

27 August 2015



## Dubbo Zirconia Project FEED Completion Highlights Robust Project Economics

Since completion of the DZP DFS in 2013, the Company has made a substantial number of project improvements, demonstrating the DZP is a world class polymetallic project. Key highlights from the Front End Engineering Design and process enhancements include:

- The DZP has strong economics with anticipated product revenue of around US\$17/kg, with costs of approximately US\$8/kg. Further, capital intensity is low at US\$38/kg of annual product.
- Annual revenue has been estimated to be approximately A\$580M with operating costs of A\$260M delivering a A\$320Mpa EBITDA, 20 year NPV of A\$1.22B and IRR of 17.5%. This is a robust project based on conservative prices.
- The Front End Engineering Design has been completed with the capital estimate for the Project of A\$1.30B (US\$0.97B) including a contingency of A\$103M. This capital estimate is up from the previous A\$1.0B (April 2013), which was largely based on a higher A\$/US\$ exchange rate.
- Substantial improvements and optimisation of the flow sheet have delivered significant reduction in annual water consumption by 50% to 2 gigalitres, and reduction of the site footprint by 50% to 500 hectares
- Overall rare earth recoveries have been improved by 11.5% for a total 6,664tpa: the economically important neodymium by 7% to 960tpa and dysprosium by 27% to 128tpa, pre-refining.
- A commercial zirconium basic carbonate production circuit has been demonstrated, with potential for higher value zirconium products.
- The development of a hafnium recovery circuit has also delivered higher purity zirconium products with high value potential.
- Significant marketing effort progressing to secure product off-take agreements. AZL is working with engineering contractors to deliver a fixed cost EPC contract and prepare a bankable feasibility study for project financing.
- The DZP has received NSW Development Consent and Federal Environmental approval, with the ML and EPL expected within the coming months.
- Alkane's financing strategy remains unchanged, targeting a combination of strategic investors, Export Credit Agency (ECA) finance and commercial debt.

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## **DUBBO ZIRCONIA PROJECT (DZP) – zirconium, hafnium, niobium, yttrium, rare earth elements**

*Australian Zirconia Ltd (AZL) 100%*

The Dubbo Zirconia Project (DZP or the Project) is located 25 kilometres south of the large regional centre of Dubbo in the Central West Region of New South Wales. The DZP is based upon large in-ground resources of the metals **zirconium, hafnium, niobium, tantalum, yttrium and rare earth elements**. Over many years the Company has developed a flow sheet consisting of sulphuric acid leach followed by solvent extraction recovery and refining to produce several products, including proving the process at demonstration pilot plant scale.

The NSW Planning Assessment Commission granted development approval for the Project on 28 May 2015. This was a significant milestone for the Project, enabling Australian Zirconia Limited (AZL), a wholly owned subsidiary of Alkane Resources Ltd, to move ahead with applications for the Environmental Protection Licence (EPL), Mining Lease and other minor permits. These applications, and associated management plans, will be submitted within the current quarter, with approval expected 2-3 months after submission.

On 24 August 2015 the Company received notification that the federal Department of the Environment has assessed the mining project and its impact on the Pink-tailed Worm-lizard (PTWL), a threatened species within the provisions of the Environment Protection and Biodiversity Conservation Act 1999, and has given its approval for the development.

### **Process and Product Development**

Over the last twelve months, substantial improvements and optimisation of the flow sheet have been achieved in partnership with ANSTO, TZ Minerals International Pty Ltd and Hatch. These include improvements for water management and waste treatment as well as a revamped rare earth circuit to improve recoveries. The developments have enabled total water consumption to be reduced from 4 gigalitres pa to 2Glp and the site footprint to be reduced by 50% to ~ 500ha.

Rare earth recoveries have improved by an overall 11.5% with particularly encouraging increases of 26.7% for dysprosium and 7% for neodymium, and with a commensurate increase in revenues. While the flow sheet naturally separates “light” rare earths (La, Ce, Pr, Nd and Sm) from the “heavy” rare earths (Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu and Y) the revised processing plan combines these two streams for initial on-site separation to produce a La-Ce concentrate for storage (or future processing), yttria ( $Y_2O_3$ ) for direct sale and a Pr-Lu (95% REO) chemical concentrate for third party toll treatment. This process will facilitate maximum economic benefit, while minimising technical risk.

Zirconium chemicals development continued with further refinement of the process to produce reactive grades of zirconium basic carbonate for automotive catalysts and other higher value zirconium chemicals applications. A yttria ( $Y_2O_3$ ) stabilised zirconia product has also been successfully developed. This offers potential for the Project to consume some of the yttrium produced from the rare earth processing and adding value to the zirconium product suite.

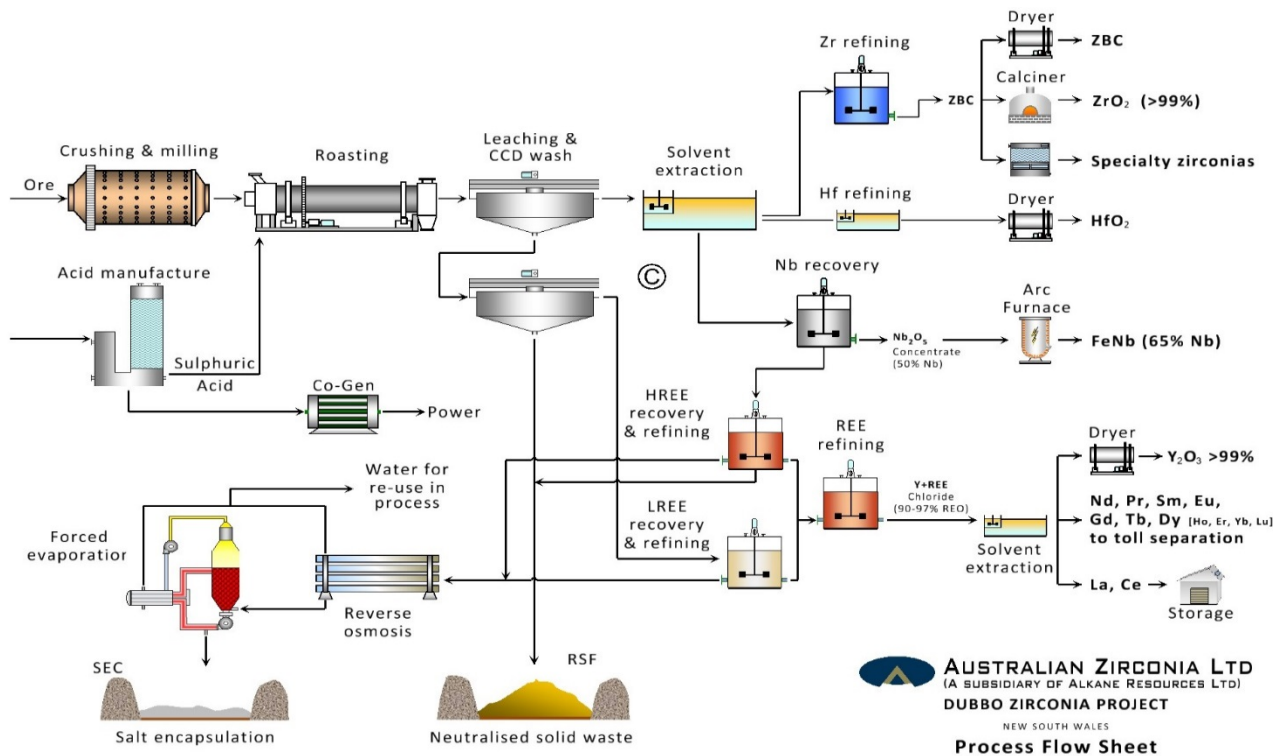
Encouraged by significant market interest, a process pathway to recover hafnium as an additional product for the DZP was been developed to piloting level by ANSTO. The developed hafnium process



has little impact on the existing flow sheet, with hafnium extracted from the zirconium refining circuit. Preliminary capital and operating estimates of the inclusion of this circuit into the final plant design suggest its incorporation will add significant value to the Project.

The hafnium recovery circuit has the added benefit of improving the quality of the zirconium product with potential for higher revenues from this product stream.

Commercial grade ferro-niobium (FeNb) has been successfully developed with technical input from the joint venture partner, Treibacher Industry AG. This flow sheet has been included in the revised capital and operating cost estimates for the Project. Treibacher have also completed a market strategy to ensure sale of all the DZP FeNb output.



## Engineering

The completed capital estimate to bring the Project into operation is A\$1.30B (US\$0.97B) at an accuracy of  $\pm 15\%$ , including a contingency of A\$103M (8%). The Project is ready for detailed design and construction to commence, contingent on financing. The estimate was prepared, via a Front End Engineering Design (FEED) study, on an Engineering, Procurement & Construction Management (EPCM) basis with the majority of inputs by Hatch and with firm pricing for most of the packages from the marketplace. AZL is satisfied with the outcome of this process with Hatch and the resultant value the Project will bring to the Company. As a consequence of the detailed work produced through this process, an opportunity has emerged to work with a global minerals and metals processing technology supplier to find further value in the project design with the intention of delivering the processing plant on an Engineering, Procurement & Construction (EPC) basis.

Several major improvements have been incorporated into the design during the FEED study. These include:



- Replacement of the filters in the leaching circuit with a counter-current decantation (CCD) circuit. This increases the wash efficiency and therefore product recovery, and reduces capital expenditure.
- Incorporation of an advanced water recovery circuit, including forced evaporation. This has the benefit of significantly reducing the fresh water required for the process.
- Matching the capital installation in the zirconium finished product area to the production ramp up and product certification. This has the benefit of reducing manpower on site during the key construction period and simplifying commissioning.

The anticipated footprint of the site has also reduced from 1000 Ha to 520 Ha, mostly through the removal of over 90% of the liquid residue storage facilities. This has been enabled by the advanced water recovery circuit described above.

The design has also been modified to provide closer integration and / or more tailored products to downstream customers and toll treatment partners. In particular these modifications include:

- A small rare earth separation plant to tailor the feedstock to toll treatment partners, to allow the production of yttrium (Y) on site and to reject rare earths that currently attract limited value in the marketplace, specifically cerium (Ce) and lanthanum (La).
- The addition of a scrub circuit into the zirconium solvent extraction process to remove the hafnium (Hf) for subsequent refining to produce a saleable hafnium product, an addition made by the AZL team outside of the FEED scope after further research with ANSTO.
- Flexibility in the zirconium circuit to allow the production of a zirconium basic carbonate (ZBC), thereby providing a route to more easily develop higher value downstream zirconium products, an addition also made by the AZL team outside of the FEED scope after further research.

The capital estimate included design, scopes and commercial conditions at an increased level of detail from the DFS published by the Company in April 2013. This allows AZL and its financiers increased certainty in the cost of bringing the Project into production. The increase in cost from the DFS is driven by a number of factors:

- The increased detail in the scope and commercial conditions for tender responses.
- Both increases and reductions in costs based on the process, environmental and product design changes.
- The fall in the exchange rate against the USD and Euro, particularly impacting on the procurement of specialist equipment.

The project contingency for the FEED study portion of the Project was set using a Quantitative Risk Analysis facilitated by Hatch. This included a Monte-Carlo simulation giving a range of probabilities of the final installed price to allow an appropriate contingency to be set. At an 80% probability level (p80) the Project has a contingency of A\$103M, which is 8% of the project cost. The financial model, prepared by AZL for the Project incorporates the capital estimate prepared by Hatch, a 3 year ramp up period post commissioning, staged capital in the finished product and tailings areas of the Project and limited cost opportunities identified by the AZL project team. It also includes the owner's costs, working capital requirements and latest product pricing. Note that AZL considers the contingency



allocated to be at a sufficient level to cover the areas outside the FEED scope, in particular the hafnium circuit and owner's costs.

Through the tendering process for the Project AZL identified a supplier who is able to deliver many of the processing packages. AZL is now working with that supplier to conduct a study with an aim to identify further value opportunities for project execution, both in application of technology as well as cost reductions.

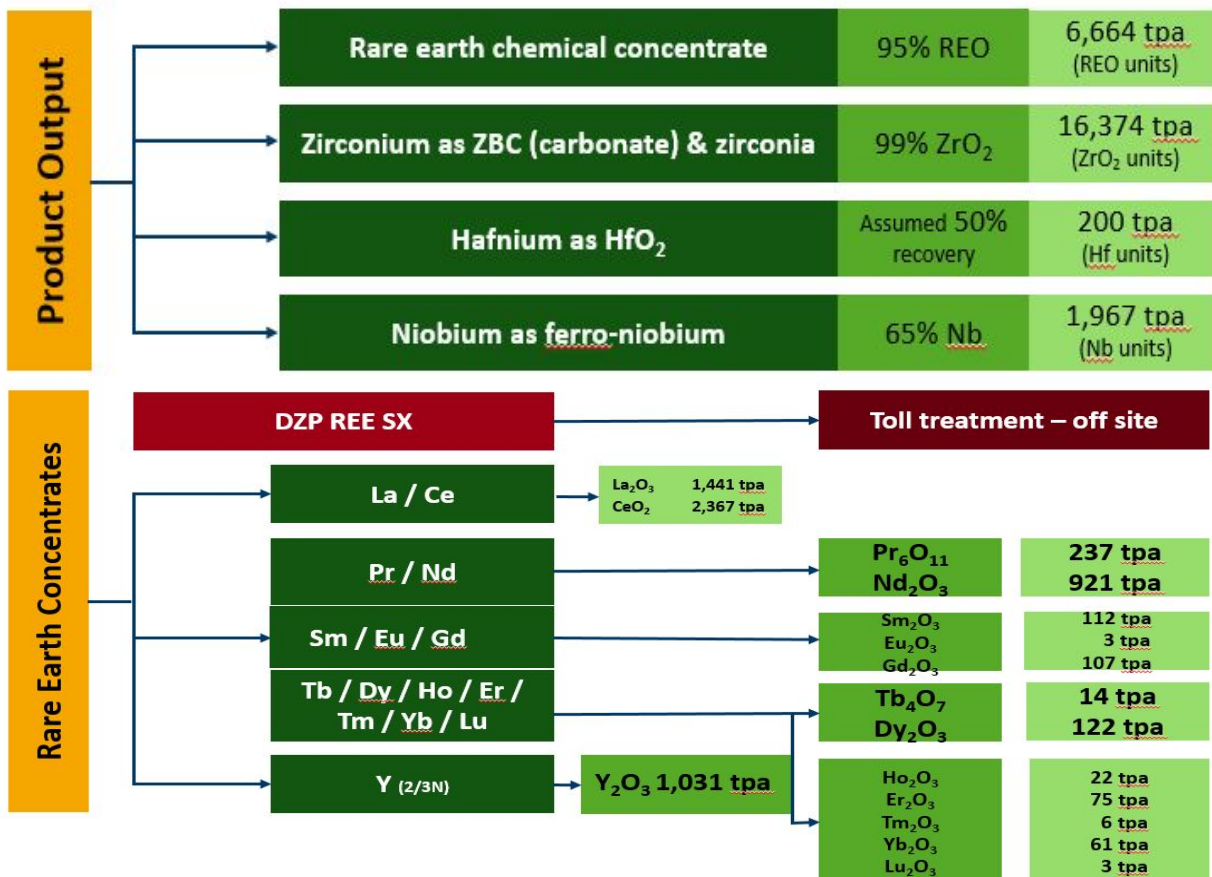
The intention is to move forward to execute the process plant part of the scope on an EPC basis. This has the advantages of developing a key technology and support relationship and to cap the execution risk for AZL. As this relationship develops further, AZL will be seeking to take a similar EPC style approach to the remaining non-process parts of the Project, in order to seek further value, limit risk and minimise interface complexity.

## Marketing

The Company has been very active with numerous visits and meetings covering all of the product outputs from the DZP. Meetings have been held in Asia, Europe and North America, involving process development, toll treatment options, product offtake and financing discussions. In addition, discussions in Australia have taken place with several leading international companies interested in product offtake and working with Alkane to maximize value adding of process streams.

### DZP Product Output

Tonnages based upon recoveries developed from mass balances of the demonstration pilot plan





## Product Pricing

AZL employs specialist consultants and specific industry contacts to maintain an interactive product pricing regime. The following table summarises current spot prices and anticipated 2020 prices which, combined with DZP product output, provide anticipated 2020 revenues.

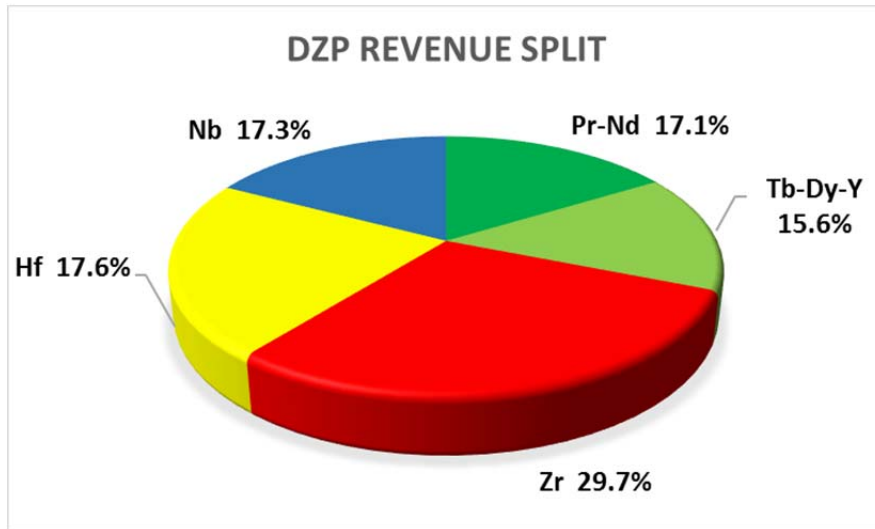
DZP Product Output and Prices US\$/kg as at 31 July 2015					
Numbers have been rounded					
Product	Units	Current Price Range US\$/kg*	Anticipated 2020 US\$/kg	Refined Output Tonnes pa	Anticipated 2020 Revenue US\$M
Lanthanum Oxide	La <sub>2</sub> O <sub>3</sub>	2.00 – 2.50	2	1369	0.00
Cerium Oxide	CeO <sub>2</sub>	2.00 – 2.50	2	2249	0.00
Praseodymium Oxide	Pr <sub>6</sub> O <sub>11</sub>	62.00 – 75.00	80	237	18.92
Neodymium Oxide	Nd <sub>2</sub> O <sub>3</sub>	45.00 – 50.00	60	921	55.23
Samarium Oxide	Sm <sub>2</sub> O <sub>3</sub>	2.50 – 3.50	3	112	0.34
Europium Oxide	Eu <sub>2</sub> O <sub>3</sub>	235.00 – 325.00	300	3	0.86
Gadolinium Oxide	Gd <sub>2</sub> O <sub>3</sub>	15.00 – 20.00	20	107	2.15
Terbium Oxide	Tb <sub>4</sub> O <sub>7</sub>	550.00 – 650.00	650	14	9.26
Dysprosium Oxide	Dy <sub>2</sub> O <sub>3</sub>	260.00 – 310.00	350	122	42.56
Holmium Oxide	Ho <sub>2</sub> O <sub>3</sub>	39.00 – 40.00	40	22	0.87
Erbium Oxide	Er <sub>2</sub> O <sub>3</sub>	39.00 – 42.00	40	75	3.00
Thulium Oxide	Tm <sub>2</sub> O <sub>3</sub>	NA	NA	6	0.00
Ytterbium Oxide	Yb <sub>2</sub> O <sub>3</sub>	29.00 – 31.00	30	61	1.82
Lutetium Oxide	Lu <sub>2</sub> O <sub>3</sub>	980.00 – 990.00	990	3	2.82
Yttrium Oxide	Y <sub>2</sub> O <sub>3</sub>	6.00 – 8.00	15	1031	15.46
					<b>153.30</b>
ZBC (zirconium basic carbonate)	100% ZrO <sub>2</sub>	5.25 – 5.75	6.00	4,000	24.00
Chemical Zirconia	99.50% ZrO <sub>2</sub>	5.00 – 20.00 <sup>1</sup>	9.00	12,356	111.20
					<b>135.20</b>
Hafnium Oxide (95% HfO <sub>2</sub> )	Hf Metal	1,000.00 – 1,200.00	500.00 <sup>2</sup>	200	<b>100.00</b>
Ferro-niobium (65% Nb)	Nb Metal	35.00 – 40.00	40.00	1,967	<b>78.68</b>
<b>TOTAL REVENUE</b>					<b>467.18</b>

\* *Chines domestic prices for REO and Zr* <sup>1</sup> *End use application specific* <sup>2</sup> *Discounted to reflect ramp up volume sold*

Source: TCMS, IMCOA, Industry Sources

## Revenue

Although many of the product prices are at four year lows, the diverse spread of output by the DZP enables a robust revenue stream to be determined at both current spot prices and those anticipated in 2020 as the Project ramps up and the speciality metal market stabilises. In 2020 a total of US\$467 million pa, or about A\$580 million (after royalties, sales and marketing, and off-site refining costs for rare earths) at the A\$:US\$ exchange rate of 0.75, will provide a substantial margin to anticipated costs.



## Finance

The FEED study included updating the mass and energy balances for the Project. AZL has estimated the operating costs based on the study balances, the latest consumption data from the demonstration pilot plant at ANSTO, current market pricing for reagents and personnel and support costs as realised at its operating asset in NSW, Tomingley Gold Operations.

On this basis, steady state operating costs were estimated to be A\$260 million per annum, generating an average EBITDA of A\$320 million per year, and a 20 year NPV of A\$1.22 billion (discount rate of 8% and pre-tax) and an IRR of 17.5%.

The current operating cost estimates indicate an overall cost to produce a kilogram of any product would be in the range US\$7.50 to US\$8.00/kg with revenue averaging US\$17.00/kg.

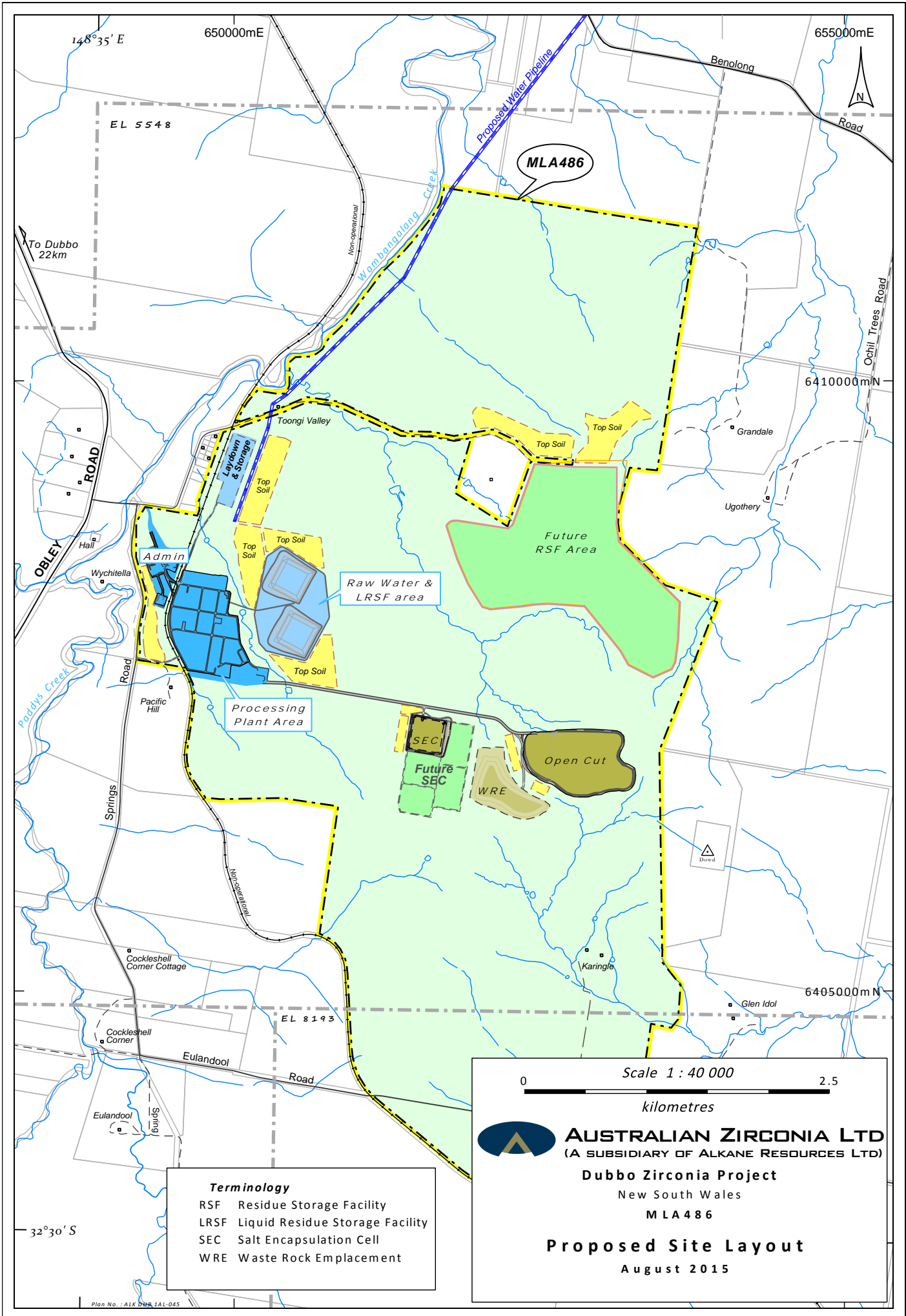
As advised in the Engineering section of this report, AZL is working with engineering contractors to deliver a fixed cost EPC (Engineering, Procurement & Construction) for development and to prepare a bankable study for financing of the Project.

AZL continues to work with its advisors to progress funding of the Project. With project development approval received, AZL is redoubling efforts in relation to funding. The broad strategy has not changed with strategic investment, Export Credit Agency finance and commercial debt remaining as the key components of the envisaged project funding suite.

### ***Strategic Significance of the DZP***

Customers from most major economies such as Europe, United States, and Japan consider the products from the DZP to be “strategic” or “critical” metals and oxides due to their economic importance and supply risk. The main factors that are considered include supply risk, economic importance, available substitutes, and whether the time frame is short or long term.

The importance of the DZP as a new source of more than ten strategic metals and oxides to diversify supply away from existing sources continues to gain recognition and support from companies and governments seeking to reduce dependence on current supply sources, particularly from China. The diversity of the Project’s products and markets also provides stability of revenue streams over a broad base as different markets cycle through ups and downs over time.



**Terminology**

RSF	Residue Storage Facility
LRSF	Liquid Residue Storage Facility
SEC	Salt Encapsulation Cell
WRE	Waste Rock Emplacement

0 2.5  
 kilometres

**AUSTRALIAN ZIRCONIA LTD**  
 (A SUBSIDIARY OF ALKANE RESOURCES LTD)

**Dubbo Zirconia Project**  
 New South Wales  
 MLA 486

**Proposed Site Layout**  
 August 2015





### Competent Person

Unless otherwise advised above, the information in this report that relates to exploration results, mineral resources and ore reserves is based on information compiled by Mr D I Chalmers, FAusIMM, FAIG, (director of the Company) who 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, Mineral Resources and Ore Reserves. Mr Chalmers consents to the inclusion in this report of the matters based on his information in the form and context in which it appears

### Disclaimer

This report contains certain forward looking statements and forecasts, including possible or assumed reserves and resources, production levels and rates, costs, prices, future performance or potential growth of Alkane Resources Ltd, industry growth or other trend projections. Such statements are not a guarantee of future performance and involve unknown risks and uncertainties, as well as other factors which are beyond the control of Alkane Resources Ltd. Actual results and developments may differ materially from those expressed or implied by these forward looking statements depending on a variety of factors. Nothing in this report should be construed as either an offer to sell or a solicitation of an offer to buy or sell securities.

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### ABOUT ALKANE - [www.alkane.com.au](http://www.alkane.com.au) - ASX: ALK and OTCQX: ANLKY

Alkane is a multi-commodity company focused in the Central West region of NSW, Australia. Currently Alkane has two advanced projects - the Tomingley Gold Operations (TGO) and the nearby Dubbo Zirconia Project (DZP). Tomingley commenced production early 2014. Cash flow from the TGO will provide the funding to maintain the project development pipeline and will assist with the pre-construction development of the DZP.

The DZP Environmental Impact Statement has been completed and development consent granted by the Planning Assessment Commission. Financing is in progress and this project will make Alkane a strategic and significant world producer of zirconium products, hafnium and heavy rare earths when it commences production in 2017.

Alkane's most advanced gold copper exploration projects are at the 100% Alkane owned Wellington and Bodangora prospects, and Elsiehora farm-in. Wellington has a small copper-gold deposit which can be expanded, while at Bodangora a large 12km<sup>2</sup> monzonite intrusive complex has been identified with porphyry style gold copper mineralisation. Encouraging gold mineralisation was recently drilled at Elsiehora.

