Ardea Resources Limited

Kalgoorlie Nickel Project – Feasibility Study Underway

ASX & Media Release

31 May 2021

ASX Symbol

ARL

Ardea Resources Limited

Suite 2 / 45 Ord St
West Perth WA 6005

PO Box 1433
West Perth WA 6872

Telephone

+61 8 6244 5136

Email

ardea@ardearesources.com.au

Website

www.ardearesources.com.au

Directors

Mat Longworth
Non-Executive Chair

Andrew Penkethman
Managing Director & CEO

Ian Buchhorn
Technical Executive Director

Executive Management

Sam Middlemas
Company Secretary & CFO

Matt Painter
General Manager Exploration

Issued Capital

Fully Paid Ordinary Shares
127,670,582

Directors/Employee Performance Rights
4,236,000

ABN 30 614 289 342

Ardea Resources Limited (**Ardea**) advises the commencement of a Feasibility Study (**FS**) on its Kalgoorlie Nickel Project (**KNP**), with the study focus and future plant site being at Goongarrie, targeting premium goethite ore.

The FS follows the positive Goongarrie Nickel Cobalt Project (**GNCP**) Pre-Feasibility Study (**PFS**) and Expansion Study (**ES**) in 2018[1] and resource upgrade in 2021[2]. With the ever-increasing nickel and cobalt demand, the 2018 studies require an upgrade to accommodate the increasing international level of Lithium Ion Battery nickel and cobalt interest.

The KNP scope has been expanded from Goongarrie alone for Goongarrie to now include high grade goethite satellite pits at Highway and Siberia North (**Goongarrie Hub**). The FS now includes mineralised neutraliser from Kalpini and Bulong (**Kalpini Hub**) and Aubils, Boyce Creek, Jump Up Dam and Lake Rebecca nontronite mineralisation (**Yerilla Hub**). The FS is evaluating the potential revenue contributions from scandium and Rare Earth Elements (REE) throughout the KNP.

The KNP FS programs are in parallel with a streamlining of the Ardea mineral asset portfolio through structured gold divestments:

- Farm-outs of Mt Zephyr and Darlot East and Mulga Plum projects completed in 2020 and provisional sale of Bedonia in 2021[3].
- The previous Ardea demerger exercise being the spin-out of the NSW assets into Godolphin Resources Limited (ASX:**GRL**) in December 2019.
- Finalising the demerger and spin-out of Ardea's Kalgoorlie region gold tenements into a new Initial Public Offering (**IPO**) named, **Kalgoorlie Gold Mining Limited** (**KalGold, ASX:KAL**).
    - Ardea Shareholders, subject to an EGM vote and admission to ASX, to receive an in-specie distribution of KalGold vendor shares at nil cost, plus have a priority right to subscribe for KalGold IPO shares.
    - Strategically located tenements within crustal-scale Tectonic Zones with known gold endowment, but are relatively unexplored for gold, due to an historic focus on KNP nickel-cobalt laterite resources.
    - Multiple gold drill targets, all within 150km of Australia's gold capital, the City of Kalgoorlie Boulder.
- Defining and quantifying Goongarrie Hub gold resource areas, particularly Lily Albany and Lady Charlotte, to facilitate designing infrastructure sites east of the Goongarrie nickel laterite resources.
    - Look to monetising the gold resources identified during the last year, including through open pit mining and custom milling (notably Big Four Gold) through finite leasing arrangements.
    - Any pit voids generated will be available as KNP Goongarrie water storage and tailings infrastructure, and additionally provide pit wall stability geotechnical data for future Goongarrie laterite pits.

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[1] ASX releases – 28 March and 24 July 2018.
[2] ASX releases – 28 March 2018 and 15 February 2021.
[3] ASX releases - 18 December 2018; 19 and 23 November 2019; 9 and 26 February 2021.

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Ardea Managing Director, Andrew Penkethman, noted:

> *"The initial Ardea KNP Feasibility Study programs including granting of water extraction licences and bench-scale metallurgy are focussed on work streams that are independent of the final decision regarding KNP throughput and sale product.*
>
> *Along with Ardea's membership of the Future Battery Industry Cooperative Research Centre at Curtin University Perth, the aim with the KNP is to replicate successful HPAL nickel operations such as Coral Bay in the Philippines and Moa Bay in Cuba, contributing Critical Minerals to the rapidly expanding Lithium Ion Battery sector".*

Feasibility Study Work Programs, H2 2021

The Ardea Board at its 28 May 2021 meeting adopted the Program and Budget for the Kalgoorlie Nickel Project Feasibility Study, focussed initially on "generic" work streams, which permit flexibility in respect to future Strategic Partner consortium options such as production rate (eg 2.25Mtpa) or product type (eg Mixed Hydroxide Product (**MHP**) or Precursor Cathode-active Material (**PCAM**)).

The FS has six key initial elements:

- FS Manager appointed, consultant with 25 years nickel operating and study management experience:
  - Gap Analysis that addresses all previous KNP studies and nominates the FS product type.
  - High Pressure Acid Leach (**HPAL**) flow-sheet, using the consultant's considerable operational and process development experience to support the design.
  - Capturing by-product Critical Mineral revenue streams in addition to the nickel-cobalt, being the scandium and Rare Earth Elements (**REE**) indicated throughout the KNP by Ardea's ongoing drill pulp re-assay programs.
- Water Extraction Licences, drill and hydrology contracts awarded.
  - Application for a 3.5GLpa water production licence based on the East Goongarrie Palaeo-channel and penetrative large-scale bedrock structures at Goongarrie South and Big Four.
  - All requisite drill programs have received statutory approval to proceed.
- Core drilling, contract awarded for a 2,200m HQ core drilling program commencing in July 2021 at Goongarrie South, Big Four, Highway, Kalpini and Bulong to obtain undisturbed test material for:
  - Bench-scale metallurgical test work;
  - Material Types analysis (XRD, HyLogger spectral);
  - Bulk Density for inputs to the ongoing KNP-wide mineral resource re-estimation.
- Bench-scale metallurgical test work, scope of works completed, contract to be awarded, focus being;
  - Nickel-cobalt manganese (**NCM**) recovery for MHP/PCAM.
  - Recovery of by-product Critical Minerals either from pre-leach gravity or autoclave Pregnant Liquor Solution (**PLS**) to capture windfall process opportunities.
  - High acid-consuming KNP Clay Lower ore ("saprolite"), notably at the Yerilla Hub, as means to regulate site acid plant net output and to stabilise the site's production, acid and energy offtakes.
  - Mineralised neutraliser, being surface calcrete, carbonate saprock and serpentine saprock (as alternatives to conventional imported Nullarbor limestone neutraliser).
- Mineral Resource Estimates
  - Goongarrie completed 15 February 2021, Highway being finalised, Siberia North and Kalpini next.
- ESG compliance
  - Decarbonisation studies, to strengthen the KNP's commitment to a net-zero carbon flow-sheet.
  - Environment, temperate woodland, strategies for rehabilitation, tailings disposed in mining voids, sustainability through low carbon, site power and steam from sulphur burning and solar array.
  - Project implementation to reflect the KNP's long-standing commitment to the diverse local communities of Kalgoorlie-Boulder and Menzies.

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FS Production Assumptions and Timing

The basic assumption of the FS is a 2.25Mtpa Train 1 production rate treating Goongarrie Hub goethite ore with high pulp density and excellent rheology. The proposed plant site is immediately east of the Pamela Jean high-grade goethite resource and is totally unconstrained, so the FS scope of works requires a plant layout design that facilitates potential for a second then even a third train for increased production at the Goongarrie Hub.

In terms of MHP or PCAM product type, this will ultimately depend on the results of the bench-scale metallurgy, and scope exists for a plant design that commissions on MHP to a steady state output, then later commission of the final design PCAM circuit.

The recovery and hence revenue contribution from the Critical Minerals (notably Sc, Nd, Pr) will be a prime product decision for the FS to address in the flow-sheet design.

The core drilling program is expected to be completed during the September Quarter and initial bench-scale metallurgy will be evaluated during the December Quarter to fine tune the programs. On the basis of bench-scale results, the Study Manager will complete a Board proposal for a KNP Demonstration Plant.

At this stage or earlier, a Tier 1 engineering consultancy will be appointed for overall management of the full Definitive Feasibility Study, including the Demonstration Plant.

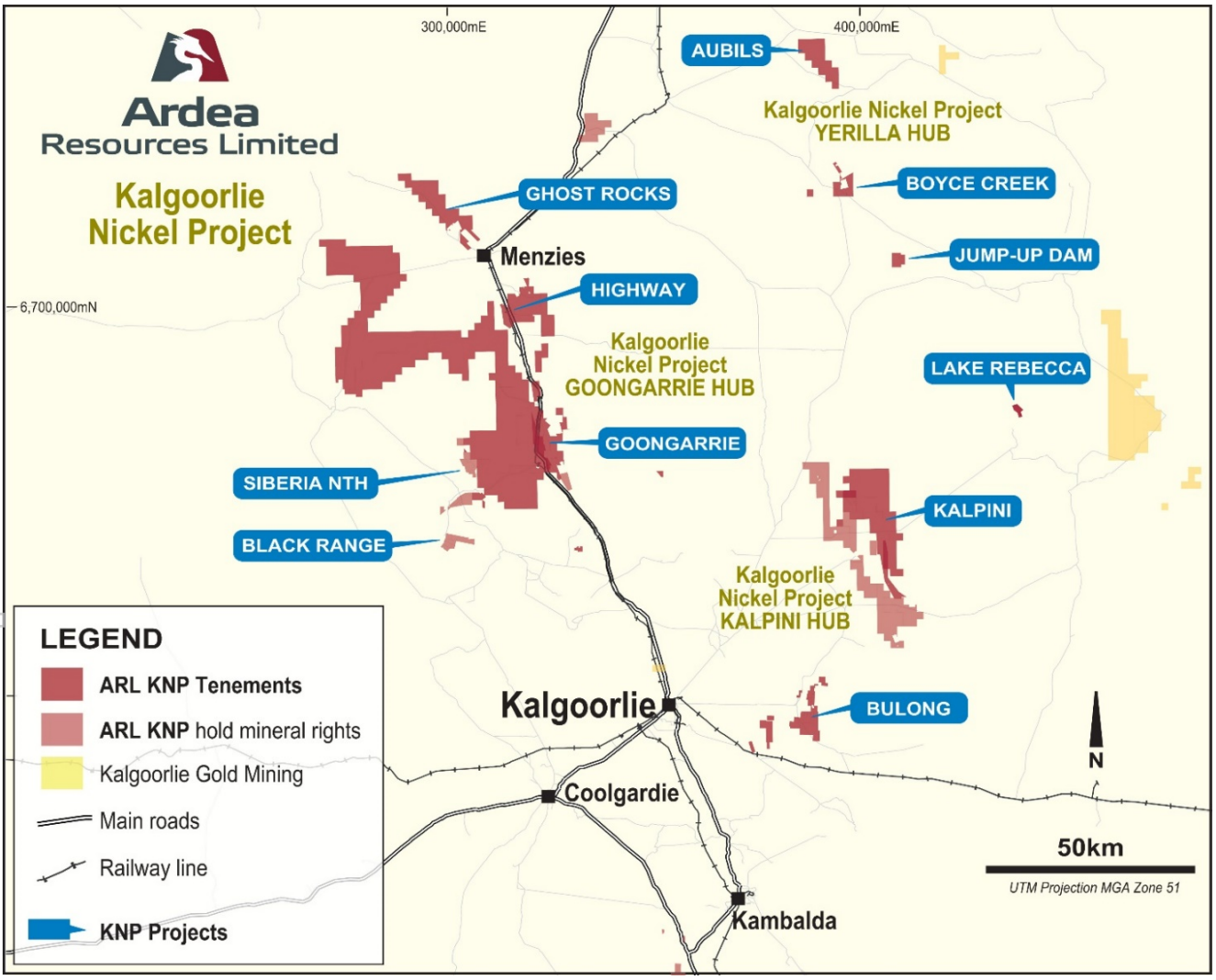

Figure 1: KNP location plan. Nickel laterite resource inventory, 826Mt at 0.7% Ni and 0.046% Co, 5.8 Million tonnes contained nickel, 384,000 tonnes contained cobalt (ASX release 15 February 2021).

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Previous KNP Studies

The KNP when owned by Heron Resources Limited (**Heron**. ASX:**HRR**) was subject to a A$34.5 million Pre-Feasibility Study by Vale Inco from 2005 to 2009. Vale Inco, a wholly owned subsidiary of Companhia Vale do Rio Doce (**Vale Inco**) completed the Kalgoorlie Nickel Project pre-feasibility study report as required by the KNP Farm in and Joint Venture Agreement (Heron ASX announcement 2 February 2009). The report consists of 18 volumes of very detailed technical data and engineering design which Ardea now owns.

Vale Inco designed a project sized for up to 36,000tpa of nickel in intermediate product. An HPAL flow sheet was selected as the best leaching technology for the project with high nickel and cobalt extractions of approximately 96% and 93% respectively, and low acid consumption of approximately 280kg/t (Heron ASX announcement 9 February 2009).

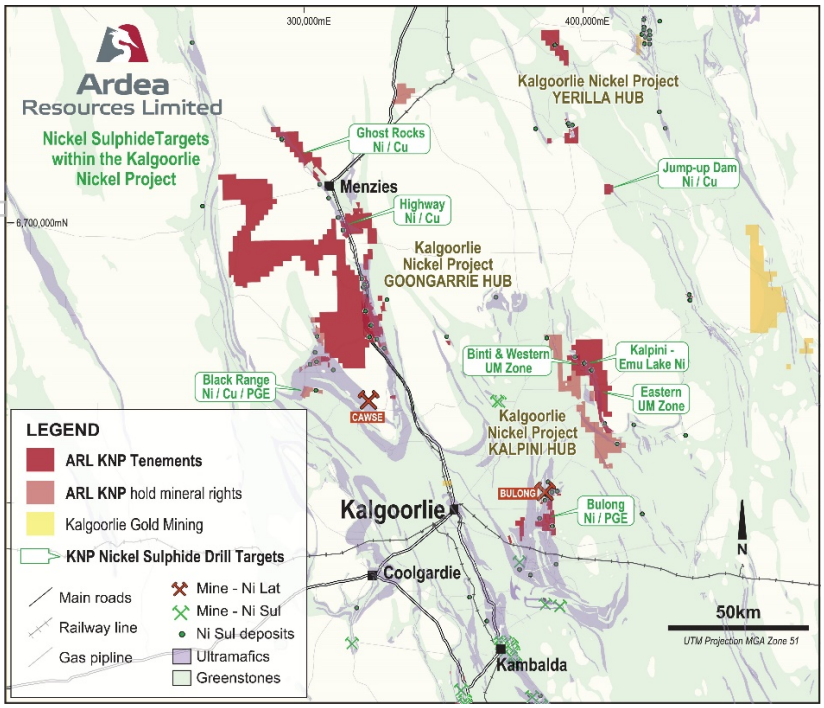
The Heron Joint Venture Agreement entitled Vale Inco to earn 60% in the KNP by sole funding all feasibility studies, securing project finance and making the decision to mine. Vale Inco withdrew from the joint venture in July 2009 with the then prevailing world nickel market uncertainty on the back of the Global Financial Crisis.

Ardea acquired the KNP from Heron on listing in February 2017. Up to June 2019, some A$20.4 million has been expended by Ardea on KNP studies, notably drilling and metallurgy, culminating in late 2018 with the completion of a piloting run production of on-specification battery grade nickel sulphate and cobalt sulphate (ASX release 31 October 2018). These on-specification outcomes can be extrapolated to MHP and PCAM.

Ancillary Nickel Programs

The KNP nickel laterite flowsheet in current desk-top studies has significant potential benefits if nickel sulphide is added to the laterite ore feed. Accordingly, the following field exploration programs have been completed:

- AELD0001 and 2 diamond drill holes at Emu Lake, nickel sulphide intersected, assays awaited for AELD0002.
- Ground Induced Polarisation (**IP**) targeting disseminated "cloud" nickel sulphide at Highway, Zeus and Black Range, deep RC drilling current.
- Ground Moving Loop Electro-Magnetic (**MLEM**) surveys targeting basal komatiite flow massive nickel sulphide at Kalpini, Ghost Rocks and Yerilla, final interpretations are awaited.
- Mapping and surface sampling for Layered Mafic Complex-hosted platinum-palladium-nickel-copper sulphide at Black Range and Bulong. Applications to drill at Bulong are current.



Any nickel sulphide discovery can provide benefits to a KNP HPAL production hub, or simply custom mill the ore under joint venture through one of the region's nickel sulphide concentrators.

To date, all nickel sulphide targets tested by Ardea (Highway, Black Range, Emu Lake) have a surface nickel layer which can only be treated through a hydrometallurgical HPAL flow-sheet.

Figure 2: Ardea Nickel sulphide targets.

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Gold Divestments in relation to the KNP

For the KalGold IPO (March 2021 Quarterly Report, page 23), the Ardea Board has determined that currently the Goongarrie Hub and associated tenure is best retained as 100% Ardea ownership for nickel, Critical Minerals and gold, rather than introduce shared commodity ownership and hence encumbrances which may needlessly complicate any future Strategic Partner negotiations.

Accordingly, at this stage, the Ardea Board will not include the Goongarrie, Highway, Ghost Rocks and Kalpini nickel laterite resource tenure within the KalGold IPO.

In the case of Kalpini, additionally high priority nickel sulphide targets including drill intercepts have recently been announced which potentially have high strategic value for the KNP (Ardea ASX announcement 27 April 2021), so again, there is a need to avoid complicating future Strategic Partner negotiations.

Authorised for lodgement by the Board of Ardea Resources Limited.

For further information regarding Ardea, please visit https://ardearesources.com.au/ or contact:

Andrew Penkethman
Managing Director and Chief Executive Officer
Tel +61 8 6244 5136

About Ardea Resources

Ardea Resources Limited (ASX:ARL) is an ASX-listed resources company, with a portfolio of 100% controlled West Australian-based projects, focussed on:

- Development of the Kalgoorlie Nickel Project (KNP) and its sub-set the Goongarrie Hub, a globally significant series of nickel-cobalt and Critical Mineral deposits which host the largest nickel-cobalt resource in the developed world; and
- Advanced-stage exploration at compelling nickel sulphide, Critical Minerals and gold targets within the KNP Eastern Goldfields world-class nickel-gold province.

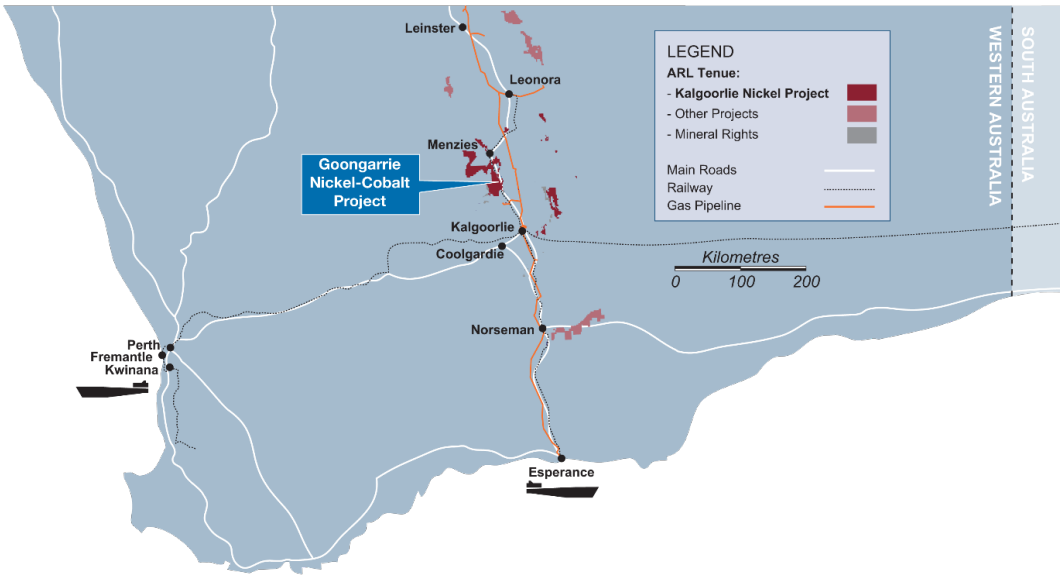

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Table 1: KNP nickel and cobalt Mineral Resources based on a 0.5% Ni cut-off grade.
Ardea ASX release, 15 February 2021, reported as Goongarrie Hub, Kalpini Hub and Yerilla Hub

Camp	Prospect	Resource Category	Size (Mt)	Ni (%)	Co (%)	Contained Metal Ni (kt)	Contained Metal Co (kt)	Estimation Details Method	Estimation Details Source	Estimation Details Year
Goongarrie	Goongarrie South	Measured	18	0.94	0.085	171	15	LUC	Ardea	2021
		Indicated	82	0.71	0.049	584	40	LUC	Ardea	2021
		Inferred	10	0.64	0.033	61	3	LUC	Ardea	2021
	Highway	Indicated	53	0.66	0.042	349	22	OK	Heron	2009
		Inferred	34	0.64	0.038	218	13	OK	Heron	2009
	Ghost Rocks	Inferred	47	0.66	0.042	312	20	OK	Snowden	2004
	Goongarrie Hill	Indicated	40	0.65	0.037	259	15	LUC	Ardea	2021
		Inferred	29	0.60	0.025	176	7	LUC	Ardea	2021
	Big Four	Indicated	49	0.71	0.047	346	23	LUC	Ardea	2021
		Inferred	14	0.68	0.043	96	6	LUC	Ardea	2021
	Scotia	Indicated	12	0.71	0.065	82	7	LUC	Ardea	2021
		Inferred	5	0.72	0.043	37	2	LUC	Ardea	2021
	Goongarrie Subtotal	Measured	18	0.94	0.085	171	15			
		Indicated	235	0.69	0.046	1,620	108			
		Inferred	140	0.65	0.037	900	52			
		Combined	***393***	***0.68***	***0.044***	***2,692***	***175***			
Siberia	Siberia South	Inferred	81	0.65	0.033	523	27	OK	Snowden	2004
	Siberia North	Indicated	10	0.64	0.051	64	5	OK	Snowden	2009
	Siberia North	Inferred	53	0.66	0.043	352	23	OK	Snowden	2009
	Black Range	Indicated	9	0.67	0.090	62	8	OK	HGMC	2017
	Black Range	Inferred	10	0.69	0.100	68	10	OK	HGMC	2017
	Siberia Subtotal	Indicated	19	0.65	0.070	126	13			
		Inferred	144	0.66	0.041	943	59			
		Combined	163	0.66	0.045	1,070	73			
KNP GOONGARRIE	**TOTAL**	Measured	18	0.94	0.085	171	15			
		Indicated	255	0.69	0.048	1,747	121			
		Inferred	283	0.65	0.039	1,844	111			
		Combined	***556***	***0.68***	***0.045***	***3,761***	***248***			
Bulong	Taurus	Inferred	14	0.84	0.051	119	7	OK	Snowden	2007
	Bulong East	Indicated	16	1.06	0.055	169	9	OK	Snowden	2004
	Bulong East	Inferred	24	0.79	0.053	190	13	OK	Snowden	2004
	Bulong Subtotal	Indicated	16	1.06	0.055	169	9			
		Inferred	38	0.81	0.052	309	20			
		Combined	***54***	***0.88***	***0.053***	***477***	***29***	-	-	-
Hampton	Kalpini	Inferred	75	0.73	0.044	550	33	OK	Snowden	2004
	Hampton Subtotal	Inferred	75	0.73	0.044	550	33			
KNP KALPINI	**TOTAL**	Indicated	16	1.06	0.055	169	9			
		Inferred	114	0.76	0.047	859	53			
		Combined	***130***	***0.79***	***0.048***	***1,028***	***62***			
Yerilla	Jump Up Dam	Measured	4	0.94	0.048	36	2	OK	Snowden	2008
		Indicated	42	0.78	0.043	324	18	OK	Snowden	2008
		Inferred	18	0.63	0.034	116	6	OK	Snowden	2008
	Boyce Creek	Indicated	27	0.77	0.058	206	16	OK	Snowden	2009
	Aubils	Inferred	49	0.70	0.066	346	33	OK	Heron	2008
KNP YERILLA	**TOTAL**	Measured	4	0.94	0.048	36	2			
		Indicated	68	0.78	0.049	531	33			
		Inferred	68	0.68	0.057	462	39			
		Combined	***140***	***0.73***	***0.053***	***1,028***	***74***			
KNP TOTAL		Measured	22	0.94	0.079	207	17			
		Indicated	339	0.72	0.048	2,446	163			
		Inferred	465	0.68	0.044	3,165	203			
	GRAND TOTAL	***Combined***	***826***	***0.70***	***0.046***	***5,817***	***384***			

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CAUTIONARY NOTE REGARDING FORWARD-LOOKING INFORMATION

This news release contains forward-looking statements and forward-looking information within the meaning of applicable Australian securities laws, which are based on expectations, estimates and projections as of the date of this news release.

This forward-looking information includes, or may be based upon, without limitation, estimates, forecasts and statements as to management's expectations with respect to, among other things, the timing and amount of funding required to execute the Company's exploration, development and business plans, capital and exploration expenditures, the effect on the Company of any changes to existing legislation or policy, government regulation of mining operations, the length of time required to obtain permits, certifications and approvals, the success of exploration, development and mining activities, the geology of the Company's properties, environmental risks, the availability of labour, the focus of the Company in the future, demand and market outlook for precious metals and the prices thereof, progress in development of mineral properties, the Company's ability to raise funding privately or on a public market in the future, the Company's future growth, results of operations, performance, and business prospects and opportunities. Wherever possible, words such as "anticipate", "believe", "expect", "intend", "may" and similar expressions have been used to identify such forward-looking information. Forward-looking information is based on the opinions and estimates of management at the date the information is given, and on information available to management at such time.

Forward-looking information involves significant risks, uncertainties, assumptions and other factors that could cause actual results, performance or achievements to differ materially from the results discussed or implied in the forward-looking information. These factors, including, but not limited to, the ability to create and spin-out a gold focussed Company, fluctuations in currency markets, fluctuations in commodity prices, the ability of the Company to access sufficient capital on favourable terms or at all, changes in national and local government legislation, taxation, controls, regulations, political or economic developments in Australia or other countries in which the Company does business or may carry on business in the future, operational or technical difficulties in connection with exploration or development activities, employee relations, the speculative nature of mineral exploration and development, obtaining necessary licenses and permits, diminishing quantities and grades of mineral reserves, contests over title to properties, especially title to undeveloped properties, the inherent risks involved in the exploration and development of mineral properties, the uncertainties involved in interpreting drill results and other geological data, environmental hazards, industrial accidents, unusual or unexpected formations, pressures, cave-ins and flooding, limitations of insurance coverage and the possibility of project cost overruns or unanticipated costs and expenses, and should be considered carefully. Many of these uncertainties and contingencies can affect the Company's actual results and could cause actual results to differ materially from those expressed or implied in any forward-looking statements made by, or on behalf of, the Company. Prospective investors should not place undue reliance on any forward-looking information.

Although the forward-looking information contained in this news release is based upon what management believes, or believed at the time, to be reasonable assumptions, the Company cannot assure prospective purchasers that actual results will be consistent with such forward-looking information, as there may be other factors that cause results not to be as anticipated, estimated or intended, and neither the Company nor any other person assumes responsibility for the accuracy and completeness of any such forward-looking information. The Company does not undertake, and assumes no obligation, to update or revise any such forward-looking statements or forward-looking information contained herein to reflect new events or circumstances, except as may be required by law.

No stock exchange, regulation services provider, securities commission or other regulatory authority has approved or disapproved the information contained in this news release.

Competent Person Statement

The technical information in this report relating to Mineral Resources and Exploration Results is based on information compiled by Mr Ian Buchhorn, who is a Member of the Australian Institute of Mining and Metallurgy. Mr Buchhorn is a full-time employee of Ardea and has sufficient experience, which is relevant to the style of mineralisation and type of deposit under consideration and to the activity which he is undertaking to qualify as a Competent Person as defined in the 2012 edition of the Australasian Code for Reporting of Exploration Results. Mr Buchhorn consents to the inclusion in the report of the matters based on his information in the form and context in which it appears. Mr Buchhorn owns shares in Ardea.