WA Silica Sand Projects

May 2019

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- The information in this Report that relates to Arrowsmith and Muchea Exploration Results is based on data collected under the supervision of Mr David Reid, in his capacity as Exploration Manager. Mr Reid, BSc (Geology), is a registered member of the Australian Institute of Geoscientists and has sufficient experience that is relevant to the style of mineralisation and type of deposit under consideration and the activity being undertaken to qualify as a Competent Person under the 2012 edition of the "Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves". Mr Reid consents to the inclusion of the data in the form and context in which it appears.
- The information in this report that relates to Mineral Resources is based on information compiled by Mr Grant Louw who is a full-time employee of CSA Global, under the direction and supervision of Dr Andrew Scogings who is an Associate of CSA Global. Dr Scogings is a Member of the Australasian Institute of Mining and Metallurgy and a Member of the Australian Institute of Geoscientists. He is a Registered Professional Geologist in Industrial Minerals. Dr Scogings has sufficient experience relevant to the style of mineralisation and type of deposit under consideration and to the activity which he is undertaking to qualify as Competent Person as defined in the 2012 Edition of the Australasian Code for the Reporting of Exploration results, Mineral Resources, and Ore Reserves (JORC Code). Dr Scogings consents to the disclosure of information in this report in the form and context in which it appears.

The world is facing a global sand crisis

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News Middle East Documentaries Shows Investigations

FEATURE / BUSINESS & ECONOMY

Running out of sand: in numbers

We illustrate the depletion of one the world's most sought-after commodities of the 21st century: sand.

Demand for sand leads to global ecological crisis

by Alexandra Popescu on 8 February 2018

A shore thing

An improbable global shortage: sand

Thanks to booming construction activity in Asia, sand is in high demand

Sand crisis hits construction workers hard in Madurai

What has made things worse is that M-sand (manufactured sand), the alternative prescribed for river sand, is available in very less quantity and its quality is also far from desirable.

TNN | January 23, 2018, 12:00 IST

The world is facing a global sand crisis

September 8, 2017 6.22am AEST

Sand for use in hydraulic fracturing operations at a processing plant in Chippewa Falls, Wisconsin in 2011. AP Photo/Steve Karnowski), Author provided

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When people picture sand spread across idyllic beaches and endless deserts, they understandably think of it as an infinite resource. But as we discuss in a just-published perspective in the journal Science, over-exploitation of global supplies of sand is damaging the environment, endangering communities, causing shortages and promoting violent conflict.

...ed with unfettered mining to meet it, is ...

TOPIC BELT AND ROAD INITIATIVE

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THE WORLD IS RUNNING OUT OF A RESOURCE, AND IT'S NOT OIL

A looming shortage of sand – a crucial resource once thought endless – could sink infrastructure projects, including those in China's Belt and Road Initiative

Global Shortage of Key Resource Could Doom Key Asian Infrastructure Projects

ENVIRONMENT 03:40 07.01.2018 (updated 07:18 07.01.2018) Get short URL

6 11 0

In the city of Kampot in southern Cambodia, the extraction of sand from an estuary on the Praek Tuek Chhu river is increasing and sand extraction is so common in Asia currently that the continent may deplete all of its sand in the not-too-distant future.

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Unchecked sand mining, with...

Global Silica Sand Use

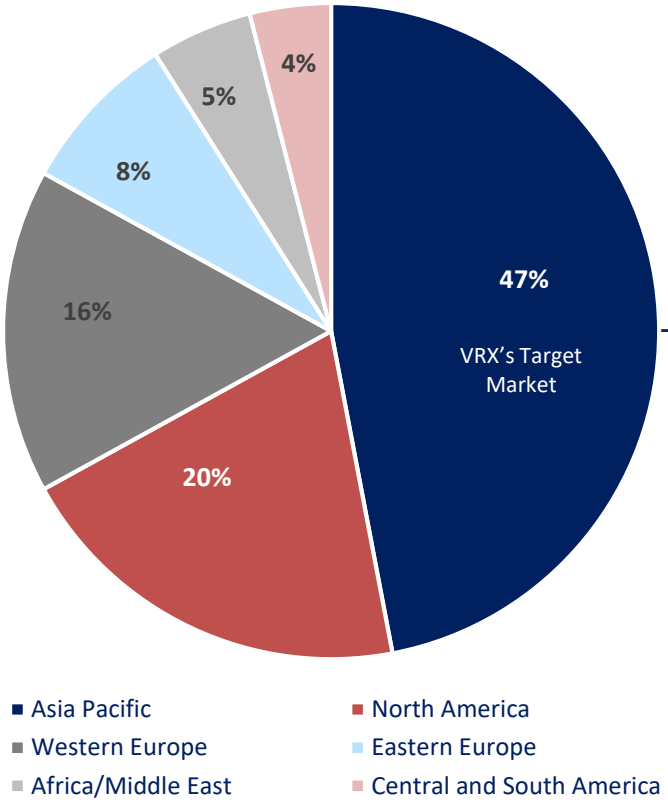
Construction Sand	Concrete
Glassmaking	Float, Containers, Architectural, Thin Film
Metal Casting/Foundry	Automobile parts
Oil/Gas Well Stimulation	Frac sand/proppant
Metallurgical	Ferrous and Non-ferrous Alloys
Paint and Coatings	Brightness and durability
Chemical Production	Sodium silicate, Silicon gels
Ceramics and Refractories	High temp resistance
Filtration	Water production
Recreational	Inert growing media, Golf bunkers

VRXSILICA Target Market

Market Outlook

Asian glass making production increasing 5-6% per year (~8 - 10Mtpa Growth)

Glassmaking silica sand demand by region*



Use	Spec	Market in Asia	Growth in Asia
Float (Plate) Glass	**99.5% SiO_2**	**60 - 65Mt**	**5% - 6%**
Container Glass	**99.5% SiO_2**	**70 - 75Mt**	**5% - 6%**
Cover Glass (Solar Panels)	**99.95% SiO_2 & Low Fe**	**5 - 6Mt**	**+30%**
Smart Glass (Ultra Clear)	99.97% SiO_2 & Low Fe	1 - 2Mt	5% - 6%
Specialist Glass (Thin Screen)	99.97% SiO_2	500 - 600kt	+10%

Source: Stratum Resources

**Source: Freedonia estimate*

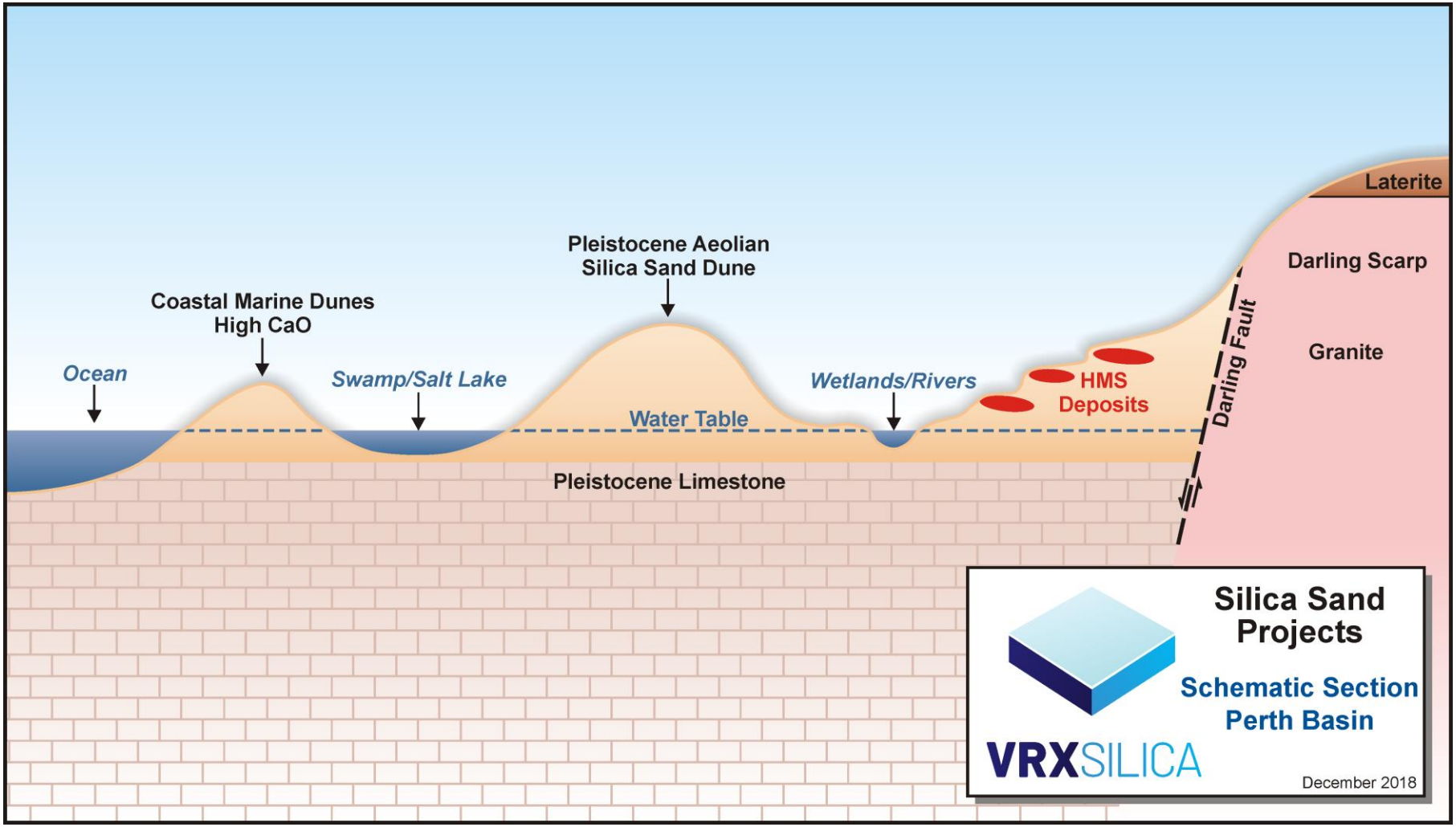
VRX's silica sand strategy

Identify and delineate large scale silica sand resources close to infrastructure

Explore opportunities for further processing to value-add

Develop plans for the mining and export of high quality silica sand

Perth Basin Setting



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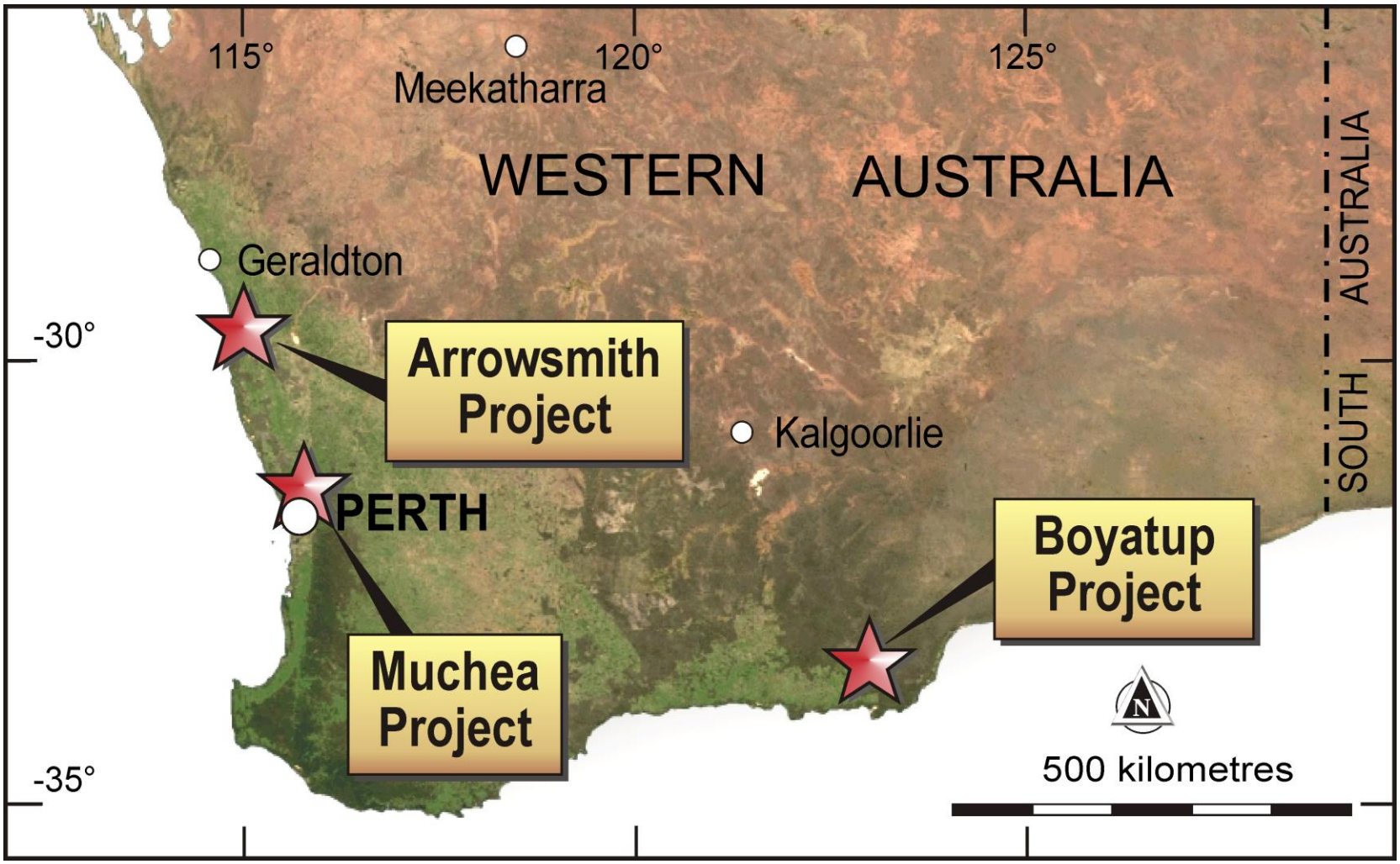

Project Locations

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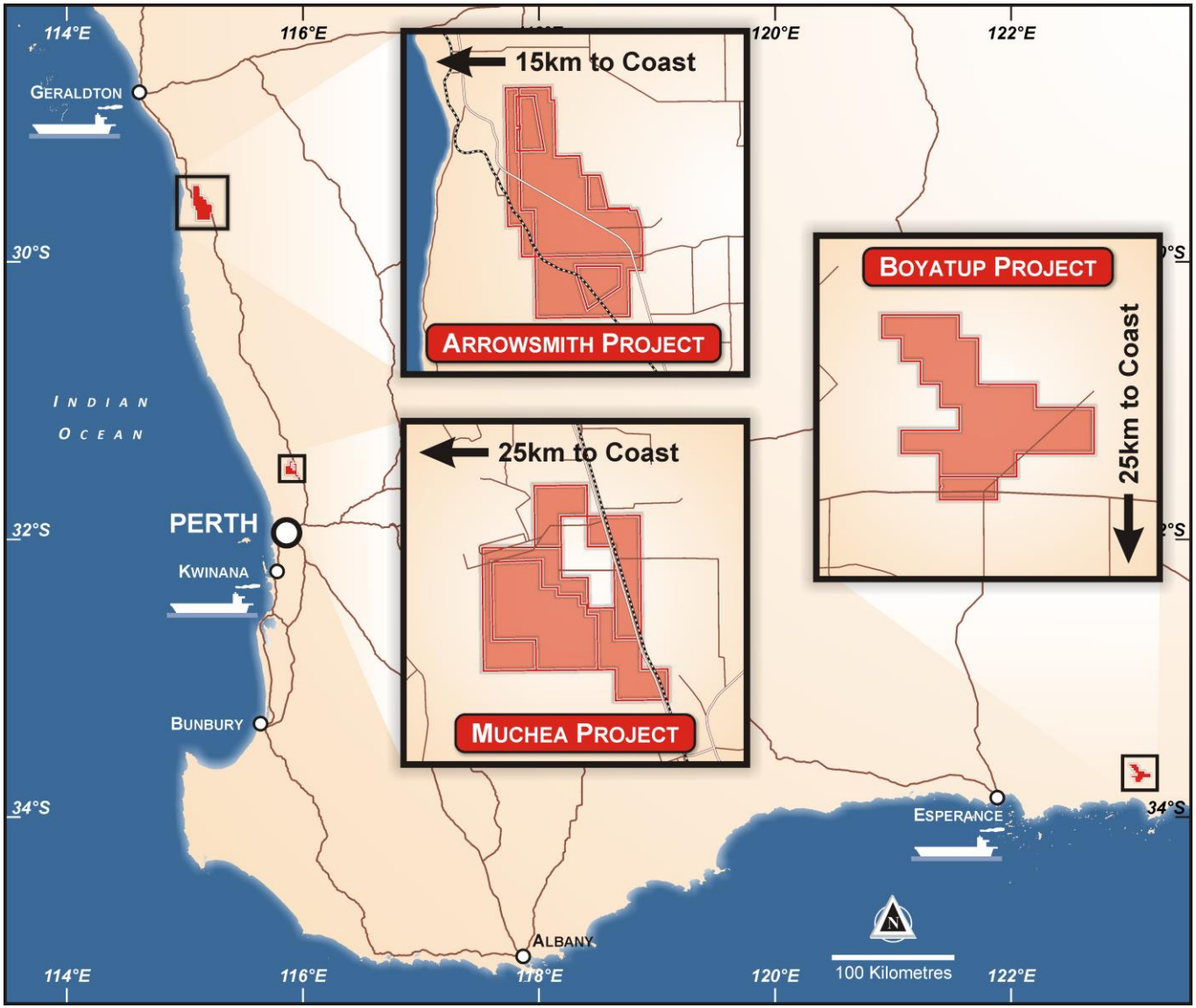
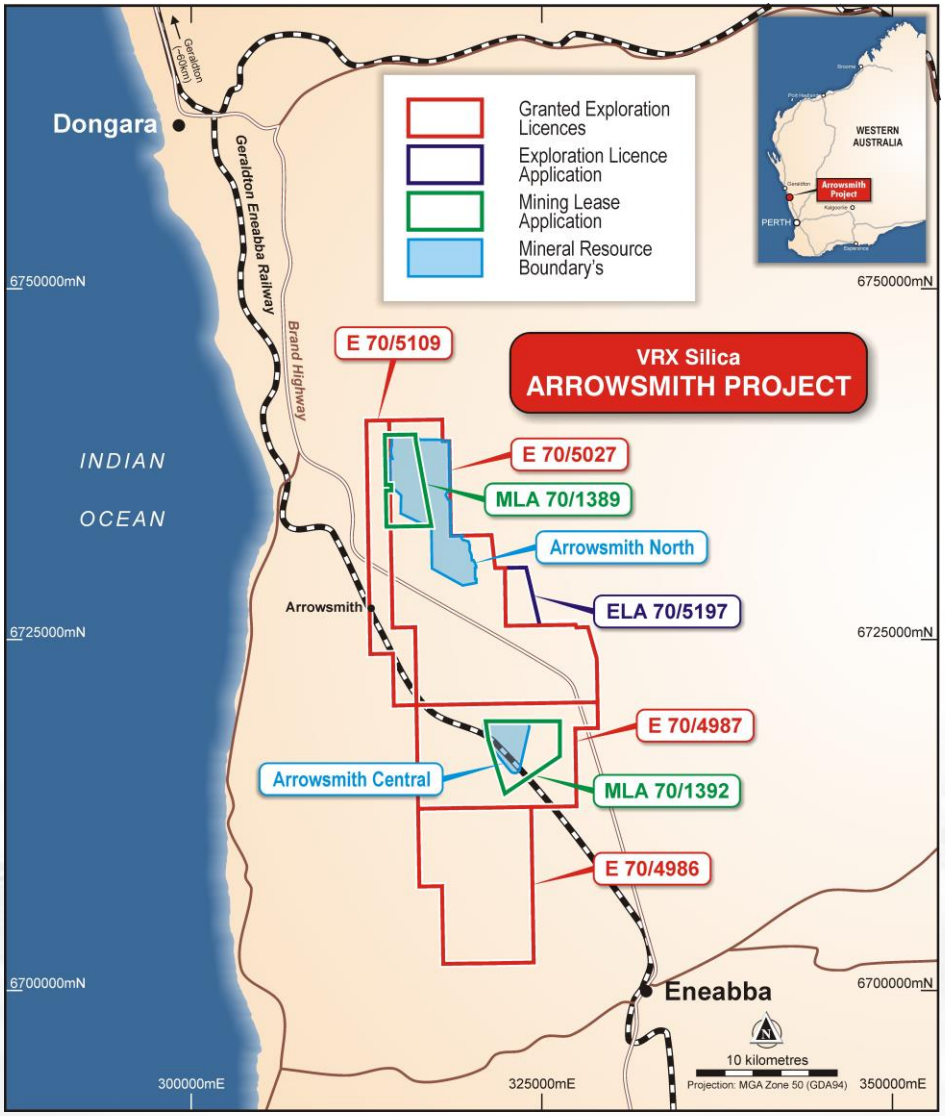


Arrowsmith Project

Arrowsmith – Overview



- 270km nth of Perth
- South of Dongara with rail connections to Geraldton Port
- Very large-scale potential
- Preliminary testwork confirms glass-making quality

  (+99.7% SiO_2)
- Low capital intensity ($25M per plant)
- Low environmental impact mining propositions
- Mining Lease applications lodged for Arrowsmith North (2,000 Ha) and Arrowsmith Central (1,800 Ha) on VCL

Arrowsmith North Inferred Resource

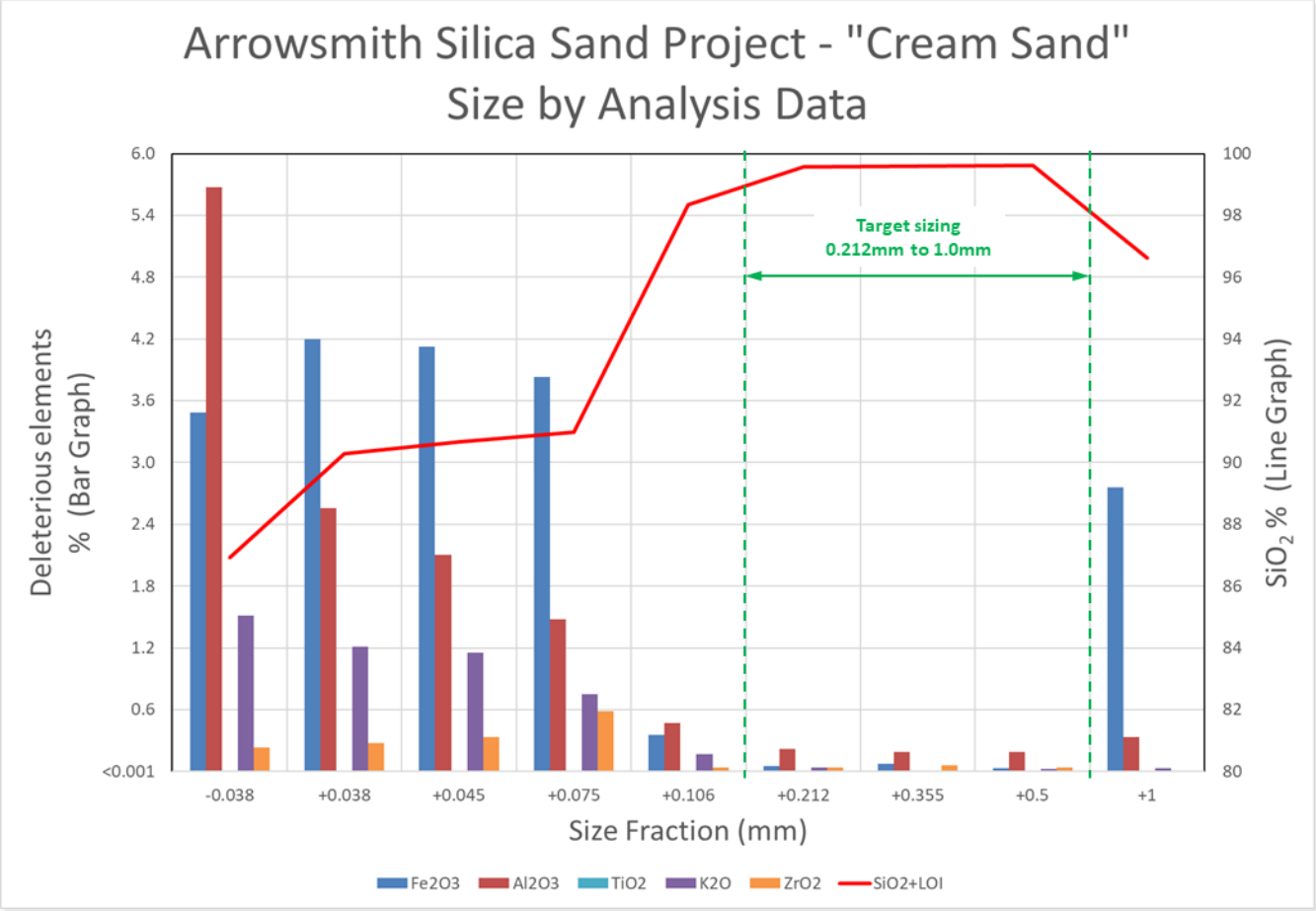
193.6 million tonnes @ 98% SiO_2*

Classification	Domain	Million Tonnes	SiO_2%	Al_2O_3%	Fe_2O_3%	TiO_2%	LOI%
Inferred	Yellow Sand	149.4	97.7	1.1	0.4	0.2	0.5
	White Sand	44.2	99.1	0.3	0.1	0.2	0.2
	All Sand	193.6	98	0.9	0.3	0.2	0.4

* *Details of Arrowsmith North Resource Estimate are contained in the ASX announcement of 2 October 2018*

**Note: Interpreted mineralisation is domained into different sand types based on drill logging data and publicly available soil mapping information, above a basal surface wireframe defined based on the current drill sampling depths. Depletion zones include the upper 0.5 m for rehabilitation purposes, and minor swamp zones in the east and south of the modelled area. Differences may occur due to rounding.*

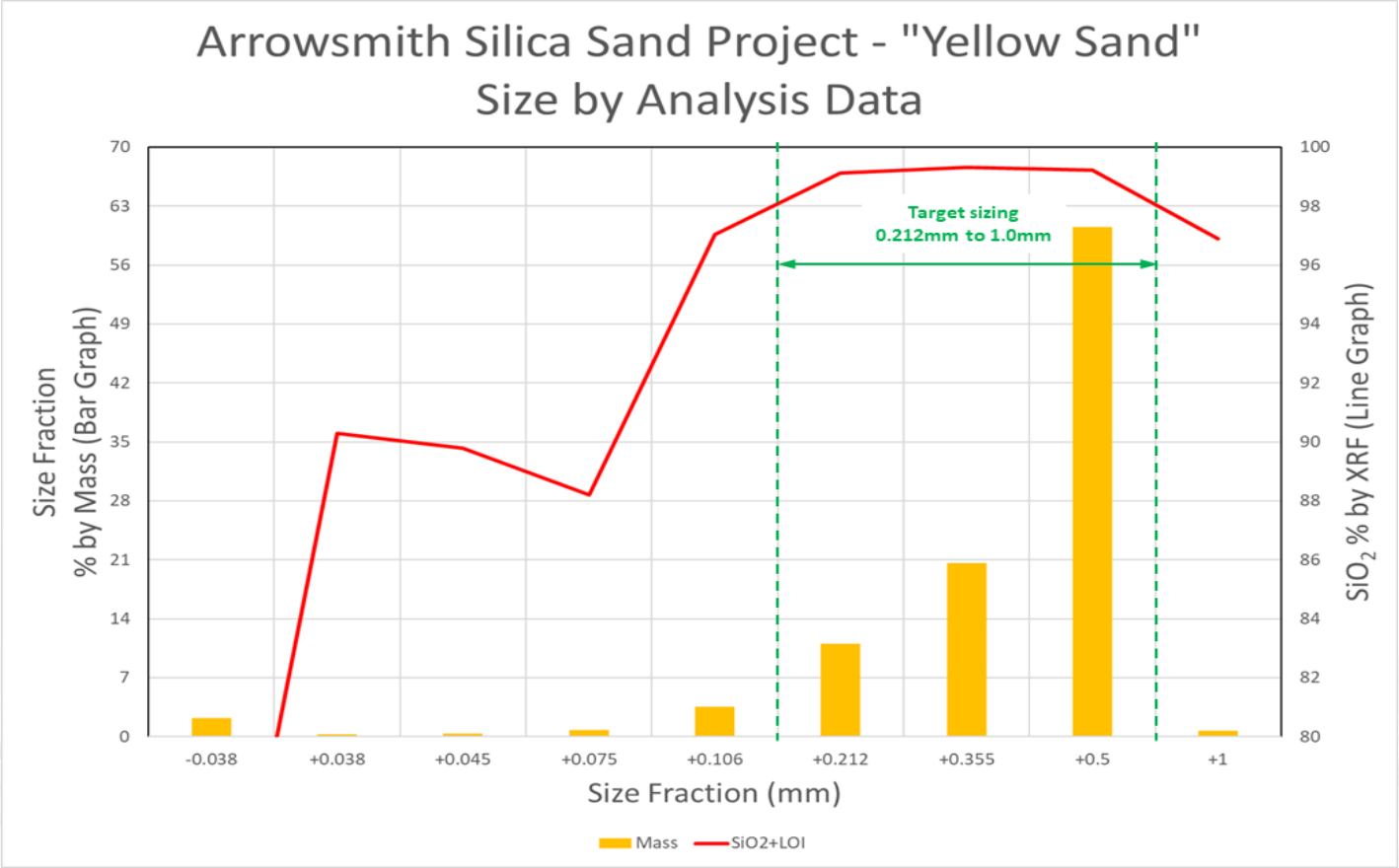
Arrowsmith North Upgrade



0.212mm – 1.0mm Screen

- Removes majority of impurities
- Upgrades to +99.5% SiO_2 product
- Delivers spec suitable for float and container glass market

Arrowsmith North Upgrade



0.212mm – 1.0mm Screen

- +90% Recoveries

Arrowsmith - Processing

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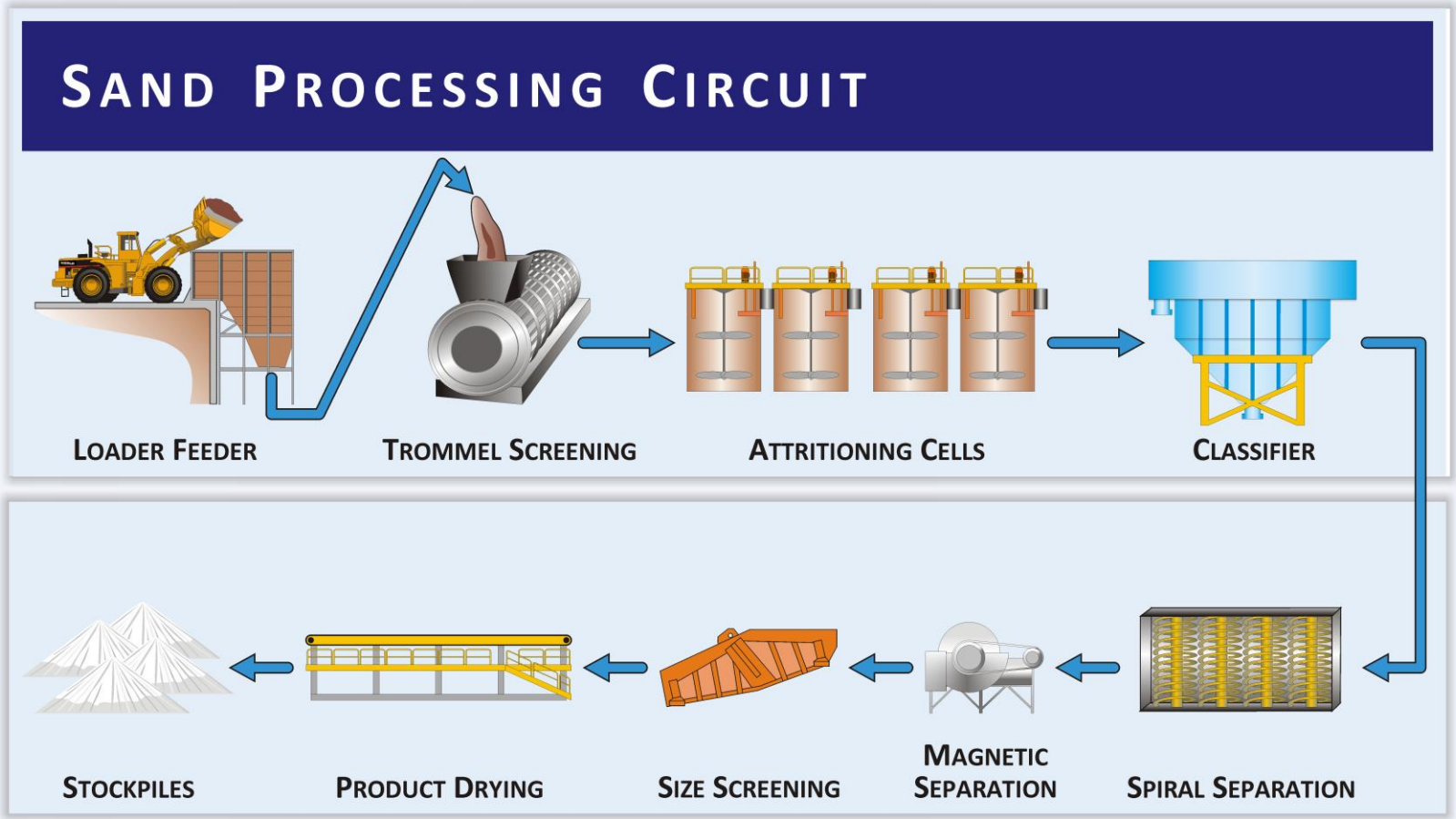
Established processing techniques - No chemicals, Double attritioning



Processing Plant Design

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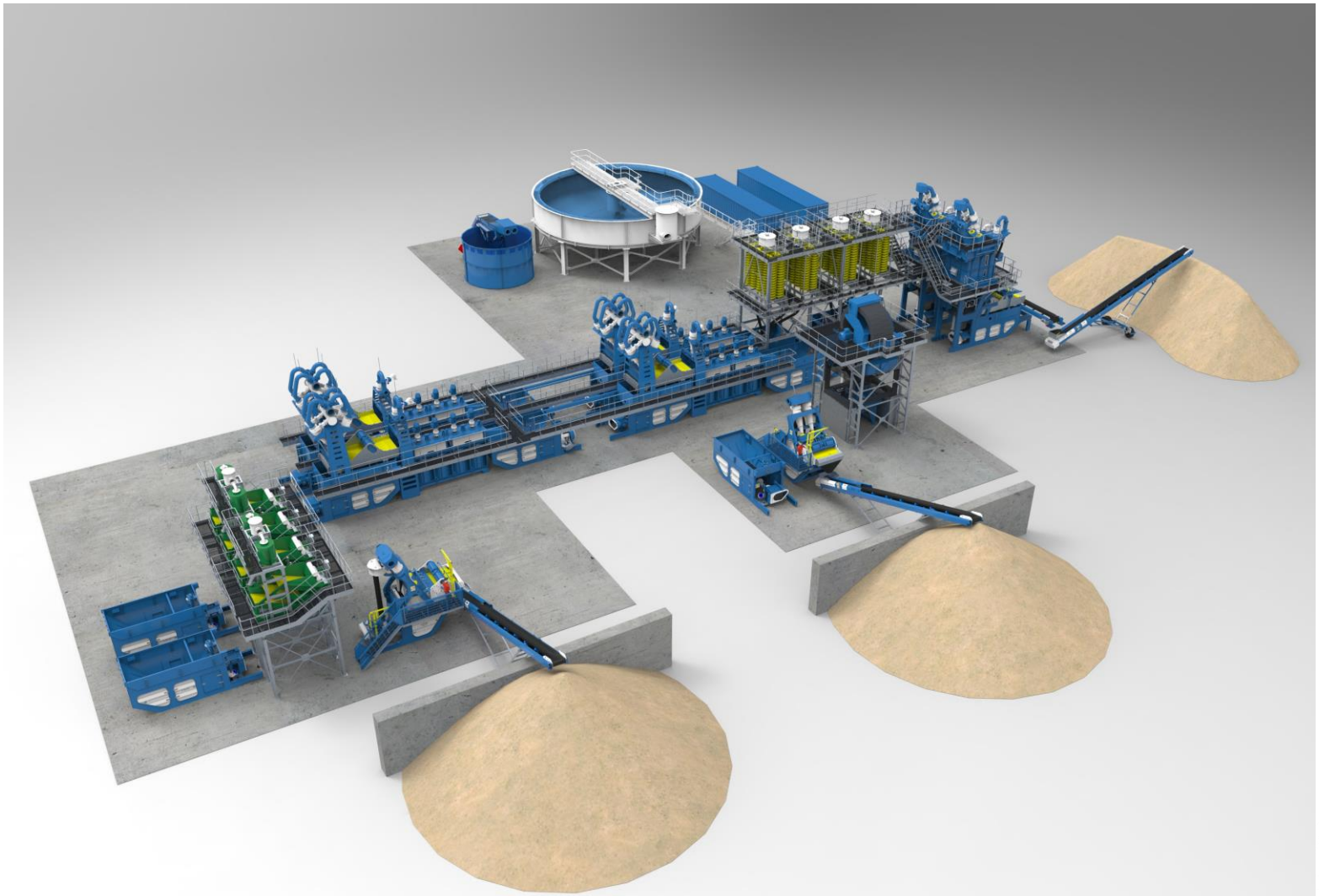
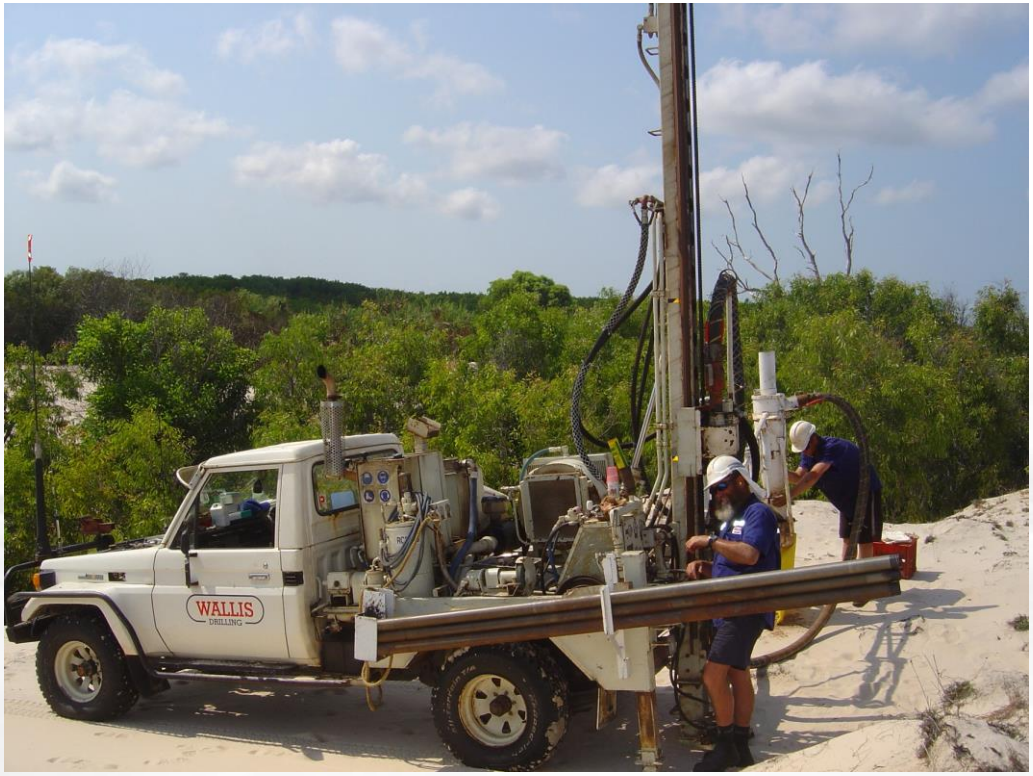


Arrowsmith - Exploration

- Exploration drill program completed using 4WD-mounted AC rig
- Drilling to increase resource size and convert a large portion of resource to Indicated status
- All exploration above the water table
- Very low cost shallow drilling (10-15m) in free running sand





Maiden drilling program using hand held auger


Arrowsmith

Rail & Port Access (Geraldton)







Muchea Project

Muchea - Overview

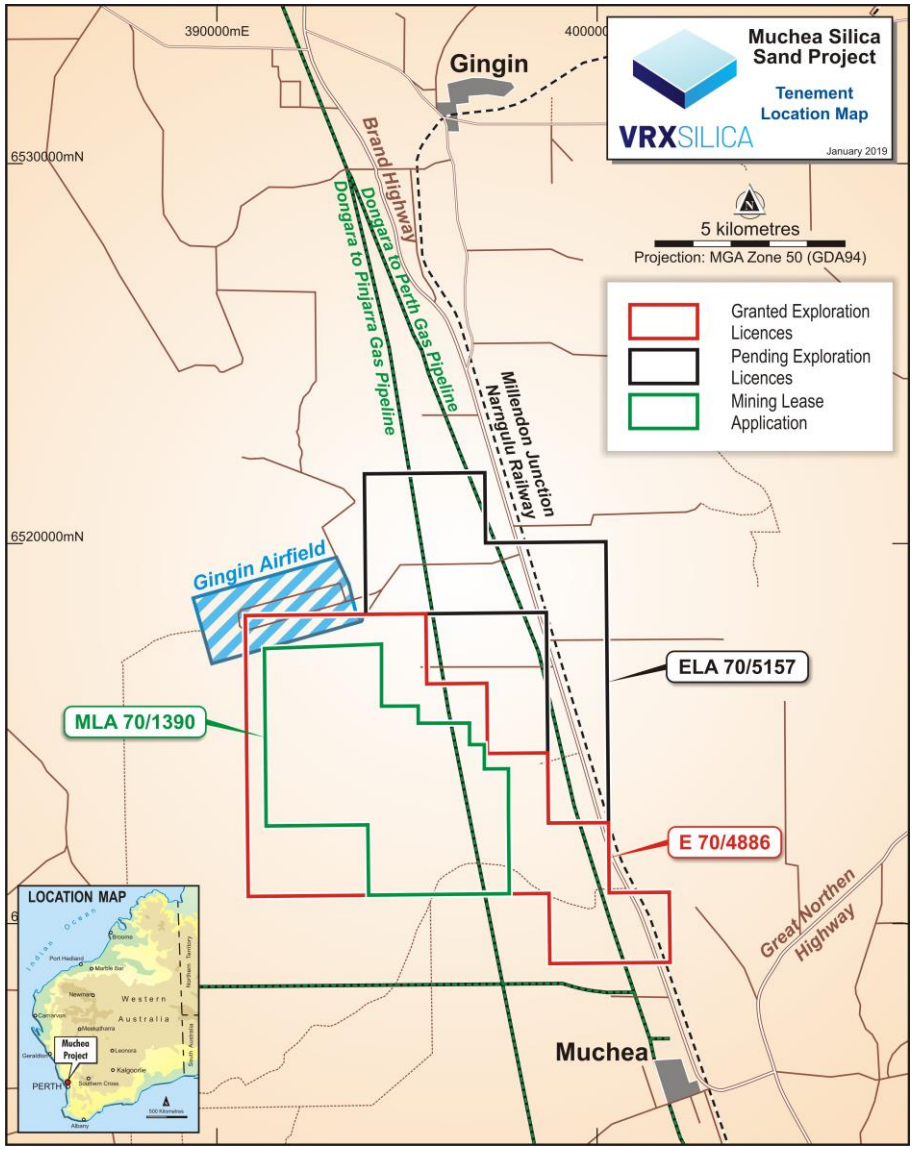


- Muchea is potentially a **world class high-grade silica** sand deposit
  - Located on VCL
  - 50 km north of Perth
  - 14 km north of Muchea
- Granted tenure 100% VRX
- Adjacent to Brand Highway
- Mining Lease application lodged (3,000 Ha)



- Transport logistics in place
  - Significant rail capacity - under-utilised with strong interest from operators
  - Export through Kwinana Port

Muchea – Initial Results



- Initial drilling program delineated high-grade Inferred/Indicated Resource (191Mt)
- Preliminary testwork indicates simple processing can upgrade sand to **specialised glass quality**

+99.9% SiO_2 (Fe_2O_3 <100ppm)



Muchea Indicated/Inferred Resource

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191Mt @ 99.6% SiO_2

Classification	Million Tonnes	SiO_2%	Al_2O_3%	Fe_2O_3%	LOI%	TiO_2%
Indicated	19	99.7	0.03	0.03	0.2	0.08
Inferred	172	99.6	0.04	0.02	0.2	0.08
Indicated + Inferred	**191**	**99.6**	**0.04**	**0.02**	**0.2**	**0.08**

* *Details of Muchea Resource Estimate are contained in the ASX announcement of 20 November 2018*

**Note: Interpreted mineralisation is domained into different sand types based on drill logging data and publicly available soil mapping information, above a basal surface wireframe defined based on the current drill sampling depths. Depletion zones include the upper 0.5 m for rehabilitation purposes, and minor swamp zones in the east and south of the modelled area. Differences may occur due to rounding.*

Muchea - Exploration Program

- Exploration program completed using 4WD-mounted AC rig
- Drilling to increase a portion of resource to Indicated status
- All exploration above the water table
- Very low cost shallow drilling (10-15m) in free running sand
- Sand 2-3% moisture (no dust…)



Recoveries

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Arrowsmith North

Product	*Industry*	*Recovery*
Arrowsmith - N20	Foundry	24%
Arrowsmith - N40 / NF500	Foundry/Glass	60%
Local Market/Filter/Bunker	Filter/Bunker	6%

Arrowsmith Central

Product	*Industry*	*Recovery*
Arrowsmith - C20	Foundry	34%
Arrowsmith - C50/CF400	Foundry/Glass	34%
High TiO_2	Mineral Sands	9%

Muchea

Product	*Industry*	*Recovery*
Muchea F80C	LCD/Foundry	20%
Muchea F80	Glassmaking	48%
Muchea F150	Glassmaking	20%

Recoveries based on CDE Global/Nagrom Testwork Mass Balance Data

- Based on 3 iterations of testwork to date and subsequent process circuit design
- Confirmed high recoveries from engineered plant design
- Key is double attritioning
- Recoveries are of products which comply with customer requirements and published catalogue
- Very strong interest to date from potential customers

Silica Sand Development Program

- Indicated Resource targeted for Arrowsmith and Muchea (Q2 2019)
- Engineering study completed (±15% capital cost estimate)
- Quality samples from recent testwork to be sent to potential customers in Japan, China, India, Vietnam, Thailand, Taiwan and Korea
- Environmental study fieldwork completed to support Mining Proposals
- Permitting Ongoing
- Feasibility studies targeted Q3 2019



		Q2 2019	Q3 2019	Q4 2019	Q1 2020	Q2 2020	Q3 2020	Q4 2020	Q1 2021
Arrowsmith	Infill Drilling								
	Resource Update								
	BFS release								
	Permitting and Approvals								
	Construction								
	Production								
Muchea	Infill Drilling								
	Resource Update								
	BFS release								
	Permitting and Approvals								
	Construction								
	Production								

Investment Considerations

VRXSILICA

- EMERGING AUSTRALIAN STRATEGIC SILICA SAND PRODUCER
- OUTSTANDING PROJECT ECONOMICS AND LOGISTICS
- IDEALLY PLACED TO CAPITALISE ON ROBUST MARKET OUTLOOK AND DEMAND
- POTENTIAL LARGE SAND RESOURCES AND PRODUCTION
- RAPID PATHWAY TO FINANCING AND PRODUCTION
- OTHER PROSPECTS UNDER INVESTIGATION

Corporate & Capital Summary

Capital Structure		
Shares On Issue	(m)	400
Options on Issue[1]	(m)	68
Share Price	cents	6
Cash	A$m	2.2
Debt	A$m	Nil
Market Capitalisation	A$m	24

[1] Volume weighted exercise price 10.67 cents

Directors

Paul Boyatzis
Non-Executive Chairman

Bruce Maluish
Managing Director

Peter Pawlowitsch
Non-Executive Director

