 200m strips along strike (northwest to southeast) and given the shallow dips, the pits were contoured to the footwall surface using the natural slope of the footwall for temporary ramps. A total of 6 strips were designed in the Southern Zone to a maximum depth of 25m, and 9 strips in the Northern Zone to a maximum depth of 50m. Final LOM pit designs are shown in Figure 14 and Figure 15.



FIGURE 14: Plan view of Southern Zone pit in relation to infrastructure with 3D oblique view insert.

The resulting pit designs produced conceptual pit inventories shown in Table 7.

TABLE 7: Conceptual pit inventories.

| Area          | Mineral Resource Class | Mt   | %P <sub>2</sub> O <sub>5</sub> | % of Total |
|---------------|------------------------|------|--------------------------------|------------|
| Southern Zone | Measured               | 1.0  | 30.0                           | 9          |
|               | Indicated              | 5.1  | 29.5                           | 46         |
|               | Sub-Total              | 6.1  | 29.6                           | 55         |
| Northern Zone | Measured               | 0.2  | 28.5                           | 2          |
|               | Indicated              | 4.7  | 29.0                           | 42         |
|               | Inferred               | 0.1  | 27.4                           | 1          |
|               | Sub-Total              | 5.0  | 28.9                           | 45         |
| Total         | Measured               | 1.2  | 29.7                           | 11         |
|               | Indicated              | 9.8  | 29.2                           | 88         |
|               | Inferred               | 0.1  | 27.4                           | 1          |
|               | Total                  | 11.1 | 29.3                           | 100        |

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FIGURE 15: Plan view of Northern Zone pit in relation to infrastructure with 3D oblique view insert.

## 4.5 Mine Waste

The majority of waste rock is able to be strip mined and deposited within the empty voids after mining reducing the requirement for specific waste rock storage facilities. For the Southern Zone given its shallow nature, a small starter "lip" is required on the pit edge to initially commence operations. As the deposit is outcropping in the Southern Zone this is minor. For the deeper Northern Zone a small waste rock storage facility is needed for the minor sections of waste that are unable to be strip mined. A conceptual facility has been designed for this based on the following parameters;

- 20m wide ramps;
- 10m benches with three lifts;
- 37 degree batter angle;
- 48m berm after first lift and a 29m berm at the second lift to enable stable final rehabilitated slope face with the bottom bench toe pushed out a further 28m; and
- Swell factor of 15% for mined waste rock since the waste rock is quite unconsolidated in-situ (as observed in recent excavations).

The final Northern Zone waste rock facility design will be able to accommodate a volume of 2.6 million BCM which includes significant contingency.

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FIGURE 16: Plan and oblique views of the Northern Zone waste rock storage facility.

4.6 Equipment & Scheduling

Scheduling was completed for the first two years of full-scale operations by month, years 3 & 4 by quarter, and the remainder by year. The Southern Zone will be mined first followed by the Northern Zone commencing late in year 5. As discussed in Section 5.3 the process plant and ROM pad will be located in the Southern Zone. Ore from the Northern Zone will be hauled on average 7km to the process plant on a newly constructed haul road. Mining has been assumed on day shift only basis and ore will be 100% re-handled on the ROM pad by a front end loader feeding the crushers on a 24/7 basis. The front end loader has been considered to be within the process plant operating costs.

The assumed mining fleet consists of;

- A single 125 tonne excavator;
- Two 90 tonne haul trucks;
- Up to three D9 equivalent dozers;
- Grader;
- Water truck; and
- An integrated tool carrier.

To maximise fleet productivity, overproduction of ore occurs in the first 6 years building up stockpiles which are then drawn down in the final years of mining. A summary of the schedule is provided in Figure 17.

A low-grade stockpile is built up over the mine life to around 1 million tonnes consisting of the contact dilution material. Based on the recovery factors developed from the PQ diamond twin program, the grade of this low-grade stockpile is assumed to be around 19% P<sub>2</sub>O<sub>5</sub>. No utilisation of this ore was considered in the Scoping Study, a test work program is planned in the Feasibility Study to assess the ability to upgrade it.

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FIGURE 17: Annual mining schedule summary from start of full-scale operations.

An annual summary of the schedule by Mineral Resource classification is provided in Table 8.

**TABLE 8:** Annual mining schedule summary by Mineral Resource classification from start of full-scale operations.

| Voor | Classification              |      |    | Ore Mined (Mt) |
|------|-----------------------------|------|----|----------------|
| Teal | Measured Indicated Inferred |      |    |                |
| 1    |                             | 100% |    | 1.1            |
| 2    | 12%                         | 88%  |    | 1.4            |
| 3    | 33%                         | 67%  |    | 1.5            |
| 4    | 23%                         | 77%  |    | 1.5            |
| 5    | 1%                          | 98%  | 1% | 1.2            |
| 6    |                             | 100% |    | 1.3            |
| 7    |                             | 100% |    | 0.7            |
| 8    |                             | 93%  | 7% | 0.7            |
| 9    |                             | 98%  | 2% | 0.9            |
| 10   | 26%                         | 74%  |    | 0.9            |

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#### 5.1 Process Testwork

The starting basis of the Scoping Study process test work program was to meet target customer physical product specifications of 90% passing 2mm, < 10% passing 75 $\mu$ m, and 3% moisture. Minimisation of the minor element ratio or "MER" ([Fe<sub>2</sub>O<sub>3</sub> + Al<sub>2</sub>O<sub>3</sub> + MgO] / P<sub>2</sub>O<sub>5</sub>), a measure of product quality, and phosphate grade were the other key considerations.

The initial drill hole of the recent PQ diamond program (PQ diamond hole AMDD007A, twin of percussion hole AMRB126) was considered to be representative of the ore body average based on its twin hole average interval assays. The hole was sampled to represent selective mining and formed into a "mini-composite". A representative photo of the ore is provided in Figure 18. Initially a 0.5kg sub-sample from the mini-composite was crushed to - 2mm and assay by size performed to assess if a crushing and deslime circuit was sufficient to meet the customer sizing specification. It was shown that the removal of the -38µm material would ensure that the product met the customer sizing specification for fines.

Attritioning is common in the phosphate rock industry to aid in the removal of gangue such as clays from phosphate mineral surfaces. Given this, a further 0.5kg sub-sample was crushed to -2mm and placed in a bench scale attritioner for 5 minutes at 60% solids, then assay by size was undertaken. Although crushing and desliming alone provides a significant upgrade in the phosphate rock grade and a drop in the MER ratio, the addition of a relatively low cost attritioning step prior to desliming provided a further significant grade uplift. Summary results are provided in Table 9.

It was noted from the test work that cadmium levels in the Ardmore ore and concentrate were ultra-low compared to most products on the market.

| TABLE 9: Mini-composit | e beneficiation | test work results |
|------------------------|-----------------|-------------------|
|------------------------|-----------------|-------------------|

| Sample  | P2O5<br>(%) | CaO<br>(%) | Al2O3<br>(%) | Fe <sub>2</sub> O <sub>3</sub><br>(%) | MgO<br>(%) | SiO2<br>(%) | F<br>(%) | Cd<br>(ppm) | MER<br>Ratio |
|---|-------------|------------|--------------|---------------------------------------|------------|-------------|----------|-------------|--------------|
| Head Grade                                    | 31.7        | 44.1       | 2.7          | 2.5                                   | 0.4        | 12.0        | 3.4      | 1.4         | 0.18         |
| Concentrate Grade<br>(Attritioning & Deslime) | 35.3        | 49.4       | 0.8          | 1.8                                   | 0.2        | 6.6         | 3.7      | 1.1         | 0.08         |
| Recoveries (%)                                | 81.3        | 81.4       | 21.8         | 53.2                                  | 39.7       | 39.9        | 80.3     | 79.1        |              |

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## FIGURE 18: PQ diamond core from mini-composite.

For design of the crushing circuit, preliminary physical characterisation test work was undertaken on selected samples from historical excavations and the mini-composite. The ore was shown to be weak and non-abrasive. The average crushing work index was 4.5 kWh per tonne, bond rod index 8.4 kWh per tonne, and the Bond abrasion index was 0.002.

Bench scale settling tests were undertaken on both concentrate and tailings samples. Filtration tests were done on the concentrate. Laser sizing analysis was undertaken on the tailings.

For full details of the recent test work results refer to the announcements of 24<sup>th</sup> July 2017 and 21<sup>st</sup> September 2017;

http://www.asx.com.au/asxpdf/20170724/pdf/43ktqlsrj97p44.pdf

## http://www.asx.com.au/asxpdf/20170921/pdf/43mj13lptzjty9.pdf

The results were reported under JORC 2012 and Centrex is not aware of any new information or data that materially affects the information contained within the release. All material assumptions and technical parameters underpinning the estimates in the announcement continue to apply and have not materially changed.

## 5.2 Process Plant Design

GR Engineering were engaged to design a process plant capable of producing 800,000 wet tonnes per annum at a moisture content of 3% (776,000 dry tonnes per annum) from the selectively mined run of mine ore. The plant design was based on the Scoping Level test work results.

Within the Scoping Study it is assumed run of mine ore would be fed from a stockpile via a front end loader to the crushing circuit. The ore would be crushed to -2mm in a three stage crushing circuit comprising primary and secondary sizers, and a tertiary rolls crusher. Potential exists to reduce the number of crushing stages given the very weak nature of the ore upon the completion of bulk test work with crushing vendors. Centrex dispatched a bulk sample to vendors in December in order to evaluate this and results will be incorporated into the Feasibility Study.

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## FIGURE 19: Scoping Study process flow diagram.

Crushed ore will be slurried and fed to a wet circuit comprising attritioner and hydrocyclones to liberate clays and other gangue and remove the slimes fraction below 38µm. The slimes will be then fed to a tails thickener and pumped to the tailings storage facility.

The concentrated product from the wet circuit will be filtered and washed prior to being sent to the drying circuit. The filtered concentrate will be stacked on dewatering stockpiles equipped with a moisture reduction system. The partially dried concentrate would be reclaimed by front end loader and fed to a hopper which in turn feeds into a rotary dryer. Dried concentrate product would be discharged into a bin for direct loading of road trains.

A summary flow sheet is provided in Figure 19.

#### 5.3 Process Plant Layout

GR Engineering was provided 1m airborne Lidar contour data and high resolution aerial imagery across the project area from a recent survey flown by RPS for Centrex on which to base process plant and infrastructure layouts.

The process plant was located near the Southern Zone deposit given this would be mined first and due to suitable surface geometry in the area. Further evaluation of the process plant location will be undertaken in the Feasibility Study. Ore from the Northern Zone would be trucked on a haul road to the plant which would be constructed prior to the commencement of operations there in year 5 of the operation.

Level 6, 44 Waymouth Street Adelaide, South Australia 5000 T +61 8 8213 3100 F +61 8 8231 4014 The tailings storage facility was located close to the plant within a natural depression utilising a containment embankment that will be progressively raised. Initial tailings dam designs and estimates were completed by Land & Marine Geological Services Limited.

A close up of the process plant layout is provided in Figure 20 and an overall site layout in Figure 21.



FIGURE 20: Process plant layout.

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FIGURE 21: Mine site layout.

## 6 Mine Site Infrastructure

## 6.1 Access

A 6km unsealed road suitable for the road trains was designed to connect the process plant to the Highway. The design included estimates for creek crossings.

## 6.2 Power & Fuel Supply

A review of potential fuel sources for onsite generators at the mine site was undertaken based on supplier quotes. Based on the review, diesel was the lowest cost option delivered to site via nearby depots. Diesel would also be required for the mining fleet and other mobile equipment. Fuel would be stored in two 70,000 litre self-bunded tanks with automatic fuel delivery systems.

Four 1MW diesel generators were allowed for to provide N+1 supply as well as distributions systems.

Although the rotary dryer could be run on diesel, to avoid potential contamination of the product, a gas-fired dryer was provided. Analysis of supplier pricing showed LPG to be more cost effective than LNG for the dryer. A single 100 tonne tank would be located at site for supply.

## 6.3 Water Supply

In the Northern Zone, the Beetle Creek Formation which hosts the ore is an unconfined aquifer below the water table. A four day pump test with a 3L/s pump within the aquifer showed no significant drawdown in either the bore or surrounding monitoring bores, indicating a substantial volume of water available. The water was tested

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and returned moderately to highly saline. For the Scoping Study it was assumed this water would be utilised for processing and for amenities. A reverse osmosis ("RO") plant was included along with brine evaporation ponds to treat the water to a potable level even for processing, given that chlorides are considered a contaminant for phosphate rock. A 6km pipeline from the proposed bore field was designed and costed to transport water to the RO plant.

From a review by Golder Associates a number of alternate water sources outside of the Mining Lease within the vicinity of the project have been highlighted for further investigation. These include potential surface water harvesting locations that may be able to supply the project water needs and eliminate the need for any desalination. Two other potential groundwater targets have also been defined. Further investigation of these alternate sources is currently underway.

#### 6.4 Buildings & Facilities

An administration office, car parks, security, OH&S, ablutions, crib rooms, maintenance facilities (mobile and fixed plant) and waste management facilities were included within the study estimate.

#### 6.5 Accommodation

An 80 man mining camp has been allowed for on the Mining Lease. Camp operations are assumed to be run by a contractor with running costs provided from quotations. At the Duchess siding there is an existing establishment with 27 rooms that may be utilised for accommodation for the road haulage and siding operations staff (discussed Section 7).

#### 7 Logistics

Based on Centrex's marketing tours and reviews, all potential customers for the Ardmore phosphate concentrate require bulk delivery, typically via handysize vessels (30,000 tonnes) to accommodate their port drafts. They can receive part shipments below this maximum. The nearest bulk port to Ardmore is the Port of Townsville approximately 830km east-northeast of the project (Figure 22).

An existing narrow-gauge rail line connects the Port of Townsville to the city of Mount Isa and is located approximately 110km north of Ardmore. The rail line travels southeast of Mount Isa to the town of Duchess, 70km hortheast of Ardmore, before it travels northeast to the town of Cloncurry and then east to Townsville. This makes the town of Duchess the closest point from Ardmore from which to transport the concentrate via rail to Townsville.

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## FIGURE 22: Ardmore location map.

A logistics option study was undertaken within the Scoping Study to determine the most cost effective mine to ship solution. At a high-level these options included transporting the concentrate to the port and storing it in containers, storing in bulk or as combinations of these two options. Six logistics contractors provided pricing inputs into the options study based on their equipment and facilities (four road proposals, four rail proposals, and three port proposals with most proposals providing multiple scenario pricing), as well as QR Rail who provided below track pricing for the rail line. GR Engineering provided pricing for a new Centrex owned unloading and storage facility at the Port of Townsville for comparative purposes to third party options.

From the options studies, transport and storage in containers was considered as the baseline for the Scoping Study, with shiploading via one of the existing rotating container facilities (rotating and emptying containers into a bulk vessel). The hybrid options of road haulage to the rail siding in bulk, or tipping containers into a bulk shed at the port for storage were only marginally different to the baseline assumption and require further analysis in the Feasibility Study.

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## FIGURE 23: Ardmore mine to port logistics options.

As rail is the largest single item of logistics operating costs, and given logistics is the largest item of the project operating costs, production levels for the project were optimised around the rail to maximise rolling stock utilisation. Each train consist can haul approximately 400,000 tonnes per annum on a wet basis along the intended route, and so 800,000 wet tonnes (776,000 dry tonnes) was selected as the optimal production case to utilise two train consists, achieve relative scales of economies for the project, and provide a reasonable mine life of 10 years based on the conceptual pit inventories.

## 7.1 Road Haulage

The sealed single lane (with passing shoulders) Boulia-Mount Isa Highway runs directly east-west through the Northern Zone deposit of Ardmore. The Highway runs 27km west of Ardmore to the town of Dajarra. At Dajarra there is a turn-off onto a State controlled dual lane gravel road, with the town of Duchess, where the trains would be loaded, located 59km northeast along this road from the turn-off.

All roads from the mine to Duchess are gazetted for triple or quad road trains. Transporting with containers, the maximum possible load for full containers via triple road trains is roughly an 84 tonne payload between three containers.

WSP provided cost estimations to modify and maintain the gravel road to allow for year round haulage operations excepting minor downtime during a major event which has been incorporated into the project costs. A week's worth of wet weather stockpiles were allowed for at the rail siding for major weather events.

In year 5 of the project a diversion of the single lane bitumen Highway running through the lease was costed by WSP to allow for mining of the Northern Zone pits which the current Highway intersects. These costs have been included in the sustaining capital estimate for the project.

## 7.2 Rail

In 1994 the rail line from Duchess to Dajarra was decommissioned. While the rail itself was reclaimed the foundations and corridor remain. Where the corridor meets the current main line QR Rail has an existing

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maintenance turnout and short siding. Centrex and QR Rail have been investigating an approximately 1km extension of the short siding along the corridor with a new hardstand on the eastern side for loading and unloading operations. Indicative estimates for the siding extension were provided by QR Rail and rail contractors. WSP provided estimates for the ancillary works required for the siding operations.



**FIGURE 24:** Aerial image of Duchess siding area (left), and maintenance rolling stock parked in existing short siding (right).

At the Duchess rail siding there is an existing 11kV main to be used for lighting. Estimates for running the power from the existing lines to the siding were included. A 5,000 litre self-bunded tank was included for siding loading equipment.

The Mount Isa-Townville rail line is a narrow gauge line with 20 tonne axle loads. The maximum train length is approximately 1,000m due to current minimum passing loop lengths on the line. The rail distance from Duchess to the Port of Townsville is approximately 890km.

For railing the product to the port in containers on flatbed wagons ,each train consist would have two locomotives, with 59-62 flatbed wagons holding 2 containers per wagon meaning a train payload of around 3,300 to 3,500 tonnes.

Full containers from the mine would be stacked along the length of the siding ready for loading. Reach stackers would be used to take the full and empty containers on and off the road trains and the trains themselves.

## <sup>1</sup>7.3 Port & Shipping

At the Port of Townsville a number of areas have been highlighted in the port precinct or at the Stuart intermodal facility where containers could be unloaded with reach stackers from the train. The Scoping Study assumed a new hardstand area in the port precinct at a location identified by the Port Authority as being available and suitable for use. An estimate for the hardstand facility was provided from rail contractors.

Containers would be trucked and stored in an existing container yard. The Scoping Study allowed for container leasing costs to have 40,000 tonnes of product stored at the port in order to have a buffer for loading the 30,000 tonne handysize vessels. During shipping the containers would be reclaimed by reach stackers onto trucks and taken to the rotating container loading crane. Cargo charges were provided by the Port Authority. Shipping would occur fortnightly.

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![](_page_33_Picture_1.jpeg)

FIGURE 25: Mineral concentrate being loaded at the Port of Townsville using Qube's Rotabox<sup>™</sup> system.

Freight estimates to Centrex's target customers were provided by Braemar ACM Shipping.

## 8 Environment, Community, Tenure & Government

## 8.1 Native Title & Heritage

The Ardmore Mining Lease is "pre 1996 grant" and consequently the lease area is not subject to matters related to the Native Title Act. State Aboriginal Heritage laws still apply and obligations exist under the Queensland Aboriginal Cultural Heritage Act 2003 ("ACHA") regarding the company's duty of care to the recognition, protection and conservation of Aboriginal cultural heritage. A search of the DATSIP Cultural Heritage Register of the lease area did not identify any Aboriginal cultural heritage sites.

An aboriginal cultural and historic heritage assessment of the lease area was undertaken by RBC Environmental in conjunction with relevant traditional owners on behalf of Centrex in June 2017. There have been no previous cultural heritage studies undertaken specific to the Mining Lease.

Management of Centrex's duty of care under the ACHA has involved direct consultation with relevant traditional owners and the undertaking of field clearance surveys with group representatives under a system of work program notifications. Since the initial extensive survey in June, a series of smaller, more targeted surveys focussing on areas which are proposed to be subject to major ground disturbance have been undertaken.

Surveys to date show no significant impediments to a phosphate rock mining operation at Ardmore.

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#### 8.2 Environment

The climate across the project is characterised as hot and semi-arid with a pronounced wet season from December to March. Potential risks associated with climate are largely related to future flooding events which may impact operations both on and off the lease. Given this, Golder Associates Pty Ltd were engaged to provide hydrological modelling across the site as inputs to engineering designs.

The area including and surrounding the Mining Lease is primarily used for low intensity cattle grazing typical of the dominant land use for the broader region. Northern Resource Consultants completed an early dry season flora and fauna survey over the Mining Lease in July 2017 showing no impediments to development of mining operations in the proposed areas. A follow up early wet season flora and fauna survey is planned for completion this month.

Baseline dust monitoring has begun with the establishment of dust deposition gauges at both the Ardmore and the Duchess rail siding sites. Data will be collected monthly and assessed over a 6-month period to capture seasonal deviation and provide an assessment of the ambient air quality at both sites.

A program of soils, waste rock, and plant tailings geochemical assessment has commenced this month to review the presence of any potentially acid forming materials.

#### 8.3 Community

The Ardmore project area is located within a remote part of North West Queensland. The nearest occupied residence is located 8kms from the project site. The township of Dajarra is located 23kms to the east of the project which falls within the Cloncurry Shire. The Mining Lease itself is split between the Cloncurry and Boulia Councils and Centrex has been engaging with both. Land owner compensation agreements are in place for mining and Centrex has been in regular contact with the pastoral lease holders.

#### 8.4 Tenure

All current planned mining operations and processing facilities are sited on Mining Lease 5542 held by Centrex Phosphate Pty Ltd, a wholly owned subsidiary of Centrex. The Mining Lease was renewed for a further 21 year term in June 2018, and includes rights in addition to phosphate for; As, Bi, Cu, Fe, Ni, Pb, Sb, V, Zn, Ag and Th.

Southern Cross Fertilisers Pty Ltd ("SCF") a subsidiary of (Incitec Pivot Limited) holds a 3% revenue royalty over the Mining Lease. In addition SCP has a right of first refusal of up to 20% of phosphate rock production from the project at market prices.

#### 8.5 Mine Closure & Rehabilitation Planning

Mine rehabilitation for the study was assumed to be progressive throughout the mine life. Where possible mine waste will be backfilled into existing excavations that will minimise waste rock storage facilities (waste dumps). Allowances have been made of soil stripping and storage in advance of operations for later use in rehabilitation. Rehabilitated areas would be re-seeded progressively.

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#### 8.6 Government

Centrex currently holds an Environmental Authority (BRMN0037) over ML5542 which was issued on 17 July 2017 by the administering authority, the Department of Environment and Heritage Protection under standard conditions. The proposed mining, processing and related construction activities will require additional approvals which may initially be through variations to the existing EA but will also require a 'Site Specific' or new EA. Centrex is currently of the view that an Environmental Impact Assessment ("EIS") will not be required for its proposed developments.

Extraction of saline groundwater from within the Northern Zone aquifer will be subject to gaining the necessary water licences.

#### Capital Cost Estimates

Capital cost estimates for the project were prepared to an accuracy of +/-50%.

Mining cost estimates were provided by Optima Consulting & Contracting on an owner operated equipment lease basis. Given this the fleet itself does not represent a start-up capital cost with the leasing covered within the operating cost estimates. Mine capital estimates provided for all required infrastructure and facilities (maintenance etc.) to support the fleet as well as initial clear and grubbing, haul road establishment, and ROM pad construction. Cost estimates were prepared from a mix of supplier quotations, contractor rates, and factored from similar recent projects.

The process plant, mine site infrastructure and tailings storage facility (based on 3<sup>rd</sup> party design) capital costs were provided by GR Engineering from a mix of supplier quotes for key equipment and factoring/rates from similar scale recent projects.

Logistics capital costs were estimated primarily from contractor pricing indications, supplemented by factored estimates from WSP from similar recent projects (initial road upgrades, diversions, ancillary works for the siding).

Owners capital costs were estimated by Centrex and included the mining accommodation based on supplier quotations.

Sustaining capital was estimated within each area. Working capital was estimated by Centrex based on the operating costs for just over the first 2 months of operations.

Summary start-up capital costs for the project as well as working capital and sustaining capital over the life of mine are provided in Table 10.

Level 6, 44 Waymouth Street Adelaide, South Australia 5000 T +61 8 8213 3100 F +61 8 8231 4014 **TABLE 10:** Summary start-up capital costs.

| Area                                     | \$A M  | \$US M |
|--|--------|--------|
| Mine Establishment                       | \$2.3  | \$1.8  |
| Process Plant & Mine Site Infrastructure | \$29.9 | \$22.4 |
| Road Haulage                             | \$0.8  | \$0.6  |
| Rail Siding                              | \$2.5  | \$1.9  |
| Port                                     | \$2.2  | \$1.6  |
| Sub-Total Directs                        | \$37.7 | \$28.3 |
| Owners                                   | \$4.7  | \$3.5  |
| Other Indirects                          | \$13.0 | \$9.7  |
| Sub-Total Indirects                      | \$17.7 | \$13.3 |
| Total Installed Cost                     | \$55.4 | \$41.5 |
| Contingency                              | \$5.5  | \$4.1  |
| Total Cost                               | \$60.9 | \$45.7 |
|  |        |        |
| Working Capital                          | \$8.4  | \$6.3  |
| LOM Sustaining Capital                   | \$13.4 | \$10.0 |

## 10 Operating Cost Estimates

Operating cost estimates were prepared to an accuracy of +/-30%.

Mine and processing plant operating cost estimates were provided by the same parties as for the capital cost estimates. Mining fleet lease rates were provided directly from equipment vendors.

Logistics costs were compiled directly from contractor pricing submissions. Below track rail pricing was provided by QR Rail. Current shipping freight rates to the target customers were provided from Braemar ACM Shipping, and inflated in real terms using Integer Research freight inflation factors over the life of mine.

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#### **TABLE 11:** Summary operating costs by area.

| Aroa                | LOM A         | LOM Average    |  |  |  |
|---------------------|---------------|----------------|--|--|--|
| Alea                | \$A/t Product | \$US/t Product |  |  |  |
| Mining              | \$11          | \$8            |  |  |  |
| Processing          | \$17          | \$13           |  |  |  |
| Road Haulage        | \$15          | \$11           |  |  |  |
| Rail & Port         | \$59          | \$45           |  |  |  |
| Owners              | \$6           | \$5            |  |  |  |
| Freight*            | \$45          | \$34           |  |  |  |
| State Royalty       | \$2           | \$2            |  |  |  |
| SCF Royalty         | \$6           | \$5            |  |  |  |
| Total CFR Cash Cost | \$162         | \$121          |  |  |  |

\*2017 freight estimate \$US 23/t, significant rise in real terms forecast for global freight rates over LOM (which in turn is forecast to raise CFR pricing)

#### 11 Financial Evaluation

#### 11.1 Key Financial Results

Table 12 shows the key financial results for the project. A flat LOM exchange rate of 0.75 AUD:USD was used within the financial modelling based on the four major Australian bank's recent long-term forecasts. All modelling was undertaken in Q4 2017 real terms and hence no escalation or inflation was necessary.

TABLE 12: Key financial results (real 2017 terms).

| Key Output   | Approximate Value Range |               |  |
|--|-------------------------|---------------|--|
| Initial Capital Cost (inclusive & exclusive contingency)   | \$A 55-61M              | \$US 41-46M   |  |
| LOM Sustaining Capital (inclusive & exclusive contingency) | \$A 12-13M              | \$US 9-10M    |  |
| Pre-tax Net Cash Flow                                      | \$A 278-283M            | \$US 209-212M |  |
| Pre-tax NPV10  | \$A 124-129M            | \$US 93-97M   |  |
| Pre-tax IRR  | 39-42%                  |               |  |
| Pre-tax Payback Period                                     | 3 years                 |               |  |

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#### 11.2 Sensitivity Analysis

Figure 26 shows the sensitivity (ex-contingency) to the four variables that have the most impact on the financial viability of the project in descending order of most sensitive to least sensitive.

![](_page_38_Figure_3.jpeg)

FIGURE 26: Sensitivity of changes to the pre-tax NPV of +/- 10% in major variables.

#### 12 Development Funding

Centrex believes that reasonable grounds exist to assume that funding for the Ardmore will be available. The Company is in discussions with several parties regarding funding options. The details of these discussions cannot be disclosed at this time for commercial reasons. No material or binding agreements for funding or product offtake have been signed at this time. Centrex recently received corporate advice on the merits of debt and equity funding mix options.

Centrex believes that the robust economics, relatively efficient capital intensity, and project size will facilitate successful fund raising. Nevertheless, successful funding remains a key risk associated with the development of Ardmore. A key to successful project financing will be the ability to gain binding off-take agreements for the significant proportion of the product from the project.

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#### 13 Project Implementation

Centrex has already commenced a Feasibility Study for Ardmore that is due for completion in mid-2018. An almost 1 tonne bulk PQ diamond core composite is presently being utilised for feasibility level test work. Concentrate generated from this bulk composite will be sent to KemWorks in the USA for independent fertiliser conversion test work prior to meeting numerous customer requests for trial samples to undertake their own testing.

A separate 1 tonne bulk sample from a recent excavation by Centrex has also been sent to the USA for vendor crusher test work that will feed into the Feasibility Study design.

Mining feasibility level studies will commence in January based on the current identified Mineral Resources.

Centrex aims to commence preliminary scale operations by the end of 2018 and deliver first shipments to customers in 2019, in order to secure long-term off-take agreements to underpin financing for full scale operations.

For further information, please contact:

#### **Ben Hammond**

Chief Executive Officer Centrex Metals Limited Ph (08) 8213 3100

#### **Gavin Bosch**

Chief Financial Officer & Company Secretary Centrex Metals Limited Ph (08) 8213 3100

For media enquiries, please contact:

#### Grant Law

Grant Law Public Relations Ph (61) 488 518 414

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#### Forward Looking Statements

These materials include forward looking statements. Forward looking statements inherently involve subjective judgement and analysis and are subject to significant uncertainties, risks and contingencies, many of which are outside of the control of, and may be unknown to Centrex Metals Limited ('Centrex' or the 'Company'). Actual results and developments may vary materially from those expressed in these materials. The types of uncertainties which are relevant to the Company may include, but are not limited to, commodity prices, political uncertainty, changes to the regulatory framework which applies to the business of the Company and general economic conditions. Given these uncertainties, readers are cautioned not to place undue reliance on such forward looking statements.

Forward looking statements in these materials speak only at the date of issue. Subject to any continuing obligations under applicable law or any relevant stock exchange listing rules, the Company does not undertake any obligation to publicly update or revise any of the forward looking statements or any change in events, conditions or circumstances on which any such statement is based.

Forward looking statements include, but are not limited to, statements concerning Centrex's planned exploration program, targeted resources, commencement of product export and other statements that are not historical facts. When used in this document, the words such as "could", "target", "plan", "estimate", "intend", "may", "aim", "potential", "should", and similar expressions reflected in these forward-looking statements are reasonable, such as statements involving risks and uncertainties and no assurance can be given that actual results be consistent with these forward-looking statements.

#### **Competent Persons Statement**

The information in this report relating to Mineral Resources is based on and accurately reflects information compiled by Ms Sharron Sylvester of OreWin Pty Ltd, who is a consultant and adviser to Centrex Metals Limited and who is a Member of the Australian Institute of Geoscientists (RPGeo). Ms Sylvester has sufficient experience relevant to the style of mineralisation and type of deposit under consideration and to the activity she is undertaking to qualify as a Competent Person as defined in the 2012 Edition of the "Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves". Ms Sylvester consents to the inclusion in the report of the matters based on this information in the form and context in which it appears.

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