

## ASX RELEASE

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ASX: ARU



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# NOLANS REVIEW COMPLETED DELIVERING SIGNIFICANT COST AND OPERATIONAL BENEFITS

- Extensive work programs identify substantial operational and cost efficiencies at Nolans Rare Earths Project
- Merchant-grade phosphoric acid added to Nolans product range, providing an additional revenue source
- Rare earths output adjusted to align with selective mining of preferred material and to defer capital expansion commitment
- Higher recovery rates, further OPEX reduction and positive environmental dividend achieved through process design improvements
- Final feasibility underway on revised configuration

Arafura Resources Limited (ASX: ARU, “Arafura” or the “Company”) is pleased to announce the outcomes of comprehensive work programs aimed at commercialising its 100 per cent-owned Nolans Rare Earths Project in the Northern Territory.

As foreshadowed in previous ASX announcements, these programs have identified many improvements to the existing project structure that will deliver a more competitive and efficient project with greater capacity to withstand cyclical downturns in rare earth prices.

Improvements to the project include the planned annual output of **110,000 tonnes of a merchant-grade (54% P<sub>2</sub>O<sub>5</sub>) phosphoric acid product** for sale to the fertiliser industry. This is possible through the introduction of lower cost phosphoric acid into the pre-leach circuit of the rare earth extraction flowsheet. When coupled with parallel process improvements in comminution and beneficiation, this results in higher rare earth recoveries, lower operating costs (“OPEX”) and reduced waste streams.

In addition, the expected capital expansion that had initially been required in year 7 of the operation has been deferred to well beyond the project’s initial financing period following investigations into the mining schedule. These studies, targeting preferred phosphate-rich material types in the project’s resource, deliver an optimal plant feed and throughput that results in an adjustment to the planned annual rare earths output to **14,000 tonnes of TREO equivalent** over the 20+ year operational life of the project.

The key features and impacts of these improvements are listed below, and metrics comparing the previous and current configurations are summarised in Table 1:

- Product and revenue diversification, and lower OPEX;
- Substantial reduction in reagent use and generation of waste streams resulting in a smaller project footprint and environmental impact;
- A reduction in the mining rate and ROM feed to the crushing plant;

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- Simplification of the comminution circuit to deliver a coarser feed into beneficiation;
- Simplification of the beneficiation circuit to employ less intensive unit operations that deliver a coarser phosphate-rich feed into pre-leach;
- A material increase in total rare earths recovery in beneficiation;
- Adoption of phosphoric acid in pre-leach to better align with a rare earth-bearing phosphate-rich feed;
- Enhanced suppression of deleterious elements in the phosphoric acid process;
- Smaller unit operations in sulfation and water leach as a consequence of treating a phosphate-rich feed in pre-leach; and
- A material increase in SEG and HRE recovery in rare earth extraction.

Table 1: Comparison metrics for previous and current project configurations

		Previous	Current	Change
<b>MINING &amp; PROCESSING</b>				
ROM feed (ktpa)		922	<b>525</b>	(43%)
Recovery (ROM to final product)	Total rare earths	63%	<b>76%</b>	21%
	NdPr	64%	<b>75%</b>	17%
	La	63%	<b>75%</b>	19%
	SEG-HRE	48%	<b>68%</b>	42%
<b>ENVIRONMENTAL</b>				
Reagents (ktpa) <sup>1</sup>		405	<b>151</b>	(63%)
Power demand (MW) <sup>2</sup>		14	<b>10.3</b>	(26%)
Water demand (GLpa) <sup>3</sup>		3.7	<b>2.7</b>	(27%)
Waste (Mtpa) <sup>2</sup>	Waste rock	6.1	<b>4.5</b>	(26%)
	Tailings and process residues	4.62	<b>2.26</b>	(51%)
<b>PRODUCTION</b>				
Product suite		- NdPr oxide - La oxide - SEG-HRE carbonate - Ce product	- <b>NdPr oxide</b> - <b>La oxide</b> - <b>SEG-HRE carbonate</b> - <b>Ce product</b> - <b>Phosphoric acid</b>	Phosphoric acid co-product
TREO equivalent (tpa)		20,000	<b>14,000<sup>4</sup></b>	(30%)
NdPr oxide (tpa)		5,260	<b>3,601</b>	(32%)
La oxide (tpa)		3,827	<b>2,658</b>	(31%)
SEG-HRE carbonate (tpa TREO equivalent)		746	<b>657</b>	(12%)
Phosphoric acid (ktpa merchant grade)		-	<b>110</b>	-





FINANCIAL <sup>5</sup>			
Capital cost (US\$m)	\$835	<b>\$680</b>	(19%)
Operating cost (US\$m pa)	\$173	<b>\$125</b>	(28%)
Operating cost (US\$/kg TREO)	\$8.65	<b>\$8.89</b>	2.7%
Operating cost (US\$/kg TREO; less credit for phosphoric acid <sup>6</sup> )	\$8.65	<b>\$6.23</b>	(28%)

<sup>1</sup> Nolans site (Mine, Concentrator and Rare Earth Intermediate Plant) and offshore Rare Earth Separation Plant

<sup>2</sup> Nolans site only

<sup>3</sup> Nolans Concentrator and Rare Earth Intermediate Plant only

<sup>4</sup> The Rare Earth Separation Plant capacity for 14,000 tpa of TREO equivalent output from Nolans is approximately 6,900 tpa of TREO. The difference of 7,100 tpa comprises a 95% cerium product which will be recovered at the Rare Earth Intermediate Plant.

<sup>5</sup> A\$1 = US\$0.70

<sup>6</sup> Phosphoric acid revenue based on US\$715/t of P<sub>2</sub>O<sub>5</sub> on an FOB basis

Further details on process improvements are provided from Page 4 of this document.

### Next Steps

- Scope and tender next phase of engineering design for final feasibility; and
- Escalate discussions with potential cornerstone investors, customers and financiers to align feasibility with their expectations.

Recent engagement with equipment providers and engineering groups has identified possible alternative feasibility methodologies to advance the project. These will be explored in the coming weeks and discussed with potential project financiers to ascertain their applicability.

Subject to financing, the Company aims to subject the flowsheet to rigorous testing during final feasibility to confirm these findings, targeting as a minimum the outcomes highlighted above in Table 1.

“We have been steadily rationalising the business which has included significant reductions in overheads along with an internal review of results from our comprehensive pilot and test programs. I am pleased to be able to communicate the progress we have made and I’d like to thank all the Arafura team for their efforts,” Managing Director, Gavin Lockyer said. “The project improvements have achieved important reductions to commodity, funding and processing risks in this capital constrained environment. Combined with our recent submission of the Nolans Environmental Impact Statement we continue to make solid progress towards commercialisation.”

– ENDS –

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## **Advantages of Process Improvements**

### **1. Reducing Commodity Risk**

The alternative process has improved overall rare earths recovery for supply critical NdPr and HRE adding further value to the project and positioning Nolans as a potential world-leading feedstock supplier into the rapidly expanding rare earth magnet market.

Additionally, the process configuration targets phosphate-rich minerals in the Nolans Bore resource to deliver a phosphoric acid product which has been verified as suitable for commercialisation in the granular fertiliser industry close to Asian markets.

Multiple revenue streams will minimise potential revenue fluctuations arising from commodity price risk making the project more attractive to financiers.

“Approximately two-thirds of the higher-confidence Measured and Indicated resource inventory at Nolans is the rare earth-bearing phosphate (apatite-monazite) style of mineralisation, so it makes sense to utilise our unique geological characteristics if it is economically viable to do so,” Mr Lockyer said. “Conceptual reviews undertaken to date by phosphate experts from a major engineering company have confirmed no fatal flaws in the process chemistry or process flowsheet aspects of the project.”

The Company is strongly of the view that its focus on the production of NdPr and phosphoric acid is better aligned with demand projections in these important growth markets.

### **2. Reducing Technical Risk**

Process, optimisation and engineering reviews along with metallurgical test work targeting a reduction in technical risk through processing efficiencies have been successfully completed in a number of areas including:

- Mining, comminution and beneficiation;
- Rare earth extraction; and
- Phosphoric acid production.

AMC Consultants Pty Ltd completed pit optimisation and strategic mine scheduling targeting the preferred phosphate-rich material types from the project’s Measured and Indicated resource base. The study confirmed that an annual output of 14,000 tonnes of TREO was achievable in the first ten years of mining production using a maximum beneficiation rate of 525 ktpa, thus deferring any capital expansion (previously forecast for year 7 of production) to well beyond the anticipated initial project financing period.

Recent test work at ALS focused on beneficiating rare earth-bearing phosphate material types which simplified upstream processing by adopting a smaller comminution (crushing and grinding) circuit and introducing an uncomplicated wet separation gravity circuit. These changes deliver a coarser concentrate feed, reduced power and water

consumption, and worker health and safety benefits due to reduced radioactive dust generation.

The re-design and subsequent testing of a less costly and more efficient beneficiation circuit that produces a high-grade rare earth phosphate concentrate optimised for improved rare earths and phosphate recoveries offers rare earth extraction an optimised feed for improved operational and cost benefits.

The Company's extensive rare earth extraction test work results along with recent phases of metallurgical locked cycle testing at SGS produced an optimised flowsheet delivering improvements in rare earths recovery, reduced operating reagent consumables, lower waste residue reporting to the project's residue storage facilities ("RSF"s) and production of a phosphoric acid product.

A reduction in reagent consumption is a key contributor to lower costs. This has the added benefit of reducing the volume of waste residue material reporting to RSFs, thus having a positive impact on the environmental footprint of the Nolans operation. Limestone, which was previously used to neutralise waste liquor from rare earth extraction, has been eliminated.

### **3. Reduced Funding Risk**

The improvement in process design criteria and equipment specification for beneficiation and rare earth extraction allowed the Company to engage with various process equipment vendors and engineering organisations to complete a capital and operating cost estimate utilising budget vendor quotations on major equipment and ancillaries. Equipment vendors for selected process items included Outotec, Jord, GEA and Metso. A major engineering company undertook a high level process review including materials of construction for key plant items, and costings for ancillary plants including the sulfuric acid plant.

The cost estimates were prepared to the same level of accuracy and basis as the previous November 2015 estimate (ASX: ARU 18/11/15) for the revised process configuration inclusive of discipline factors and indirect costs.

Since the Company commenced initiatives in April 2013 to improve the viability and fundability of the Nolans Project, the project's capital cost ("CAPEX") estimate has been reduced by US\$658 million, or almost 50%, and the OPEX estimate by US\$5.50/kg of TREO, or 38%. The total initial CAPEX for the Nolans Project is now estimated at US\$680 million inclusive of 20% contingency. Table 2 shows the CAPEX broken down by plant area.

Table 2: Total Capital Cost Estimate Summary

Project Area	Estimated CAPEX US\$m
Mine & Concentrator	48
RE Intermediate Plant	279
RE Separation Plant	59
Transport & Logistics	3
Infrastructure & Ancillaries	96
Indirect Costs	195
<b>TOTAL</b>	<b>680</b>

#### 4. Enhanced Recoveries

By targeting phosphate-rich minerals in the Nolans Bore resource, Arafura is allowing the resource to guide the process which results in a marketable phosphoric acid product, lower reagent consumption, reduced waste streams, and enhanced rare earth recoveries. Importantly, the higher recoveries of SEG and HRE do not come at the expense of the project's high-value NdPr product used in the key growth market for rare earth magnets. Arafura's extensive market interaction indicates that demand for NdPr is likely to grow at around 10% per annum and the Company is positioning itself to become an important low-risk, environmentally responsible supplier of this product.



## Nameplate Production

The CAPEX and OPEX estimates in this document are based on a nameplate production target of 14,000 tonnes per annum of TREO equivalent from Measured and Indicated Mineral Resources at Nolans Bore. The Mineral Resources were estimated and reported by the Company (ASX: ARU 9/12/14) following the guidelines of the JORC Code 2012. Classification of total resources at Nolans Bore into Measured, Indicated and Inferred resources, using a 1.0% TREO cut-off grade, is shown in Table 3. Contained (in-situ) resources of rare earths are also shown.

**Table 3: Statement of Nolans Bore Mineral Resources at 9 December 2014 using a 1% TREO COG**

RESOURCES	TONNES million	RARE EARTHS TREO %	TONNES TREO	PHOSPHATE P <sub>2</sub> O <sub>5</sub> %	URANIUM U <sub>3</sub> O <sub>8</sub> lb/t
Measured	4.3	3.3	144,000	13	0.57
Indicated	21	2.6	563,000	12	0.42
Inferred	22	2.4	511,000	10	0.37
<b>TOTAL</b>	<b>47</b>	<b>2.6</b>	<b>1,217,000</b>	<b>11</b>	<b>0.41</b>

Numbers may not compute exactly due to rounding. 1 lb/t U<sub>3</sub>O<sub>8</sub> = 0.0454% U<sub>3</sub>O<sub>8</sub>.

## Competent Person's Statement

The information in this report that relates to Mineral Resources is based on information compiled by Mr John Tyrrell, a Competent Person who is a Member of the Australasian Institute of Mining and Metallurgy. Mr Tyrrell is a full time employee of AMC Consultants Pty Ltd. Mr Tyrrell has sufficient experience that is relevant to the style of mineralisation and type of deposit under consideration and to the activity being undertaken 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 ("JORC Code 2012"). Mr Tyrrell consents to the inclusion in the report of the matters based on his information in the form and context in which it appears.

In undertaking the assignments referred to in this report, AMC acted as an independent party, has no interest in the outcome of the Nolans Project and has no business relationship with Arafura Resources other than undertaking those individual technical consulting assignments as engaged, and being paid according to standard per diem rates with reimbursement for out-of-pocket expenses. Therefore, AMC and the Competent Person believe that there is no conflict of interest in undertaking the assignments which are the subject of the Mineral Resource estimate referred to in this report.