## **Arafura Rare Earths**

All Australian Rare Earth production; initiate at Overweight ahead of upcoming FID & funding catalyst

We initiate on Arafura Rare Earths (ARU.ASX) with a 60cps price target and an Overweight rating. The stock's offering is an end to end, Australian-based rare earth oxide production, with 4.4ktpa of neodymium-praseodymium (NdPr) oxide targeted from ramp up in 2025. A near-term funding decision with FID (scheduled MarQ23) is the key risk for the stock ahead of A\$1.7bn build commencing from JunQ23. Debt financing is under finalisation and we have incorporated a hefty \$750m raise, but still see value in the stock should the raise price come in below our base case of 41cps (20% discount to Tuesday's close). We remain positive on rare earths' place in the green transition despite the recent sell off and while we prefer LYC for rare earths exposure from a valuation perspective, we like the lower geographical risk, simpler product strategy and growth options that ARU offers. At 0.88x P/NPV, we initiate at Overweight.

- ARU to be a top 3 ASX NdPr oxide producer at 4.4ktpa with expansion optionality; imminent funding requirement. The Nolans rare earth and phosphate project in the Northern Territory, Australia, is slated to produce 4.4ktpa of NdPr oxide from late 2025 over a 38-year life, and will make it the third-largest ASX-listed producer of NdPr oxide after LYC (12ktpa capacity) and ILU (5.5ktpa). With a A\$1.7bn (JPMe), 2.5-year build, we value the project at A\$1.1bn with a 15% post-tax IRR and 10-year payback on our \$90/kg LT NdPr oxide price assumption. The large resource base and long mine life presents upside for expansions, which could add A\$1bn on a scenario basis. Funding details will be revealed with the upcoming FID (scheduled MarQ23 but likely to come JunQ23). We expect the project will be 45% equity funded with a \$750m equity raise (~70% of ARU mkt cap). Our raising sensitivity analysis still shows value support, even at a very conservative 40% discount.
- NdPr markets rattled by TSLA claims, Chinese quotas, spot prices below our LT forecast. NdPr oxide prices have fallen 28% since the start of Feb, with 18.5% of this fall coming in the last fortnight following Tesla's announcement it would utilise NdPr-free magnet technologies in its next-generation vehicles. This appears to have flowed into delays to the announcement of China production quotas, which remain an overhang on pricing near term. We have heard claims of an 18% YoY increase (unconfirmed by Western media at the time of writing), but appears to be the worst-kept secret among local traders who have bid the price down, leaving spot below our LT \$90/kg NdPr oxide. We believe the Western world's rare earths production will continue to present strategic appeal, with supply security, provenance and ESG factors all becoming more important in OEM's procurement frameworks.
- Initiate at Overweight; 60cps PT represents 18% upside to last close. Comping against LYC and ILU once ramped up in FY30, ARU screens well on EV/EBITDA (2.7x), PE (10x) and EBITDA margins (61%) with a 0.88x P/NPV. ARU presents a solid base case, expansion potential and clean, all Australian rare earth exposure. Initiate at Overweight.

Sources for: Style Exposure - J.P. Morgan Quantitative and Derivatives Strategy; all other tables are company data and J.P. Morgan estimates.

### See page 44 for analyst certification and important disclosures, including non-US analyst disclosures.

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## Initiation Overweight

ARU.AX, ARU AU Price (21 Mar 23):A\$0.51 Price Target (Dec-23):A\$0.60

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### Half Yearly Forecasts (FYE Jun)

Revenue	(A\$ mn)		
	2022A	2023E	2024E
H1	0	0A	0
H2	0	0	0
FY	0	0	0

#### Style Exposure

Quant	Current	His	Hist %Rank (1=Top)				
Factors	%Rank	6M	1Y	3Y	5Y		
Value	98	100	88	100	81		
Growth	67	92	26	33	88		
Momentum	1	5	41	33	37		
Quality	100	98	84	73	56		
Low Vol	96	96	94	92	88		

#### Contents

Executive Summary	3
Portfolio	6
Valuation	16
Financials	19
Comps	24
Rare Earth Markets	28
Management and Board	40



310.2%

(27.9%)

(28.0%)

(3.4%)

0.0%

NM

NM

6.0

0.0%

0.7

(40.0%)

0.0%

12.8

(9.6%)

(9.6%)

(12.3%)

0.0%

NM

NM

2.0

## Summary Investment Thesis and Valuation Investment Thesis

Arafura Rare Earths (ARU AU) is developing the Nolans rare earth and phosphate project in Northern Territory, Australia. On current reserves of 30Mt at 2.9% REO, the project is planned to produce 4.4ktpa NdPr oxide over a 38-year mine life from 2025, with 140ktpa of merchant grade phosphoric acid as the primary by-product. The company has exposure to key rare earth elements for the green transition, particularly Neodymium (Nd) and Praseodymium (Pr) oxide (~85% of revenue for ARU), which are important inputs for permanent magnets that improve efficiencies of electric vehicle motors as well as wind turbines for green energy production. We are Overweight on the stock based on valuation.

## Valuation

Our Dec-23 price target is based in line with our DCF based valuation.

Upside/downside risks include: (1) permitting and approval delays/coming in earlier than expected; (2) commodity prices and forex movements against our expectations; (3) slower/ quicker adoption of electric vehicles; and (4) technological risks associated with the magnets technology.

Source: J.P. Morgan Quantitative and Derivatives Strategy for Performance Drivers; company data, Bloomberg Finance L.P. and J.P. Morgan estimates for all other tables. Note: Price history may not be complete or exact.

60.6%

0.0%

(2.2%)

(11.1%)

(38.1%)

0.0%

NM

NM

2.3

NM

16.5%

0.0%

NM

(2.9%)

(6.5%)

(39.2%)

0.0%

NM

NM

2.1

Adj. EPS growth

Adj. tax rate Net debt/EBITDA

FCFF yield

Dividend yield

EV/Revenue EV/EBITDA

Adj. P/E

P/ BV

ROCE

ROE

Valuation

Ratios

REE: Rare Earth Elements.

**REO:** Rare Earth Oxides. A more naturally stable chemical compound with REE combined with oxygen.

**Nd:** Neodymium. Primarily a permanent magnet input.

**Pr:** Praseodymium. Primarily a permanent magnet input. Also used for strengthening metals.

**NdPr:** A combination of Neodymium and Praseodymium; can occur naturally and is suitable for use in permanent magnets.

**Dy:** Dysprosium. Small amounts added to permanent magnets (NdPr-based) to improve operation at higher temperatures.

**Tb:** Terbium. Small amounts added to permanent magnets (NdPr-based) to improve operation at higher temperatures. Also used in fuel cells and for defense technologies.

**Ce:** Cerium. Used in catalytic convertors, glass polishing and alloying. The most abundant REE.

La: Lanthanum. Used in glass applications, photography and lenses, petroleum refining and alloying.

**LREE:** Light Rare Earth Elements. Key elements that fall into this category are NdPr and LaCe.

**HREE:** Heavy Rare Earth Elements. Key elements that fall into this category are Dy and Tb, as well as Samarium, Europium, and Gadolinium.

**SEG:** Samarium/Europium/Gadolinium. A commonly referenced basket of heavy rare earths and sometimes used interchangeably with the term Heavy REE.PM: Permanent magnet.

## **Executive Summary**

## All Australian rare earth oxide production from 2025

Arafura Rare Earth's (ARU AU) is developing the Nolans rare earth and phosphate project in Northern Territory, Australia. On current reserves of 30Mt at 2.9% REO, the project is planned to produce 4.4ktpa Ndpr Oxide over a 38-year mine life from 2025, with 140ktpa of merchant grade phosphoric acid as the primary by-product (10% of revenue). To put it in context, the project's output will be ~80% of the production capacity of ILU's Eneabba refinery which will be ramping up just ahead of ARU on our estimates. FID is imminent (due MarQ23, likely to come JunQ23), with last build capex guide of A\$1.6bn (A\$1.7bn/+7.5% JPMe) likely to require a substantive equity raise which we estimate will be 45% equity funded or \$750m. Incorporating raise dilution and utilising our LT price assumptions of LT US\$90/kg NdPr oxide, we still see good value in the stock.

## Electrification thematic exposures, but China-dominated supply chain

Key rare earth elements for the green transition, particularly Neodymium (Nd) and Praseodymium (Pr) oxide (~85% of revenue for ARU), are important inputs for permanent magnets that improve efficiencies of electric vehicle motors as well as wind turbines for green energy production. With China dominating the market (90% of global production), Western world materials like those of ARU are appealing from a geostrategic and ESG perspective for Western OEMs and governments attempting to shore up security of supply. However, with pricing power in the hands of the dominant player, rare earth pricing is still hinged upon the state of play in China, which is currently working to stabilize REO markets (key rare earths have moved down 27% from their recent Feb23 high). We also note TSLA's recent claims around utilising NdPr-free drivetrains in its next-generation of vehicles has weighed on sentiment. We assume LT prices of \$90/kg Nd and Pr, \$1.00/kg Ce and La, \$300/kg Dy, \$1,300/kg Tb, \$650/t phosphate and 74c AUD, not far from the three-year averages.

### Valuation

Our methodology is aligned with the rest of our mining coverage. We utilize the CAPM to determine our 8.8% post-tax WACC. We utilize a 100% DCF-based valuation, yielding a 58cps Dec-23 NPV and a 60cps PT when rounding to the nearest 5cps. The bulk of our valuation is clearly in our base-case Nolans project valuation. We incorporate \$350m of expansion upside and \$150m for exploration that combines for 13cps. Negative 11cps for corporate costs and a Dec23 net cash balance of A \$289m/7cps following mid-2023 funding finalisation rounds out our valuation.

### Figure 1: JPM Dec-23 ARU valuation

Valuation	A\$m	A\$ps
Nolans	1,921	0.49
Total operations	1,921	0.49
Expansion upside + Explo	500	0.13
Corporate & other costs	-416	-0.11
Net cash (debt)	289	0.07
Total	2,294	0.58

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#### Figure 2: ARU share price vs ASX200 and NdPr oxide price performance





Source: J.P. Morgan estimates, Company data.

## Figure 4: Rare earth oxide and phosphoric acid price forecasts

(US\$/kg)	2021	2022	1Q23e	2Q23e	3Q23e	4Q23e	2023e	Spot	LT real
Neodymium Oxide - FOB (US\$/kg)	104	132	109	95	95	95	99	85	90
Praseodymium Oxide - FOB (US\$/kg)	100	129	101	95	95	95	96	87	90
Dysprosium Oxide - FOB (US\$/kg)	537	490	442	400	350	350	385	284	300
Terbium Oxide - FOB (US\$/kg)	1,377	2,027	1,872	1,800	1,750	1,700	1,780	1,420	1,300
Cerium Oxide - FOB (US\$/kg)	1.49	1.40	1.23	1.20	1.20	1.20	1.21	1.19	1.00
Lanthanum Oxide - FOB (US\$/kg)	1.46	1.35	1.15	1.10	1.10	1.10	1.11	1.09	1.00
Phosphoric Acid - CFR (US\$/t)	1,071	1,481	1,050	950	935	919	963	1,050	650

Source: J.P. Morgan estimates, Bloomberg Finance L.P.

## Figure 5: Valuation sensitivity to key commodity prices

NPV (A\$/sh)		Phosphoric Acid (US\$/t)					
		500	600	700	800	900	
-	60	0.15	0.17	0.20	0.22	0.25	
¥g.	70	0.28	0.30	0.33	0.35	0.38	
S\$	80	0.41	0.43	0.46	0.48	0.51	
e (n	90	0.54	0.56	0.59	0.61	0.64	
xid	100	0.67	0.69	0.72	0.74	0.77	
°,	110	0.80	0.82	0.85	0.87	0.90	
Ę	120	0.93	0.95	0.98	1.00	1.03	
_	130	1.06	1.08	1.11	1.13	1.16	

Source: J.P. Morgan estimates.

### Figure 6: Valuation sensitivity to equity raising inputs

		Funding Shortfall = New Equity Raised (A\$m)						
	/ (A\$/511)	550	650	750	850	950		
	0.25	0.49	0.47	0.45	0.43	0.42		
/sh	0.30	0.53	0.51	0.50	0.48	0.47		
(A\$	0.35	0.57	0.55	0.54	0.53	0.52		
<u>e</u>	0.40	0.60	0.59	0.58	0.57	0.56		
pr	0.45	0.63	0.62	0.61	0.60	0.59		
ing	0.50	0.65	0.64	0.64	0.63	0.62		
Sais	0.55	0.67	0.67	0.66	0.65	0.65		
<u> </u>	0.60	0.69	0.69	0.68	0.68	0.67		

## **Investment risks**

As we highlight in the body of this note, key risks to our valuation are:

- **Commodity pricing.** We outline the valuation impact of key commodity price assumptions in the Valuation section. We note a 13cps increase in NPV with every \$10/kg increase in the NdPr oxide price and a 2.5cps increase with every \$100/t increase in the phosphoric acid price.
- **Raising risks.** Substantial funding is required for the project build. We assume 45% of the project is equity funded (\$800m) and run sensitivities in the Capex, funding and balance sheet section below. We estimate that every 5cps change in the raise price moves our valuation ~3cps in the same direction, while every \$100m increase in required equity funding hits our valuation by 1cps on average.
- **Construction/development**. Substantial growth projects are susceptible to timing and budget blow outs. We have added conservatism on timing as well as 7.5% additional capex.

## Portfolio

Arafura's cornerstone asset is the 100% owned Nolans Rare Earth Project, located 135km north of Alice Springs in the Northern Territory, Australia. The project will encompass a mine and on-site rare earths separation facility, making it one of Australia's first vertically integrated rare earth operations. Mineral Resources of 56 million tonnes at an average grade of 2.6% total rare earth oxides (TREO) and 11% phosphate ( $P_2O_5$ ), Arafura is targeting first production of NdPr Oxide in 2025 with annual production expected to ramp up to 4.4ktpa in 2027. The project will produce three rare earth products (NdPr oxide, SEG concentrate, cerium oxides) and merchant grade phosphoric acid (MGA). Over 85% of the project's revenue will be generated by NdPr oxide which will feed growing demand for permanent magnets. The latest study estimate from November 2022 is for A\$1.6bn capex to build the project. Final Investment Decision (FID) is targeted for MarQ23, although this looks tight at present with offtake and funding to be finalised.

Additionally, Arafura has a 40% interest in the Bonya tungsten and copper project, (280km north-east of Alice Springs) through a JV agreement with Thor Mining (60%).

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## Figure 7: Nolans project location - Northern Territory



## Figure 8: Nolans project layout



Source: Company reports.

Source: Company reports.

## **Nolans Rare Earth Project - Northern Territory**

The 100% owned Nolans Rare Earth Project is located 135km north of Alice Springs in the Northern Territory, Australia. The project consists of five exploration licenses spread across a total area of 1,115km<sup>2</sup> which will host an open pit mine, process plant (comprising beneficiation, extraction and separation plants) along with related infrastructure. The project is located near major road, rail, water and gas infrastructure.

Arafura completed a DFS on the Nolans project in February of 2019 and 2x updated feasibility studies in May 2021 and November 2022. The latest study outlines a 1Mtpa operation, producing 4.44ktpa of NdPr oxide and 144ktpa of merchant grade phosphoric acid. The current production schedule results in a LOM of 38 years consisting of a two-year ramp period and a five-year period of processing stockpiled material off low-grade stockpiles at the end of the LOM. Operating costs are estimated at of US\$35/kg of NdPr oxide (inc. by-products) with a pre-production capital cost of A\$1.6bn.

We summarise key ARU study parameters and contrast them with our assumptions in Figure 9. Key areas of difference in our A\$1.1bn valuation vs ARU's A\$2.4bn primarily stems from:

- LOM NdPr oxide price and AUD. We run \$90/kg vs ARU at \$130/kg. We also assume higher AUD.
- **Capex.** We take a more conservative view on the cost of the build, adding an additional 7.5% to take the build cost to A\$1.7bn
- **Opex.** We also run more conservative cost assumptions (+50% including byproducts in AUD terms)

Metric	Unit	ARU	JPMe	JPMe vs ARU
Life of operation	Years	38	38	0%
Mineral Resource	Mt	56		
Mineral Reserve	Mt	30		
LOM Material Mined (JPMe)*	Mt		37	
% Resources modelled	%		66%	
% Reserves modelled	%		125%	
Average NdPr Oxide production	tpa	4,440	4,211	-5%
Average Phosphoric acid production	ktpa	144	149	3%
Nominal average costs post ramp up				
Mining costs	A\$/kg NdPr	10	17	69%
Processing and other costs	A\$/kg NdPr	52	80	55%
Operating costs excl by-products	A\$/kg NdPr	62	96	57%
Operating costs incl by-products	A\$/kg NdPr	49	73	50%
Operating costs incl by-products	US\$/kg NdPr	35	54	56%
Total capital (incl contingencies)	A\$m	1,590	1,709	8%
LT NdPr Oxide price (real)	US\$/kg NdPr	130	90	-31%
LT AUD	AUD:USD	0.71	0.74	4%
ARU numbers from Nov22 study				
WACC	%	8.0%	8.8%	10%
Post tax NPV	A\$m	2,358	1,120	-53%
Post tax IRR	%	19.3%	15.0%	-22%
Payback	Years	4.8	10	108%

#### Figure 9: JPM assumptions for the Nolans Project vs ARU study estimates

Source: Company reports, J.P. Morgan estimates.

## **Geology, Reserves and Resources**

### Geology

The REE mineralisation at Nolans Bore is hosted in apatite-bearing gneiss and metasediment. Apatite mineralisation has historically been mined for its phosphate content, and is different to monazite mineralisation that is characteristic of ILU's Eneabba deposit and LYC's Mt Weld deposit. However, phosphate processing for REO is moving towards the mainstream. Mt Weld will transition through an Apatite zone with the plant upgrades currently under development, including an Apatite circuit.

## **Reserve/resources**

An updated JORC-2012 compliant project mineral resource was released in March 2020 of 56Mt at 2.6% TREO and a reserve of 29.5Mt at 2.9% TREO for a 38-year LOM at 4.44ktpa NdPr oxide. The mineral resource inventory has been reported at a cutoff grade of 1% TREO. The Ore Reserves include mining factors of 5% for ore-loss and 15% for dilution which leads to the marginal increase in Proved Reserves from Measured Resources. A parent block size of 20m x 20m by 5m was chosen for the model, based on the principal drill section spacing and the typical drilling density. Geological grade control was conducted primarily through RC drilling with an average 20 metre spacing on the principal drill sections and a 40 metre-spaced pattern on the alternate sections.

We model 125% of reserve tonnes at reserve grade, implying a 26% conversion of additional resources to reserves (Figure 10).

#### Figure 10: Nolans mineral reserve, resource and JPM modelled inventory

We have determined resource split of contained REO for ex. NdPr oxide from the 2014 resource statement.

	Α	RU			
	Reserve	Resource	Modelled	% Reserves	% Resource
Ore (Mt)	30	56	37	125%	66%
REO grade	2.9%	2.6%	2.9%	101%	113%
P2O5 Grade	13%	11%	13%	101%	119%
Contained REO (Mt)	0.9	1.5	1.1	126%	74%
Contained P2O5 (Mt)	3.8	6.2	4.8	126%	79%
REE in REO (%)					
NdPr	26%	26%	26%	99%	100%
Ce		48%	48%		100%
La		20%	18%		93%
Dy		0.34%	0.35%		103%
Tb		0.08%	0.08%		95%
Contained REE (Mt)					
NdPr	0.23	0.38	0.28	126%	74%
Ce		0.70	0.52		74%
La		0.29	0.20		69%
Dy		0.005	0.004		77%
Tb		0.001	0.001		71%

Source: Company reports, J.P. Morgan estimates.

## Production, processing and cost profile

The company is targeting annual production of 4.4ktpa of NdPr oxide over a 38-year life at an operating cost of \$35/kg NdPr oxide including by-products. We summarise the first 10 years of mine life in Figure 11





Source: J.P. Morgan estimates, Company data.





Source: J.P. Morgan estimates, Company data.

### Mining

The deposit will be mined using typical open pit mining techniques (drill, blast, load, haul). An external mining contractor will be used at the commencement of mining until Year 9 of operations, after which the operation will switch to an owner-operator model utilising leased mining equipment for the remainder of the life of mine. The mining schedule is based on an average mining rate for the first seven years of 3.2 Mt per annum, average over the duration of mining of 7.6 Mt per annum, with a maximum rate of 11.2 Mt per annum. The project's average strip ratio is ~4.5. Ore from the run of mine (ROM) pad will be blended and trucked the 8.5 kilometres to the process plant. The production schedule includes a two-year ramp up period and a five-year period of processing stockpiled material off low-grade stockpiles at the end of the LOM.

## Processing

The process plant has been designed for 1Mtpa of ore to produce 340ktpa of concentrate, commensurate with a nominal 4.5ktpa NdPr oxide output and a potential maximum of approximately 4.7ktpa. The by-product of the process will be  $P_2O_5$  contained in merchant grade (MGA) phosphoric acid with an average annual production of 78ktpa  $P_2O_5$  in 144ktpa of MGA phosphoric acid. Ore processing will increase to approximately 1.2Mtpa from year 13 (we assume \$100m capex) followed by an increase to 1.5Mtpa from year 23 onwards (\$165m capex JPMe), to allow the beneficiation plant to maintain production of 330ktpa total concentrate in later years of the production schedule as grades decline.

The process plant is broken into several packages:

- **Beneficiation plant** Ore will be crushed, milled and beneficiated using flotation producing a phosphate concentrate, which will be fed into the extraction plant, and tailings, which will be sent to the Residue Storage Facility (RSF).
- **Hydrometallurgical plant** Separate the REE from gangue minerals to produce an MGA phosphoric acid by-product, a cerium hydroxide product, and a rare earth chloride liquor which will be fed into the separation plant.
- Separation Plant The solvent extraction facility and product handling area will separate the SEG/HRE and NdPr into final rare earth products.
- **Reagents** Located at the main process plant, the reagents area will store and deliver all the necessary reagents used in the beneficiation, extraction and separation areas of the plant. The reagents area will also include a sulphur burning acid plant and a chlor-alkali plant (installed in years six and seven of operation, \$42m guide, \$53m JPMe).

Production of rare earths from phosphate minerals is not a conventional processing route for (limited) rare earth operations. LYC's Mt Weld expansion plans include the addition of an Apatite (i.e. Phosphate) circuit. A key component of the flow sheet for the project shown in Figure 13 is the pre-leaching step, which reduces material presenting to the rare earth and phosphoric acid circuits.

Figure 13: Processing flow sheet



Source: Company reports.

## Geometallurgy

Geometallurgical variability was noted in the original DFS and appears to be a driver in recovery variability through the proposed mine plan. Different ore types drive this, which can be broadly categorised into phosphate-dominant (apatite - amenable to flotation) mineralisation and calcsilicate-rich phosphate (epidoite+allanite - not amenable to flotation) mineralisation. Study metrics were optimised to prioritise phosphate dominant mineralisation as these minerals float. Stockpiling of calcsilicate-rich phosphate minerals, ~35% of measured and indicated resources, will be undertaken for processing at end of life. Further studies on processing this material earlier in mining and optimising recoveries presents upside.

## Costs

ARU targets opex of US\$44/kg NdPr oxide ex. by-product credits or \$35/kg including them. We take a more conservative view, with our estimates outlined in Figure 14 yielding an average \$54/kg NdPr oxide cost including by products, 54% higher than guided.

#### Figure 14: JPM cost assumptions

Mining (A\$/t TMM)	6.0
Concentrating (A\$/t processed)	75
Phosphate circuit (A\$/t processed)	100
REO circuit (A\$/t processed)	350
Admin/other (A\$/t processed)	50
Total cost ex.by-products (US\$/kg NdPr oxide)	71
Total cost inc.by-products (US\$/kg NdPr oxide)	54

## Permitting

A Native Title Agreement (NTA) covering all parts of the Nolans Project was executed in June 2020 with the site's Native Title Holders. Following the execution of the NTA, the Northern Territory Government granted the Project's Mineral Leases (ML) in July 2020 with the MLs for the borefield area granted in February 2021. The MLs provide Arafura tenure over the Nolans asset for 25 years and a licence to operate (subject to annual compliance reviews) for the same period. During 2021/22 the company prepared the Mining Management Plan and associated Environmental Management Plans, receiving approval for these plans in November 2022 which grants the company its authority to mine, the final permit required before commencing construction and operations.

A Northern Territory government water permit remains the key outstanding item.

## Infrastructure Access

Nolans is located 10 kilometres west of the Stuart Highway which links the coastal cities of Darwin to the North and Adelaide to the South. The project is 65 kilometres west of the Adelaide-Darwin railway. The project benefits from its close proximity to transport, energy, telecommunications and water infrastructure. The Amadeus Gas Pipeline passes through the project site with sufficient supply of natural gas to power the project infrastructure, and a sustainable groundwater resource has also been located approximately 25 kilometres southwest of the process plant.

## Offtake

ARU are targeting 85% of planned production on offtake with a focus on non-Chinese customers. At present, 40% of NdPr oxide production has been contracted to Kia and Hyundai, over a seven-year term. Under the Offtake Agreement, Kia and Hyundai can elect to receive rare earth oxide (produced by ARU) or finished metal (ARU oxides toll treated by a metal convertor and delivered - Figure 15). Pricing will be determined using a formula-based mechanism referencing the NdPr Price Ex Works China price on a lagged basis.

The remaining 45% of production slated for offtake is under negotiation. Arafura is advancing negotiations with additional offtake parties which includes several groups aligned with European export credit agency (ECA) project financing mandates for critical minerals procurement. A MoU has been signed with GE Renewable Energy. Arafura is aiming to conclude remaining binding offtake agreements during 2023 to align with final investment decision (FID).

#### Figure 15: Material flow to customers



Source: Company reports

## **Regional exploration and other projects**

The Aileron-Reynolds project north-west of Alice Springs is Arafura's key exploration asset in the Northern Territory. The project comprises six granted exploration licences, including license EL 28473 which hosts the Nolans Bore deposit, and covers an area of approximately 1,240 km<sup>2</sup>. The region is prospective for apatite-hosted NdPr mineralisation. Exploration undertaken by Arafura in the region to date has largely been focused in the Nolans Bore area. The company has acquired extensive airborne geophysical surveys over large parts of the project area, including magnetic-radiometric and hyperspectral, to help prioritise targets for on-ground geological, geochemical and biogeochemical assessment, and drilling. The primary emphasis of Arafura's exploration at Aileron-Reynolds is on NdPr opportunities that are likely to deliver additional mill feed for the Nolans operation, or complement the development of the project.

The company has a 60% share of the Bonya JV, a partnership with Thor Energy (THR.ASX) exploring for tungsten and copper in the Northern Territory. We ascribe no value to the project.

## Valuation

Our methodology is aligned with the rest of our mining coverage. We utilize the CAPM to determine our 8.8% post-tax WACC. We utilize a 100% DCFbased valuation, yielding a 58cps Dec-23 NPV and a 60cps PT when rounding to the nearest 5cps. Our Dec23 base case Nolans valuation is A\$1.9bn which makes up the bulk of our valuation (note this contrasts with the valuation of A\$1.1bn from project commencement in JunQ23). We add \$350m for expansion optionality (outlined in the Upside/expansion options section below) and \$150m for exploration upside. \$40mpa in corporate costs nets out at a negative \$416m/11cps NPV with \$289m cash remaining in December 2023 following the raising but prior to build completion.

We outline a sensitivity analysis on different price assumptions for NdPr oxide and phosphoric acid (85% and 10% of revenue, respectively). We note a 13cps increase in NPV with every \$10/kg increase in the NdPr oxide price and a 2.5cps increase with every \$100/t increase in the phosphoric acid price (Table 1).

### Figure 16: ARU WACC build up

CAPM Discount Rate	
Beta (5y)	1.20
Risk free rate (10y)	3.50%
Equity Risk Premium	5.50%
CAPM discount rate	10.1%
Cost of Equity (post tax)	10.1%
Debt premium	1.5%
Cost of Debt (pre tax)	5.0%
Gearing	20%
Eff Tax rate	30%
WACC (post tax)	8.8%

### Figure 17: ARU valuation breakdown

Valuation	A\$m	A\$ps
Nolans	1,921	0.49
Total operations	1,921	0.49
Expansion upside + Explo	500	0.13
Corporate & other costs	-416	-0.11
Net cash (debt)	289	0.07
Total	2,294	0.58

Source: J.P. Morgan estimates, Bloomberg Finance L.P.

Source: J.P. Morgan estimates.



Figure 18: ARU discounted cash flow and % of valuation (ex. expansion, explo and net cash) by year

NDV/	A¢/ab)				NdPr oxic	le (US\$/kg)				Spot
		60	70	80	90	100	110	120	130	80
/t)	300	0.10	0.23	0.36	0.49	0.62	0.75	0.88	1.01	0.36
\$\$r	400	0.12	0.25	0.38	0.51	0.64	0.77	0.90	1.03	0.38
d (L	500	0.15	0.28	0.41	0.54	0.67	0.80	0.93	1.06	0.41
Acid	600	0.17	0.30	0.43	0.56	0.69	0.82	0.95	1.08	0.43
. <u>.</u> .	700	0.20	0.33	0.46	0.59	0.72	0.85	0.98	1.11	0.46
oło	800	0.22	0.35	0.48	0.61	0.74	0.87	1.00	1.13	0.48
Iso	900	0.25	0.38	0.51	0.64	0.77	0.90	1.03	1.16	0.51
Ч	1,000	0.27	0.40	0.53	0.66	0.79	0.92	1.05	1.18	0.53
Spot	1,050	0.28	0.41	0.54	0.67	0.80	0.93	1.06	1.19	0.54

## Table 1: JPM ARU valuation sensitivity to NdPr oxide and phosphoric acid prices

Source: J.P. Morgan estimates.

## Figure 19: JPM ARU valuation sensitivity to beta and risk free rates

NDV (A\$/ch)					Beta			
			1.10	1.15	1.20	1.25	1.30	1.35
	2.0%	0.74	0.71	0.69	0.68	0.66	0.64	0.62
ee rate	2.5%	0.70	0.68	0.66	0.64	0.63	0.61	0.59
	3.0%	0.66	0.65	0.63	0.61	0.60	0.58	0.56
	3.5%	0.63	0.61	0.60	0.58	0.57	0.55	0.54
k fr	4.0%	0.60	0.59	0.57	0.56	0.54	0.53	0.51
Risl	4.5%	0.57	0.56	0.54	0.53	0.52	0.50	0.49
	5.0%	0.55	0.53	0.52	0.51	0.49	0.48	0.47
	5.5%	0.52	0.51	0.50	0.48	0.47	0.46	0.45

## **Upside/expansion options**

The 38-year mine life clearly presents opportunities for expansion. We have run a scenario where production is doubled to ~9ktpa NdPr oxide, which adds A\$1bn to our Nolans valuation. We incorporate a \$350m portion of this upside by discounting at 35%.

Key assumptions are as follows:

- 2y build starting FY30, when net cash is forecast
- 1y ramp up of new capacity
- Similar capex to initial build with 10% discount given installed infrastructure
- Mine life shortens to 23y
- 150% of current reserves and 78% of resources utilised
- All debt funded (\$500m required, rest funded by CF from base case project)
- 10% cost out from scale benefits



#### Figure 20: Expanded production scenario physicals

Source: J.P. Morgan estimates.

Valuation	A\$m	A\$ps
Nolans	2,815	0.71
Total operations	2,815	0.71
Expansion upside + Exploration	0	0.04
Corporate & other costs	-377	-0.10
Net cash (debt)	276	0.07
Total	2,864	0.73

## Figure 21: Expanded production scenario valuation

## **Financials**

## Capex, funding and balance sheet

## Capex

We note build capex of US\$1.135bn/A\$1.59bn required for the project as per the November 2022 study update. FID is targeted for MarQ23 and we expect construction works to begin JunQ23 with a 2.5y build time frame. Despite 12%/A\$196m contingency budgeted by ARU, we have added an additional 7.5% to growth capex for conservatism, taking the total budget to A\$1.7bn.

We have estimated ongoing sustaining capex of A\$15/t processed, yielding ~\$15mpa rate. In addition, we have added \$52.5m capex in FY30 for the Chlor-Alkali plant, \$100m for expansion of the beneficiation plant from 1.2Mtpa in FY38 and another \$165m in FY47 for another expansion from 1.2Mtpa to 1.5Mtpa.





## Funding

We outline our assumptions on project funding in Figure 23 below. The capital structure had initially been targeted at 60% debt, but the latest study saw capex revised higher, and debt target expectations lowered. We have assumed 50% debt. This nets out with A \$825m covered by debt (50%), 5% covered by existing cash and a known grant with the remainder covered by strategic and new equity (\$750m, 45%). Summarising funding options:

- Debt
  - *Government Debt.* \$300m of Northern Australia Infrastructure Facility (NAIF) and Export Finance Australia (EFA) funding has been secured subject to due diligence and credit approval. We assume a little more can be squeezed here (+ \$50m).
  - *Bank Debt.* Mandated Lead Arrangers are Societe Generale and NAB. Partly covered by government (ECA), part uncovered. Offtake helps secure as well.
- Equity
  - *Strategics*. Remaining offtake could be secured with equity, with GE currently in negotiations. Hancock Prospecting own 10% of the company at present.
  - Other equity. We note the last raising announced at the end of 2022 for A\$121m at 37cps represented a 15% discount to 5d VWAP at announcement date. We expect a heavier discount given the greater funding requirement
- Other
  - *MMI grant*. The Modern Manufacturing Grant is \$30m that goes directly towards the construction of the separation plant.
  - *Cash.* Following the Dec22 raise, there is currently ~\$150m cash on the BS, of which we expect \$50m will remain prior to the build.

A key concern of the market, is the equity piece as this would make up the balance of funding and its quantum determines dilution. We expect an announcement on a raising to coincide with FID. We note LTR raised \$450m at a 12% discount to 5d VWAP and CXO raised \$91m at a 2.4% discount, both in late 2021. Our base case is for \$750m of new equity raised at the ARU spot price as of 21 March 2023 with a 20% discount (41 cps) We also outline scenarios around our base case valuation in Figure 24 on the simplified assumption all equity is raised in JunQ23 with a 2% raising fee. A 5cps change in the raise price moves our valuation ~3cps and every \$100m increase in required equity funding lowers NPV by 1cps.

#### Figure 23: Funding stucture - JPMe



#### Source: J.P. Morgan estimates, Company data.

### Figure 24: Equity raise scenarios

NPV (A\$/sh)			Funding Shortfall = New Equity Raised (A\$m)									
		450	550	650	750	850	950	1,050				
	0.25	0.51	0.49	0.47	0.45	0.43	0.42	0.41				
ice (A\$/sh)	0.30	0.55	0.53	0.51	0.50	0.48	0.47	0.46				
	0.35	0.59	0.57	0.55	0.54	0.53	0.52	0.51				
	0.40	0.62	0.60	0.59	0.58	0.57	0.56	0.55				
br	0.45	0.64	0.63	0.62	0.61	0.60	0.59	0.58				
ing	0.50	0.66	0.65	0.64	0.64	0.63	0.62	0.62				
Rais	0.55	0.68	0.67	0.67	0.66	0.65	0.65	0.64				
Ľ.	0.60	0.70	0.69	0.69	0.68	0.68	0.67	0.67				

Source: J.P. Morgan estimates.

### **Balance sheet**

Heavy capex in initial years of the build predictably sees the peak of net debt (\$947m) and gearing of 52% in FY25. A positive net cash position is achieved in FY31, freeing up options beyond for capital management including expansions or capital returns.





100%

## Earnings and cash flow

The project generates ~85% of revenue from NdPr oxide, with phosphoric acid contributing 10% and other rare earth oxides making up the balance (Figure 26). The project generates a decent 60% EBITDA margin once ramped up, which declines to ~40% with processed grades (Figure 27). We run EBITDA sensitivities for FY27 and FY30 on a set of NdPr oxide and Phosphoric Acid price combinations in Figure 29 and Table 2 with every \$10/kg increase in NdPr oxide adding ~A\$65m EBITDA and a \$100/ t increase in phosphoric acid yielding an additional \$12m.

### Figure 26: Average revenue split and share of total revenue - A\$m



Source: J.P. Morgan estimates.



## Figure 27: Revenue, costs and EBITDA

600					105	447	471	481	454	445	800
400		326	338	375	425	447			454	443	00
400 -	147									_	60
200 -	331	542	595	654	718	721	741	761	781	805	40
-200 -	-184	-216	-257	-278	-294	-274	-270	-280	-327	-360	20
-400	5,000	5.07	51/00	5)(00	51/00	51/04	51/00	51/00	5)(0.1	5)/05	0%
	FY266	FY2/e	FY28e	FY29e	FY30e	FY31e	FY32e	FY33e	FY34e	FY35e	
	Re	evenue (A\$m)	C	Costs (A\$m)	Ur	nderlying EBI	ITDA (A\$m)	EE	BITDA Margir	n (%) - RHS	

Source: J.P. Morgan estimates, Company data.





Source: J.P. Morgan estimates, Company data.

22

## Figure 29: FY27 EBITDA sensitivity

FY27 EBITDA (A\$m)					NdPr oxid	le (US\$/kg)				Spot
		60	70	80	90	100	110	120	130	80
/t)	300	120	176	232	289	345	402	458	514	232
\$\$	400	130	186	242	299	355	412	468	524	242
l l)	500	140	196	252	309	365	422	478	534	252
Aci	600	150	206	262	319	375	431	488	544	262
.2	700	160	216	272	329	385	441	498	554	272
e e e e e e e e e e e e e e e e e e e	800	170	226	282	339	395	451	508	564	282
lso	900	180	236	292	349	405	461	518	574	292
L H	1,000	190	246	302	359	415	471	528	584	302
Spot	1,050	195	251	307	364	420	476	533	589	307

Source: J.P. Morgan estimates.

## Table 2: FY30 EBITDA sensitivity

FY30 EBITDA (A\$m)					NdPr oxid	le (US\$/kg)				Spot
		60	70	80	90	100	110	120	130	80
/t)	300	155	229	304	379	454	529	603	678	304
\$\$r	400	168	242	317	392	467	542	616	691	317
1) b	500	181	256	330	405	480	555	629	704	330
Aci	600	194	269	343	418	493	568	642	717	343
Lic.	700	207	282	356	431	506	581	655	730	356
oho	800	220	295	369	444	519	594	668	743	369
lso	900	233	308	382	457	532	607	682	756	382
hh	1,000	246	321	395	470	545	620	695	769	395
Spot	1,050	252	327	402	477	551	626	701	776	402

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## Comps

Within our coverage, LYC is the closest comp to ARU with only REO exposure. We also include ILU which has growing REO exposure although we note both Eneabba and Balranald have material mineral sands "by-products" in this analysis. We summarise NdPr oxide equivalent production across the three names in Figure 30. LYC's 13ktpa rate includes its 12ktpa target of NdPr oxide, leaving it as the largest ASX-listed producer, although its production ultimately flows through the Kuantan plant in Malaysia. ILU's Eneabba plant is rated to 5.5ktpa of NdPr oxide capacity with remaining equivalent production coming from mineral sands. Both ARU and ILU's production will all be undertaken in Australia.

On earnings, we compare in FY27 and FY30 as periods when all three businesses are running at capacity. ARU screens most positively on FY30 EV/EBITDA and EBITDA margins are strongest as a result of favourable production mix (limited value from lower value CeLa) and targeting higher grade early in the mine plan. It presents weakest on gearing given LYC and ILU are already in production and is unlikely to be a yield story this decade. From a valuation standpoint, at 0.88x P/NPV, the stock offers decent upside in our view.

Figure 30: Comparative NdPr oxide equivalent production - JPM rare earth exposed coverage

FY25e FY26e FY27e FY28e FY29e FY30e FY31e FY32e FY33e FY34e FY35e

■ ILU - Eneabba+Balranald ■ ARU

13







13

LYC

12



15

10

5

0

12



Source: J.P. Morgan estimates, Company data.



Source: J.P. Morgan estimates, Company data.



Figure 35: Dividend yield



Source: J.P. Morgan estimates, Company data.



Figure 36: FCF yield



Source: J.P. Morgan estimates, Company data.

## Figure 38: Gearing



## Figure 37: ROIC (EBIT/Assets)



Source: J.P. Morgan estimates, Company data.

## Figure 39: EBITDA margin



Source: J.P. Morgan estimates, Company data.

Source: J.P. Morgan estimates, Company data.



## Figure 40: ARU % of register shorted



Dec-22

Jan-23

- - - 1yr Avg. = 0.5

Feb-23

- 14DMA days to cover

Mar-23

## Figure 41: ARU days to cover

Source: Bloomberg Finance L.P.

Source: Bloomberg Finance L.P.

Oct-22

Nov-22

ARU Days to cover - last = 1.6

Share Px(A\$/sh - RHS)

Sep-22



### Figure 42: Retail trade value via CBA platform in the past 2 weeks



Source: Bloomberg Finance L.P.

## **Rare Earth Markets**

Rare earths, particularly NdPr, have been defined by numerous governments as critical minerals/commodities, given their importance for the green transition as well as the relative concentration of the supply chain in China in an increasingly turbulent global geopolitical regime. With China accounting for a substantial proportion of both supply and demand, the market remains relatively opaque. We note market commentator estimates of a 55kt supply gap by 2030 on current projections, clearly a bullish scenario for pricing.

## Demand

Rare earth oxides are used for a range of applications with key uses shown in Figure 44. Approximately 85% of ARU's revenues will be generated from the sale of NdPr oxide, which predominantly goes into permanent magnets, and we focus our attention on this segment of the market below. Estimates of current global NdPr consumption are approximately 70-80kt for 2022 and could double to 140ktpa by 2030 (9% CAGR). Traditional uses of NdPr include magnets in air conditioning, audio/speaker technology and consumer electronics applications. Key growth areas are both EVs and wind turbines (particularly offshore wind turbines), with these combined uses growing from 42% of magnet demand combined in 2022 to +60% in 2030 (Figure 45, Figure 46).



Figure 44: REO demand breakdown

Source: GWEC 2022 report (link)



Figure 46: Estimated NdPr oxide demand split - 2030



Source: J.P. Morgan estimates, Woodmac, Adamas.

Source: J.P. Morgan estimates, Woodmac, Adamas.

## Figure 47: NdPr oxide demand growth



Source: J.P. Morgan estimates.

### **Electric vehicles**

Magnets improve the efficiency of motors from a weight perspective; important in the growing move towards battery powered vehicles where saving weight allows for smaller batteries and/or enhanced range/performance. We note recent claims from Tesla indicating that the next generation of its vehicles will use no rare earths. We assume this means the company will return to using ferrite magnets, which are heavier and less robust. We have work to do on the topic, but initial impressions are that this will likely lead to a trade off with more lithium required for larger batteries to support the same driving range as well as the potential for higher ongoing maintenance costs for EV owners.

Utilising our global EV database, we calculate an approximate 15% CAGR in NdPr oxide demand to 2030. Assumptions are as follows:

- Magnet demand by vehicle type as of 2022:
  - Battery Electric Vehicle 3kg magnets/vehicle
  - Hybrid/plug-in hybrid vehicles 2.5kg magnets/vehicle
  - Combustion engine 1.5kg magnets/vehicle
- NdPr metal content per magnet = 30%

- NdPr metal to NdPr oxide conversion factor = 1.23
- Annual efficiency improvements in NdPr usage = 3%

We run sensitivities on key drivers of auto based NdPr oxide demand. A 5% increase in BEV penetration yields a 3.7kt/2.7kt increase in NdPr oxide demand in 2025/2030 (Figure 49). A 5m unit increase in vehicle sales results in a 2.7kt/3.5kt increase in NdPr oxide demand in 2025/2030 (Figure 50).

![](_page_29_Figure_6.jpeg)

![](_page_29_Figure_7.jpeg)

Source: Company reports.

Figure 49: NdPr oxide demand vs BEV penetration

![](_page_29_Figure_10.jpeg)

![](_page_29_Figure_12.jpeg)

![](_page_29_Figure_13.jpeg)

Source: J.P. Morgan estimates.

## Wind turbines

Wind turbines are another source of growth for magnets and therefore NdPr oxide demand. There are numerous wind power technologies, that can broadly be grouped into two categories: geared and direct drive (Figure 51). A conventional geared windmill uses a gearbox to convert energy from the turning blades to a generator, and typically has lower/no permanent magnets. With the growth of offshore wind energy production, direct drive windmills have gained traction due to lower maintenance requirements as well as improved efficiency. Lower maintenance is a result of utilising magnets to transfer energy from the blades to the generator, meaning fewer moving pieces.

To project wind energy demand, we take new installation estimates from the Global Wind Energy Council (GWEC) to 2026 with growth of 6.6% from 2021-2026. We temper growth rates from 2026 to 2030 (Figure 52).

We estimate the average NdPr oxide consumption of a gearbox wind turbine at 50-100kg/MW and a direct drive wind turbine is estimated to be 200-300kg/MW. Given higher NdPr oxide intensity for direct drive technologies (favoured for offshore applications), growth in NdPr from wind is more highly leveraged to offshore growth (Figure 53).

### Figure 51: Wind power technologies

![](_page_30_Figure_8.jpeg)

Source: European Commission Joint Research Centre (link). EE = Electrically Excited; PM = Permanent Magnet; SG = Synchronous Generator; HTS = High temperature Super Conductor

## Figure 52: Wind energy deployment

![](_page_30_Figure_11.jpeg)

Source: GWEC, J.P. Morgan estimates.

![](_page_31_Figure_3.jpeg)

#### Figure 53: Wind energy NdPr oxide demand split

Source: J.P. Morgan estimates.

## **Supply**

Total rare earth oxide mined production has been estimated by the USGS at 300kt in 2022, with China comprising 210kt/70% of feedstock supply. Global reserves are more equally spread although China and Russia combine to hold 50% of reserves, a precarious situation for Western governments in light of heightened geopolitical tensions.

### Figure 54: Mine REO production by country (kt)- 2022 Total=300kt

![](_page_31_Figure_9.jpeg)

### Figure 55: Mine REO production by country (kt)- 2021 Total=280kt

![](_page_31_Figure_11.jpeg)

Source: USGS.

#### Figure 56: REO reserves by country (kt) - 2022 Total=130Mt

![](_page_31_Figure_14.jpeg)

Source: USGS.

![](_page_31_Figure_16.jpeg)

Source: USGS.

## Figure 57: REO reserves by country (kt) - 2021 Total=125Mt

![](_page_31_Figure_20.jpeg)

Source: USGS.

## China

China's supply of rare earths predominantly comes as a by-product of industrial processes, including steel making. The Chinese government controls annual production quotas which are released bi-annually. The full-year mined material quota stood at 168kt in 2021 and was lifted to 210kt in 2022, while separation capacity quotas increased to 202kt from 162kt (Figure 58). Western media has not yet reported the 2023 quota, although market feedback indicates it is likely to be a step down in the pace of increases from 2021 and 2022, in the range of 15-20%. We believe China typically increases quotas in line with anticipated demand and factoring in Western world imports, which are likely to be lower this year given LYC's cracking and leaching transition. Continued implementation of Chinese government policy and environmental regulations is likely to restrict future domestic supply. To meet projected demand over the next decade, additional supply is expected to be developed in Australia and North America, although China will likely remain a dominant market player.

The largest producer in China is the China Rare Earth Group, which accounted for ~60% of Chinese production in 2021 (or ~35% of global supply). The consolidation likely improves efficiency, and with State Supervision, potential for improved price controls (<u>link</u>). China has asserted its strong market position in the past, reportedly imposing a ban of REO exports to Japan in 2010 (<u>link</u>). This led to substantial price increases for rare earths, with NdPr oxide prices rising to a peak of over ~6x over the following nine months. This has led to the proliferation of Western world economies looking to shore up supplies of ex. China supply sources.

The size and grade of China's rare earth source material is unknown. China's 2022 production of NdPr oxide has been estimated at 52kt, implying a 25% NdPr oxide grade processed of the total 210kt of REO produced.

![](_page_32_Figure_7.jpeg)

Figure 58: China rare earth mined production quota and annual YoY change

#### Figure 59: China Rare Earth Group conglomerate members

China Rare Earth Group Co. Ltd									
Members	Subscribed capital	Shares ratio							
The State-owned Assets Supervision and Administration Commission (the national asset regulator)	RMB 31.21 million	31.21%							
Aluminum Corporation of China (CHALCO)	RMB 20.33 million	20.33%							
China Minmetals Corporation	RMB 20.33 million	20.33%							
Ganzhou Rare Earth Group Co., Ltd	RMB 20.33 million	20.33%							
China Iron & Steel Research Institute Group	RMB 3.9 million	3.9%							
Grinm Group Corporation Ltd.	RMB 3.9 million	3.9%							

Source: China briefing.

## RoW

LYC is the only ex. China producer of finished rare earth oxides at present. Midstream products (concentrates and mixed rare earth carbonate) are currently produced by MP Materials (MP US – Not Covered) and ILU (ILU AU – covered by JPM Al Harvey), with ILU developing its Eneabba refinery to produce finished rare earth oxides in 2026 (5.5ktpa NdPr capacity but targeting 2.7ktpa initially until additional ore sources such as Wimmera are proved up).

Vietnam and Brazil both host large reserves but currently produce <1kt of REO combined annually. Key mines: the 10Mt Dong Pao mine in Vietnam, the Araxa Carbonatite in Brazil (currently mined for Niobium) and the huge Seis Lagos Carbonatite Complex, also in Brazil (2.9Bt; declared a biological conservation area and indigenous reserve).

## **Phosphoric Acid Market**

Phosphoric acid is used for the production of phosphate fertilizers, such as Mono-Ammonium Phosphate (MAP) and Diammonium Phosphate (DAP), and is also used in the food and beverage industry to improve food texture, increase shelf life, regulate the pH of the environment, and improve quality.

Globally, phosphoric acid is the second-most consumed inorganic acid after sulfuric acid. It is industrially produced in three grades with different concentration levels as per its end use. The three grades include food grade, agriculture grade, and industrial grade. Agriculture grade phosphoric acid leads the global market, in terms of value as well as volume, owing to its high usage in the manufacturing of fertilizers.

Demand for phosphate-based fertilizers remained strong during 2021 and peaked in 2022 with higher prices recorded across all phosphate product groups. Medium and long-term phosphoric acid price projections from CRU through to 2032 predict prices declining from peak prices in 2022. Supply over the year was constrained by lower phosphoric acid Chinese exports, war in Ukraine and demand growth. Medium and long-term prices over the forecast period are anticipated to decline to more normal levels due to softening demand, demand destruction and greater supply capacity from major producers in Middle East and Morocco. The Indian fertilizer market remains the largest importer of wet phosphoric acid by region with supply mainly sourced from North Africa and the Middle East. Long-term demand for phosphoric acid is expected to remain stable in the Indian fertilizer market and projected export prices are forecast to decline to normal levels from 2022.

![](_page_34_Figure_7.jpeg)

Source: Markets and Markets (link)

#### 35

## **Pricing**

We run LT pricing of \$90/kg NdPr oxide, \$650/t phosphoric acid and \$1/kg LaCe oxide. We note recent studies across our coverage reference consulting firm Adamas Intelligence and WoodMac LT forecasts. ILU's Eneabba Study from April 2022 utilises a \$106/kg NdPr oxide price and ARU's November 2022 study update runs \$130/kg. We have run NPV and earnings sensitivities on differing LT price assumptions in the sensitivities section above.

Pricing for REOs trended down from a peak in February 2022 (Figure 62 to Figure 73), relating to several factors including consolidation amongst the Chinese producers into the China Rare Earths Group and a crackdown by the government on stockpiling and speculation. The increase in half and full year quotas (released late Jan and mid August respectively) also appears to have played a part in easing supply shortage concerns. More recently, Tesla's claims of producing a NdPr-free drivetrain at the end of February this year have caused a significant decrease in pricing.

### Table 3: JPMe REO and phosphoric acid price forecasts

	2021	2022	1Q23e	2Q23e	3Q23e	4Q23e	2023e	2024e	2025e	2026e	2027e	LT real
Neodymium Oxide - FOB (US\$/kg)	104	132	109	95	95	95	99	95	97	98	100	90
Praseodymium Oxide - FOB (US\$/kg)	100	129	101	95	95	95	96	95	97	98	100	90
Dysprosium Oxide - FOB (US\$/kg)	537	490	442	400	350	350	385	349	342	335	334	300
Terbium Oxide - FOB (US\$/kg)	1,377	2,027	1,872	1,800	1,750	1,700	1,780	1,601	1,533	1,473	1,449	1,300
Cerium Oxide - FOB (US\$/kg)	1.49	1.40	1.23	1.20	1.20	1.20	1.21	1.13	1.10	1.10	1.11	1.00
Lanthanum Oxide - FOB (US\$/kg)	1.46	1.35	1.15	1.10	1.10	1.10	1.11	1.10	1.10	1.10	1.11	1.00
Phosphoric Acid - CFR (US\$/t)	1,071	1,481	1,050	950	935	919	963	880	818	756	724	650

Source: J.P. Morgan estimates, Bloomberg Finance L.P.

![](_page_35_Figure_9.jpeg)

![](_page_35_Figure_10.jpeg)

![](_page_36_Figure_3.jpeg)

![](_page_36_Figure_4.jpeg)

Source: Bloomberg Finance L.P.

![](_page_36_Figure_7.jpeg)

![](_page_36_Figure_8.jpeg)

Source: Bloomberg Finance L.P.

![](_page_36_Figure_10.jpeg)

## Figure 66: Dysprosium (US\$/kg) - 3Y

![](_page_36_Figure_12.jpeg)

![](_page_36_Figure_13.jpeg)

Source: Bloomberg Finance L.P.

![](_page_36_Figure_15.jpeg)

![](_page_36_Figure_16.jpeg)

![](_page_37_Figure_3.jpeg)

Figure 69: Terbium (US\$/kg) - 10Y

![](_page_37_Figure_5.jpeg)

Source: Bloomberg Finance L.P.

Figure 70: Cerium (US\$/kg) - 3Y

![](_page_37_Figure_9.jpeg)

Figure 71: Cerium (US\$/kg) - 10Y

![](_page_37_Figure_11.jpeg)

Source: Bloomberg Finance L.P.

## Source: Bloomberg Finance L.P.

![](_page_37_Figure_14.jpeg)

### Figure 72: Lanthanum (US\$/kg) - 3Y

Source: Bloomberg Finance L.P.

## Figure 73: Lanthanum (US\$/kg) - 10Y

![](_page_37_Figure_18.jpeg)

## J.P.Morgan

- Mar-23

Mar-22

Mar-21

## Figure 74: Phosphoric acid (US\$/kg) - 3Y

![](_page_38_Figure_4.jpeg)

Mar-16

Phosphoric acid (US\$/kg)

Spot: US\$1.05/kg

Mar-15

- Mar-18

Mar-19

Mar-17

- Mar-20

10Y average price: US\$/kg

![](_page_38_Figure_5.jpeg)

Source: Bloomberg Finance L.P.

Source: Bloomberg Finance L.P.

•

Mar-14

### Table 4: Register summary

Shareholder	%
Hancock Prospecting Pty Ltd	10.0%
ECE Nolans Investment Co Pty Ltd	5.2%
FIL Ltd	1.8%
Vanguard Group Inc/The	1.4%
Dimensional Fund Advisors LP	1.2%
Blackrock Inc	1.0%
GAM Holding Ag	0.7%
Wang Jing	0.5%
Tudehope Danielle Sharon	0.5%
Element Au SMSF Pty	0.5%
Nord Est Asset Management Sa	0.3%
Ca Inv Corp Pty Ltd	0.3%
Lockyer Gavin John	0.3%
Harrison David John	0.2%
Charles Schwab Corp/The	0.2%
Sunsuper Fund	0.1%
Insignia Financial Ltd	0.1%
Aware Super Pty Ltd As Trustee Of	0.1%
Perennial Investment Management Lt	0.1%
VicSuper Pty Ltd	0.1%
Top 20 Holders	24.5%
Free Float	82.7%

## Management and Board

Figure	Position	Comment
Mark Southey	Non-Exec Chairman	Appointed as Chairman of Arafura in 2019. Extensive global experience in the industrial and natural resources sector. Previously held executive positions with Honeywell, ABB and WorleyParsons. Mr Tonkin is also a Non-Executive Director of Fleetwood Corporation and an advisory board member for Gas Cleaning Technologies LLC.
Chris Tonkin	Non-Exec Director	Over 40 years' experience as a senior business executive with a broad multiple industry background in resources, telecommunications and banking and finance covering project finance, business generation, management, technical and strategy development roles. Held corporate and project advisory roles at AIDC, The Chase Manhattan Bank, KPMG Corporate Finance and ANZ. More recently, Chris was Head of Natural Resources Project Finance at ANZ.
Quansheng Zhang	Nominee Director	Joined Arafura in 2006 as Chief Financial Officer and Company Secretary. Previously held several senior finance and treasury positions in global mining companies including Newcrest and Newmont following a successful international investment banking career in Australia and London.
Cathy Moises	Non-Exec Director	Extensive experience in the resources sector having worked as a senior resources analyst for several major stockbroking firms including McIntosh (now Merrill Lynch), County Securities (now Citigroup) as well as a partner at Evans and Partners. Ms Moises was head of research at Patersons securities between 2017-2019, and she currently serves as a non-exec director of WA Kaolin Limited and an advisory panel member for Argonaut Resources Fund.
Darryl Cuzzubbo	Non-Exec Director	Over 30 years' experience in global roles in multi-commodity resources, services and manufacturing, holding both Senior Executive and Executive Director roles over a very successful career. Experience running major operational assets and development and execution of significant breakthrough strategies to deliver major projects.
Gavin Lockyer	Managing Director	Management and leadership experience in a range of disciplines including; Accounting, Financial & Investment Banking, Major Resource Development & Operations, and Global Bank Treasuries. Over the past 20 years Gavin's career has exposed him to business practices in North America, Europe, and Australasia.
Peter Sherrington	CFO	Commenced employment with Arafura in 2008 as Commercial Manager and was appointed CFO in July 2013. More than 20 years' experience in professional and corporate roles in Perth. Prior to working with Arafura, he held senior finance and commercial positions with several ASX and unlisted entities. He has also worked in public practice for 10 years in the areas of business services and corporate advisory.
Lloyd Kaiser	General Manager Sales & Marketing	More than 10 years' experience in the sales and marketing of industrial minerals into high value sector markets including the nuclear, automotive, and advanced ceramics sectors. Prior to joining Arafura, he held several senior positions in account management, business development and marketing across a diverse range of commodities and chemicals including alumina, coal, industrial minerals, refractories, and ceramics.
Stewart Watkins	General Manager Projects	Over 30 years' experience in many facets of the mining industry including operations, engineering consulting, project development and management. This includes roles in corporate and business management, business development, project/study management, process design, commissioning and process plant operation. Stewart is a Fellow of the AusIMM.

## Arafura Resources Ltd. (ARU)

Profit & Loss (A\$m)	FY22A	FY23E	FY24E	FY25E	FY26E
Revenue	0	1	-	-	331
Costs	(35)	(54)	(40)	(41)	(184)
EBITDA	(35)	(54)	(40)	(41)	147
Depreciation and amortisation	(0)	(0)		-	(45)
EBIT	(36)	(54)	(40)	(41)	102
Net Interest	(0)	0	(22)	(59)	(71)
NPBT	(36)	(54)	(62)	(100)	32
Tax Expense	-	-	-	-	(10)
NPAT	(36)	(54)	(62)	(100)	22
Minority interest	-	-	-	-	-
Underlying NPAT	(36)	(54)	(62)	(100)	22
Extraordinary Items	-	-		-	-
Reported NPAT	(36)	(54)	(62)	(100)	22
				0.000	0.000
Shares outstanding (m)	1,566	3,938	3,938	3,938	3,938
Normalised EPS (cents)	(2)	(1)	(2)	(3)	1
Normalised EPS growth					
DPS (A¢ps)	-	-	-	-	-
DPS/EPS payout	0%	0%	0%	0%	0%
Cashflow (A\$m)	FY22A	FY23E	FY24E	FY25E	FY26E
Operating cashflow	(27)	(58)	(50)	(66)	70
Capex	(0)	(190)	(760)	(760)	(9)
Free cash flow	(27)	(248)	(810)	(825)	61
Investing cashflows	(4)	(192)	(760)	(760)	(9)
Dividends	-	-	-	-	-
Financing cashflows	45	913	875	150	-
Change in cash	14	663	65	(675)	61
Balance Sheet (A\$m)	EV22A	EV23E	EV24E	EV25E	EV26E
Cosh	25	600	752	70	120
	25	100	155	1 710	1.09
	1/3	008	1 823	1,710	1,074
	0	330	975	1,007	1,002
	11	7	013	1,020	1,020
Equity	122	000	040	975	000
Net dobt / (cosh)	(24)	(699)	122	0/5	900
	(24)	(000)	122	547	000
Physicals	FY22A	FY23E	FY24E	FY25E	FY26E
NdPr Oxide production (kt)	0.0	0.0	0.0	0.0	2.4
Phosphoric acid production (kt)	0	0	0	0	83
Cash costs excl by-prod (US\$/kg)	0	0	0	0	55
Cash costs incl. by-prod (US\$/kg)	0	0	0	-13	41

Valuation Summary					A\$m
Current mkt capitalisation					1,083
EV					1,107
MD & CEO				Gav	/in Lockyer
CFO				Peter S	Sherrington
Chairperson				Ma	rk Southey
WACC					8.8%
Valuation				A\$m	A\$ps
Nolans				1,921	0.49
Total operations				1,921	0.49
Expansion upside + Explo				500	0.13
Corporate & other costs				-416	-0.11
Net cash (debt)				289	0.07
Total				2,294	0.58
P/NPV					0.88
Key Ratios	FY22A	FY23E	FY24E	FY25E	FY26E
PE	-22.6	-37.6	-32.3	-20.1	90.8
EV/EBITDA (x)	na	na	na	na	13.4
Dividend yield	0.0%	0.0%	0.0%	0.0%	0.0%
Free cash flow yield (%)	-3.4%	-12.3%	-40.1%	-40.9%	3.0%
ROE (Norm NPAT/Equity)	-27%	-5%	-7%	-11%	2%
ROA : EBIT / (assets - cash)	-30%	-17%	-4%	-2%	6%
ROIC (EBIT/Assets)	-25%	-5%	-2%	-2%	5%
EBIT / net interest	na	168.4	na	na	1.5
Gearing : net debt/ (net debt + equity)	-22%	-227%	11%	52%	50%
EBIT margin	nm	nm	nm	nm	31%
EBITDA margin	nm	nm	nm	nm	44%
FCFPS (A¢)	-1.7	-6.3	-20.6	-21.0	1.5
P/free cash flow (x)	-29.4	-8.2	-2.5	-2.4	33.2
Price assumptions	FY22A	FY23E	FY24E	FY25E	FY26E
AUD/USD	0.72	0.69	0.70	0.71	0.73
Neodymium (\$/kg)	153	102	95	96	98
Praseodymium (\$/kg)	151	98	95	96	98
Dysprosium (\$/kg)	552	421	350	344	337
Terbium (\$/kg)	2,126	1,836	1,625	1,548	1,488
Cerium (\$/kg)	1.46	1.22	1.15	1.10	1.10
Lanthanum (\$/kg)	1.41	1.12	1.10	1.10	1.10

Cash costs incl. by-prod (US\$/kg) Source: Company data, J.P. Morgan estimates.

## Investment Thesis, Valuation and Risks

## Arafura Rare Earths (Overweight; Price Target: A\$0.60)

### **Investment Thesis**

Arafura Rare Earths (ARU AU) is developing the Nolans rare earth and phosphate project in Northern Territory, Australia. On current reserves of 30Mt at 2.9% REO, the project is planned to produce 4.4ktpa NdPr oxide over a 38-year mine life from 2025, with 140ktpa of merchant grade phosphoric acid as the primary by-product. The company has exposure to key rare earth elements for the green transition, particularly Neodymium (Nd) and Praseodymium (Pr) oxide (~85% of revenue for ARU), which are important inputs for permanent magnets that improve efficiencies of electric vehicle motors as well as wind turbines for green energy production. We are Overweight on the stock based on valuation.

## Valuation

Our Dec-23 price target is based in line with our DCF-based valuation.

Valuation	A\$m	A\$ps
Nolans	1,921	0.49
Total operations	1,921	0.49
Expansion upside + Explo	500	0.13
Corporate & other costs	-416	-0.11
Net cash (debt)	289	0.07
Total	2,294	0.58

Source: J.P. Morgan estimates.

## **Risks to Rating and Price Target**

Upside/downside risks include: (1) permitting and approval delays/coming in earlier than expected; (2) commodity prices and forex movements against our expectations; (3) slower/ quicker adoption of electric vehicles; and (4) technological risks associated with the magnets technology.

## Arafura Rare Earths

A\$ in millions, year end Jun						
Profit And Loss	FY21	FY22	FY23E	FY24E	FY25E	Valuation Summary
Revenue	0	0	0	0	0	Current mkt capitalisation
Revenue growth	-	-	-	-	-	
COGS	(6)	(35)	(54)	(40)	(41)	Price Target
SG&A	-	-	-	-	-	Capital growth to price ta
EBITDA	(6)	(35)	(54)	(40)	(41)	
EBITDA growth	31.3%	470.6%	52.7%	(24.9%)	2.3%	Trading Multiples
EBITDA margin	-	-	-	-	-	PE Pre-abnormals
Amortisation	-	-	-	-	-	PE Reported
Depreciation	(0)	(0)	(0)	0	0	EV/EBITDA
EBIT	(6)	(36)	(54)	(40)	(41)	EV/EBIT
EBIT growth	34.4%	450.8%	51.9%	(25.2%)	2.3%	
EBIT margin	-	-	-	-	-	Kev Ratios
Net Interest	(0)	(0)	0	(22)	(59)	Dividend Yield
Pre-Tax Profit	(6)	(36)	(54)	(62)	(100)	Franking
Тах	0	()	()	0	0	Return on Assets (%)
Tax Rate	0.0%	0.0%	0.0%	0.0%	0.0%	Return on Fauity (%)
Minorities	0.070	0.070	0.070	0.070	0.070	ROIC (%)
Abnormals (post tax)	Õ	Õ	0	0 0	Ő	
Reported NPAT	(6)	(36)	(54)	(62)	(100)	Leverage
	(0)	(00)	(04)	(02)	(100)	Gearing (Net Debt / Equ
Normalised NPAT	(6)	(36)	(54)	(62)	(100)	Gearing (ND / (ND + E))
Growth	34 7%	448 7%	50.9%	16.5%	60.6%	Net Debt / FRITDA
Slowall	04.170	10.170	00.070	10.070	00.070	FRIT Interest Cover (v)
End of Period Shares	1 171	1 566	3 038	3 038	3 038	
EEDOWA	1 171	1,000	3 038	3 038	3 038	Balanco Shoot
Penorted EPS	(0.01)	(0.02)	(0.01)	(0.02)	(0.03)	Cash
Normalized EPS	(0.01)	(0.02)	(0.01)	(0.02)	(0.03)	Pacaivables
Growth	31 10/	21/ 20/	(0.02)	(0.02)	60.6%	Investments
Glowin	J <del>7</del> .470	514.570	(11.470)	(21.370)	00.070	Investments
DBS	0.00	0.00	0.00	0.00	0.00	Other Current Accete
Growth	0.00	0.00	0.00	0.00	0.00	Total Current Accests
DRS/ERS novert	0.0%	- 0.00/	- 0.00/	0.0%	- 0.00/	Not DDE
DPS/EPS payout	0.0%	0.0%	0.0%	0.0%	0.0%	Total Intensibles
Cook Elow Statement	EVOA	EVOO	EVODE	EV04E	EVOEE	Total Intangibles
	F121	(25)	FIZJE	FT24E	FIZJE	Other Non Current Asse
EBITDA	(0)	(35)	(54)	(40)	(41)	Total Non Current Ass
Tex Deid	-	-	-	-	-	I otal Assets
Tax Palo	-	-	-	-	-	One diteres
(Inc)/Dec in working Capital	-	-	-	-	-	Creditors
	1	ŏ (OT)	(4)	12	35	
Operating Cash Flow	(5)	(27)	(58)	(50)	(66)	Total Current Liabilities
						Non Current Borrowings
Net Capex	-	-	-	-	-	Non Current Provisions
Net Acquisitions	-	-	-	-	-	Other Non Current Liabil
Other Investing cashflows	(/)	(4)	(2)	0	0	Total Non Current Liabil
Investing Cash Flow	(7)	(4)	(192)	(760)	(760)	I otal Liabilities
Inc/(Dec) in Borrowings	0	0	0	875	150	Equity
Equity Issued	0	45	928	0	0	Reserves
Dividends Paid	0	0	0	0	0	Retained Profits
Other Financing Cashflows	0	0	(15)	0	0	Outside Equity Interests
Financing Cash Flow	0	45	913	875	150	I otal Shareholders Eq
Net Cash Flow	(12)	14	663	65	(675)	Net Debt

_	Relative recommend	lation:			Over	weight
	Valuation Summary				A\$m	ps
)	Current mkt capitalisation				2,008.30	0.51
-	Drive Terret					0.00
) -	Price Target Capital growth to price target					0.60 17.6%
)	ouplial growth to price target					17.070
6	Trading Multiples	FY21	FY22	FY23E	FY24E	FY25E
-	PE Pre-abnormals	NM	NM	NM	NM	NM
-	PE Reported	NM	NM	NM	NM	NM
)		INIVI	NIVI	INIM	INIVI	INIVI
)	EV/EDII	INIVI	INIVI	INIVI	INIVI	INIVI
-	Key Ratios	FY21	FY22	FY23E	FY24E	FY25E
)	Dividend Yield	0.0%	0.0%	0.0%	0.0%	0.0%
)	Franking	-	-	-	-	-
)	Return on Assets (%)	(5.0%)	(26.5%)	(9.4%)	(4.4%)	(5.4%)
ó	Return on Equity (%)	(5.2%)	(28.0%)	(9.6%)	(6.5%)	(11.1%)
ן ר	RUIC (%)	-	-	-	-	-
)	Leverage	FY21	FY22	FY23E	FY24E	FY25E
	Gearing (Net Debt / Equity)	NM	NM	NM	0.1	1.1
)	Gearing (ND / (ND + E))	(9.5%)	(22.4%)	(227.3%)	11.5%	52.0%
0	Net Debt / EBITDA	1.7	0.7	12.8	NM	NM
	EBIT Interest Cover (x)	(232.7)	(1,798.3)	168.4	(1.8)	(0.7)
2	Balance Sheet	FY21	FY22	FY23F	FY24F	EY25E
)	Cash	11	25	688	753	78
)	Receivables	0	1	1	1	1
6	Investments	-	-	-	-	-
	Inventories	0	0	0	0	0
)	Other Current Assets	0	0	0	0	0
-	Total Current Assets	11	25	689	755	79
0	Net PPE Total Intangibles	0	0	190	950	1,710
	Other Non Current Assets	114	117	118	118	118
)	Total Non Current Assets	115	117	308	1,068	1,828
-	Total Assets	126	143	998	1,823	1,907
-	Craditara	2	10	6	c	~
-	Creditors	3	10	0	0	0
, ו	Total Current Liabilities	1	11	7	7	7
,	Non Current Borrowings	0	0	0	875	1 0 2 5
-	Non Current Provisions	Õ	0	ů 0	0	0
-	Other Non Current Liabilities	0	0	0	0	0
)	Total Non Current Liabilities	0	0	0	875	1,025
)	Total Liabilities	4	11	7	882	1,032
)	Equity	242	288	420	420	420
J	Reserves	13	13	(105) (105)	(105)	(105)
ר ר	Reidineu Pronis	(133)	(801)	(195)	(195)	(195)
) )	Total Shareholders Equity	122	132	990	940	875
)	Net Debt	(11)	(24)	(688)	122	947

Source: Company reports and J.P. Morgan estimates. Note: A\$ in millions (except per-share data).Fiscal year ends Jun. o/w - out of which

## J.P.Morgan

## **Companies Discussed in This Report** (all prices in this report as of market close on 21 March 2023) Iluka Resources(ILU.AX/A\$9.99/N), Lynas Rare Earths Ltd.(LYC.AX/A\$6.41/OW)

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• Market Maker/ Liquidity Provider: J.P. Morgan is a market maker and/or liquidity provider in the financial instruments of/related to Arafura Rare Earths, Lynas Rare Earths Ltd., Iluka Resources.

• Client: J.P. Morgan currently has, or had within the past 12 months, the following entity(ies) as clients: Iluka Resources.

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Arafura Rare Earths (ARU.AX, ARU AU) Price Chart

![](_page_43_Figure_14.jpeg)

Source: Bloomberg Finance L.P. and J.P. Morgan; price data adjusted for stock splits and dividends.

Price Target

(A\$)

8.3

8.5

8.7

8.6

8.6

8.6

![](_page_44_Figure_3.jpeg)

Source: Bloomberg Finance L.P. and J.P. Morgan; price data adjusted for stock splits and dividends. Initiated coverage Oct 25, 2022. All share prices are as of market close on the previous business day. Iluka Resources (ILU.AX, ILU AU) Price Chart

![](_page_44_Figure_5.jpeg)

Source: Bloomberg Finance L.P. and J.P. Morgan; price data adjusted for stock splits and dividends. Initiated coverage Aug 26, 2003. All share prices are as of market close on the previous business day.

Data Pating I		Drico (A¢)	Prico Taract
	Raung	FIICE (A\$)	(A\$)
13-Apr-20	OW	7.29	9.8
29-Apr-20	OW	7.28	9.6
07-May-20	OW	7.41	8.9
17-Jun-20	Ν	8.55	8.7
28-Jul-20	N	9.30	8.9
14-Aug-20	N	9.68	9.1
12-Sep-20	N	9.60	8.9
09-Oct-20	Ν	9.37	9.5
14-Oct-20	Ν	9.61	9.4
26-Oct-20	Ν	5.12	5.9
14-Dec-20	N	5.91	6
27-Jan-21	N	7.04	6.3
09-Feb-21	Ν	6.84	6.5
25-Feb-21	N	7.38	6.7
05-Mar-21	N	7.38	6.6
27-Mar-21	OW	6.77	8.1
09-Apr-21	OW	7.27	8.2
20-May-21	OW	8.16	8
21-Jun-21	Ν	7.96	8.1
22-Jul-21	N	8.70	9
25-Aug-21	N	9.06	9.1
13-Sep-21	N	10.00	9.2
25-Jan-22	N	10.61	9.4
24-Feb-22	Ν	10.99	10
27-Apr-22	Ν	10.42	11
04-Jul-22	Ν	9.51	10.5
24-Aug-22	N	9.45	11
30-Sep-22	OW	8.97	11
14-Dec-22	OW	10.11	11.25
25-Jan-23	Ν	10.76	11.25

The chart(s) show J.P. Morgan's continuing coverage of the stocks; the current analysts may or may not have covered it over the entire period. J.P. Morgan ratings or designations: OW = Overweight, N= Neutral, UW = Underweight, NR = Not Rated

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IB clients**	47%	45%	35%
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Completed 22 Mar 2023 12:38 AM AEDT

Disseminated 22 Mar 2023 12:39 AM AEDT