



**VRX**SILICA

# WA Silica Sand Project Developer

October 2019



# Important Information



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# Important Information (cont.)



## Disclaimer and Cautionary Statements (cont.)

Full details of the bankable feasibility studies for the Arrowsmith North, Arrowsmith Central and Muchea projects, including material assumptions underpinning production targets and forecast financial information, are contained in VRX's ASX announcements of 28 August 2019, 17 September 2019 and 18 October 2019, respectively. All such material assumptions continue to apply and have not materially changed. Whilst VRX considers all of the material assumptions to be based on reasonable grounds, there is no certainty that they will be correct or that the range of outcomes indicated within the studies will be achieved.

The probable ore reserves and inferred mineral resources for the Arrowsmith North, Arrowsmith Central and Muchea projects have been prepared by a Competent Person and Competent Person's Statements are set out below.

The production targets for the Arrowsmith Central and Muchea silica sand projects incorporate in each case the probable ore reserves that sit within the proposed mining areas for the respective projects and a portion of the inferred mineral resources within each of those areas. Given the simple nature of the silica sand deposits at both projects, VRX expects that additional drilling will be sufficient to upgrade the inferred mineral resources for both projects and to realise the production targets. Notwithstanding this, there is a low level of geological confidence associated with inferred mineral resources and there is no certainty that further exploration work will result in the determination of indicated mineral resources or that either or both of the production targets at Arrowsmith Central or Muchea will be realised.

## Competent Person's Statements

The information in this report that relates to Arrowsmith North, Arrowsmith Central and Muchea Exploration Results and Muchea Aircore Drilling Area Mineral Resources are based on data collected and compiled under the supervision of Mr David Reid, who is a full-time employee of VRX Silica. 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 (JORC Code). 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 Arrowsmith North, Arrowsmith Central and Muchea Auger area 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 information in this report that relates to Arrowsmith North, Arrowsmith Central and Muchea Probable Ore Reserves is based on data collected and compiled under the supervision of Mr David Reid, who is a full-time employee of VRX Silica. 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 (JORC Code). Mr Reid consents to the inclusion of the data in the form and context in which it appears.

# Investment Highlights

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1

EMERGING AUSTRALIAN STRATEGIC SILICA SAND PRODUCER

2

OUTSTANDING PROJECT ECONOMICS AND LOGISTICS

**Combined NPV<sub>10</sub> of \$727m**

3

IDEALLY PLACED TO CAPITALISE ON ROBUST MARKET OUTLOOK AND DEMAND

4

RAPID PATHWAY TO FINANCING AND PRODUCTION



# 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.

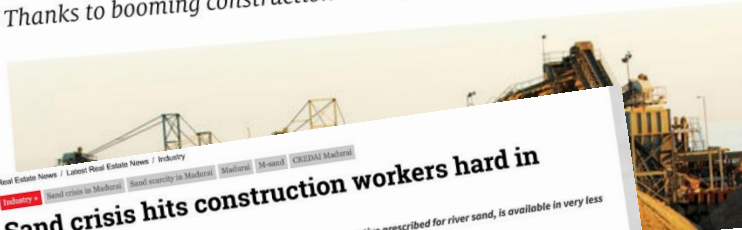
### Demand for sand leads to global ecological crisis

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

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## 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.

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.

Philippines Indonesia

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SPECIAL COVERAGE

## Sand mining: Growing pains of cross-border trade

Unchecked sand mining with

# Silica Sand Use



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

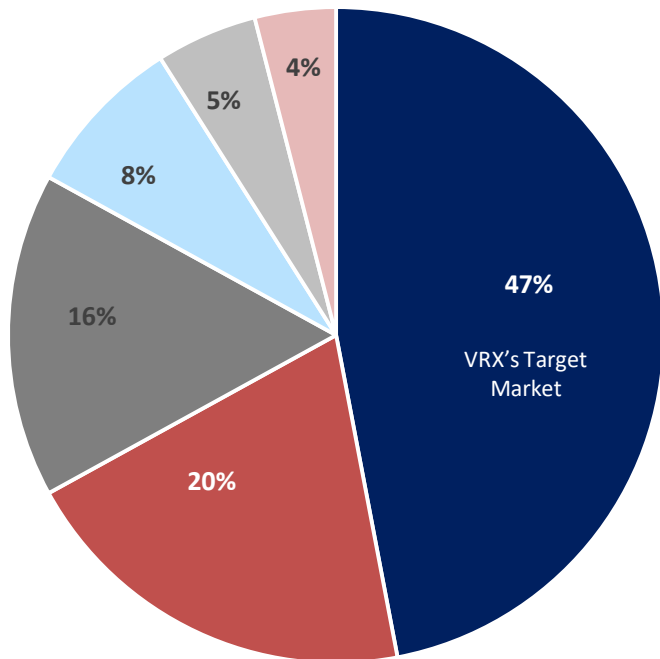


# Market Outlook



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

Glassmaking silica sand demand by region\*



- Asia Pacific
- North America
- Western Europe
- Eastern Europe
- Africa/Middle East
- Central and South America

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

Source: Stratum Resources

\*Source: Freedonia estimate

# VRX's Silica Sand Strategy

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**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



# Three Advanced WA Silica Sand Projects



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## **Muchea** (100%)

- Very high-grade product with outstanding financial metrics
- Well located to key port and rail infrastructure
- Specialist glass products
- Potential +100 year mine life:
  - JORC Resource of **208Mt @ 99.6% SiO<sub>2</sub>**
  - Probable Ore Reserve of **18.7Mt @ 99.9% SiO<sub>2</sub>**
- BFS completed Oct 2019

## **Arrowsmith North** (100%)

- High-grade with exceptional financial metrics
- Close proximity to port and rail infrastructure
- Glass making, foundry and ceramic markets
- Potential +100 year mine life:
  - JORC Resource of **771Mt @ 98% SiO<sub>2</sub>**
  - Probable Ore Reserve of **223 Mt @ 99.7% SiO<sub>2</sub>**
- BFS completed Aug 2019

## **Arrowsmith Central** (100%)

- High grade with strong financial metrics
- Adjacent to rail infrastructure to port
- Container glass and foundry products
- Significant resource base:
  - JORC Resource of **76.5 Mt @ 96.8% SiO<sub>2</sub>**
  - Probable Ore Reserve of **18.9 Mt @ 99.6% SiO<sub>2</sub>**
- BFS completed September 2019

Geraldton  
Port

Kwinana  
Port

# BFSs Demonstrate Exceptional Economics\*



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	Arrowsmith North	Arrowsmith Central	Muceha	Total
Post Tax, ungeared NPV <sub>10</sub>	\$242.3m	\$147.6m	\$337.9m	<b>\$727.8m</b>
Post Tax, ungeared IRR	79%	60%	96%	<b>83%</b>
Payback period (yrs) (post tax) (ramp up rate)	2.4	2.8	2.3	<b>2.4</b>
Exchange Rate US\$/A\$	\$0.70			
Life of Mine (yrs) (BFS Study)	25			
EBIT	\$1.144bn	\$737m	\$1.540bn	<b>\$3.421bn</b>
Total Sales (25 years) no escalation	\$2.773bn	\$2.167m	\$3.345bn	<b>\$8.285bn</b>
Cashflow after finance and tax	\$835m	\$539m	\$1.123bn	<b>\$2.497bn</b>
Capex (2 mtpa)	\$28.260m	\$25.88m	\$32.8m	<b>\$87m</b>
Capex contingency (inc)	20%			
Life of Mine C1 costs, FOB Geraldton (inc Royalties)	\$30.18	\$27.67	\$32.74	<b>\$30.24</b>
Tonnes Processed (million tonnes) (BFS Study)	53	51	54	<b>158</b>
Production Target (initial 25 years) (Mt)	47.7	39.6	48.3	<b>136</b>
Probable Ore Reserves (million tonnes)	99.7% SiO <sub>2</sub> 204	99.6% SiO <sub>2</sub> 19	18.7	<b>242</b>
Ore Reserve life (yrs)	102	10	9-10	
JORC Resources (million tonnes)	771	77	208	<b>1,056</b>

\* Full details of the bankable feasibility studies for the Arrowsmith North, Arrowsmith Central and Muceha projects, including material assumptions underpinning production targets and forecast financial information, are contained in VRX's ASX announcements of 28 August 2019, 17 September 2019 and 18 October 2019, respectively. All such material assumptions continue to apply and have not materially changed. Whilst VRX considers all of the material assumptions to be based on reasonable grounds, there is no certainty that they will be correct or that the range of outcomes indicated within the studies will be achieved.

# Arrowsmith Projects

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# Proximity to Key Infrastructure

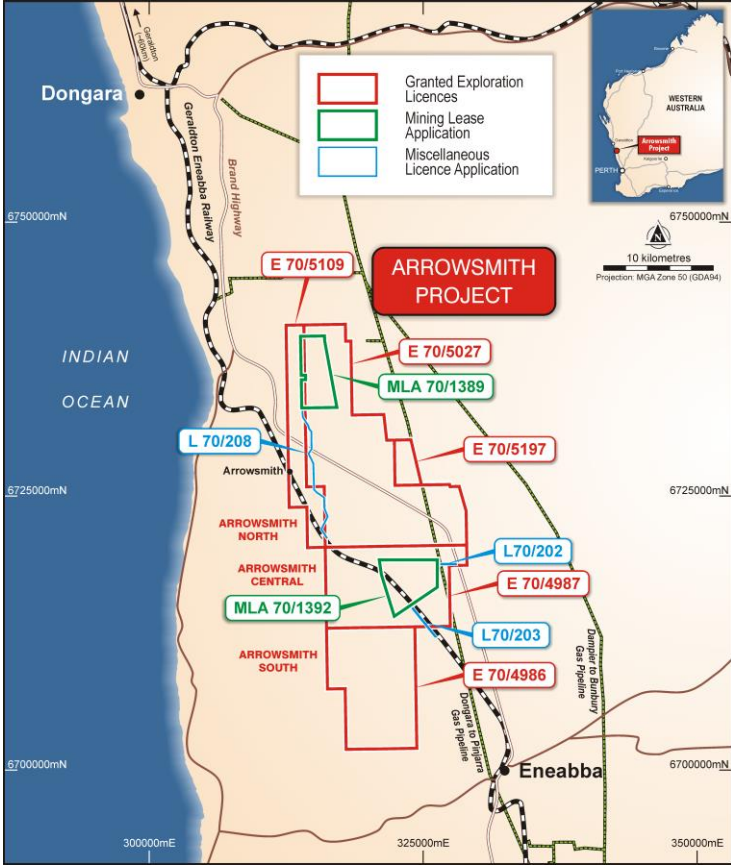


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- Arrowsmith Projects located 100 km south of Geraldton Port and 270km north of Perth
- Rail connections to Geraldton Port



Geraldton Port

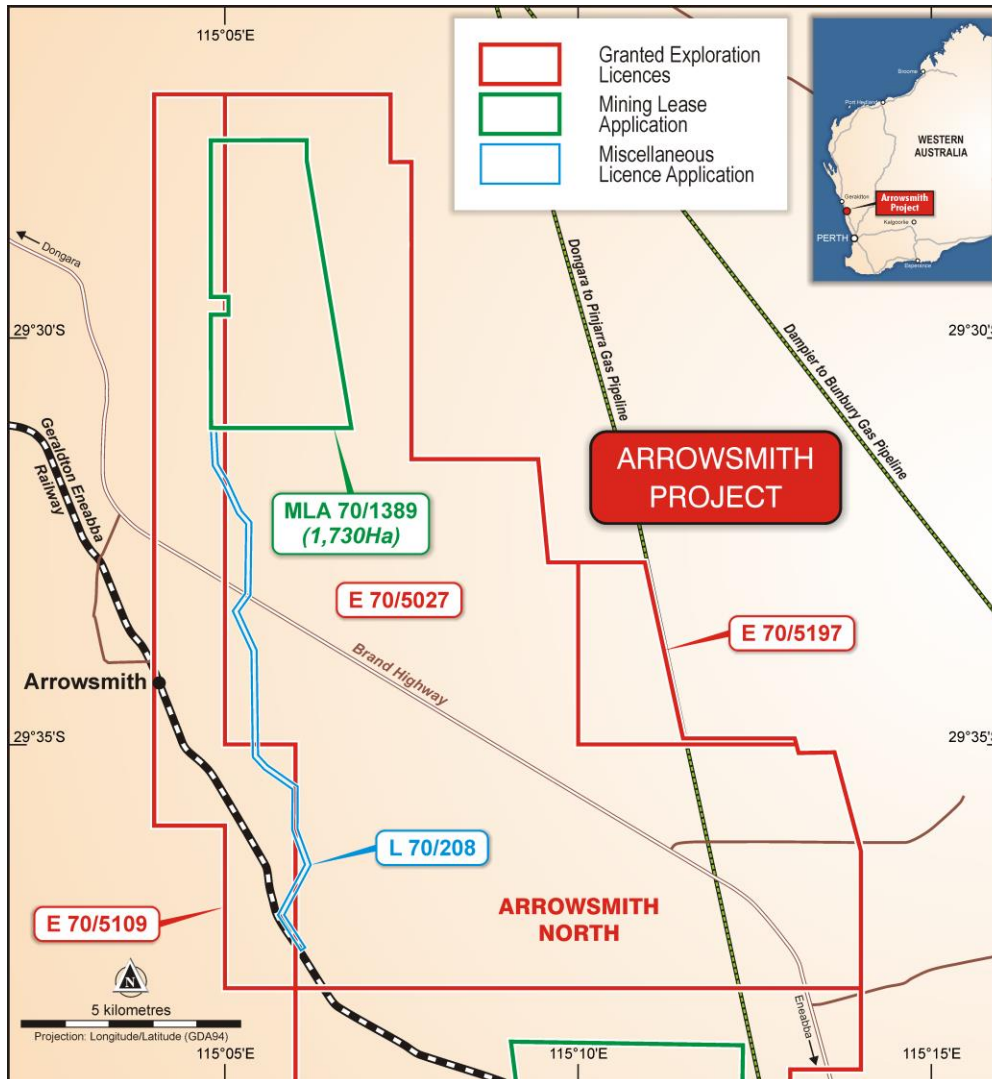


Rail to Geraldton

# Arrowsmith North Overview



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- **Very large-scale potential:**
  - Probable Ore Reserve of **223 Mt @ 99.7% SiO<sub>2</sub>**
- Exceptional project economics
- BFS completed Aug 2019:
  - Post Tax, ungeared NPV<sub>10</sub> – \$242m
  - Post Tax, ungeared IRR – 79%
  - Capex (2mtpa) – \$28.3m
  - BFS LoM – 25 years
- Substantial testwork confirms glass-making quality **(+99.7% SiO<sub>2</sub>)**
- Low environmental impact mining propositions
- Mining Lease applications lodged for Arrowsmith North (1,730 Ha)



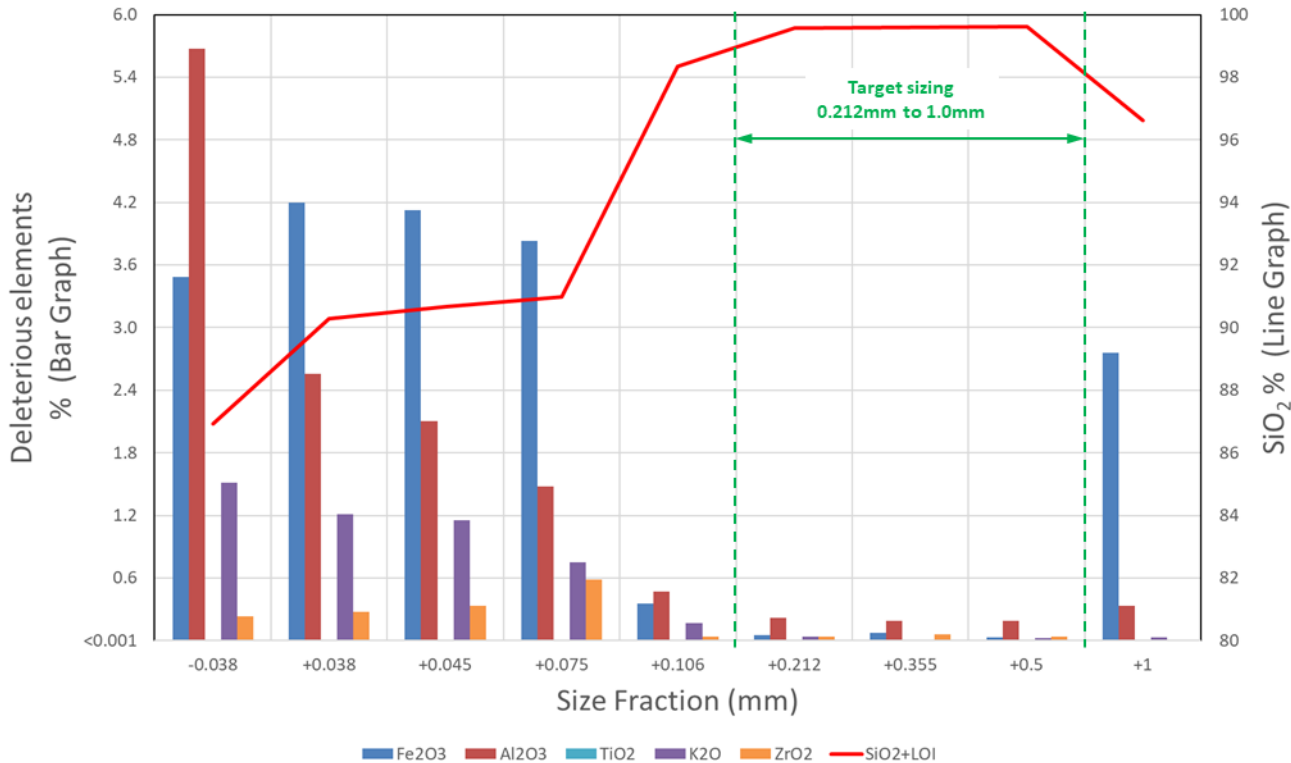
# Arrowsmith North Upgrade



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## 0.212mm – 1.0mm Screen

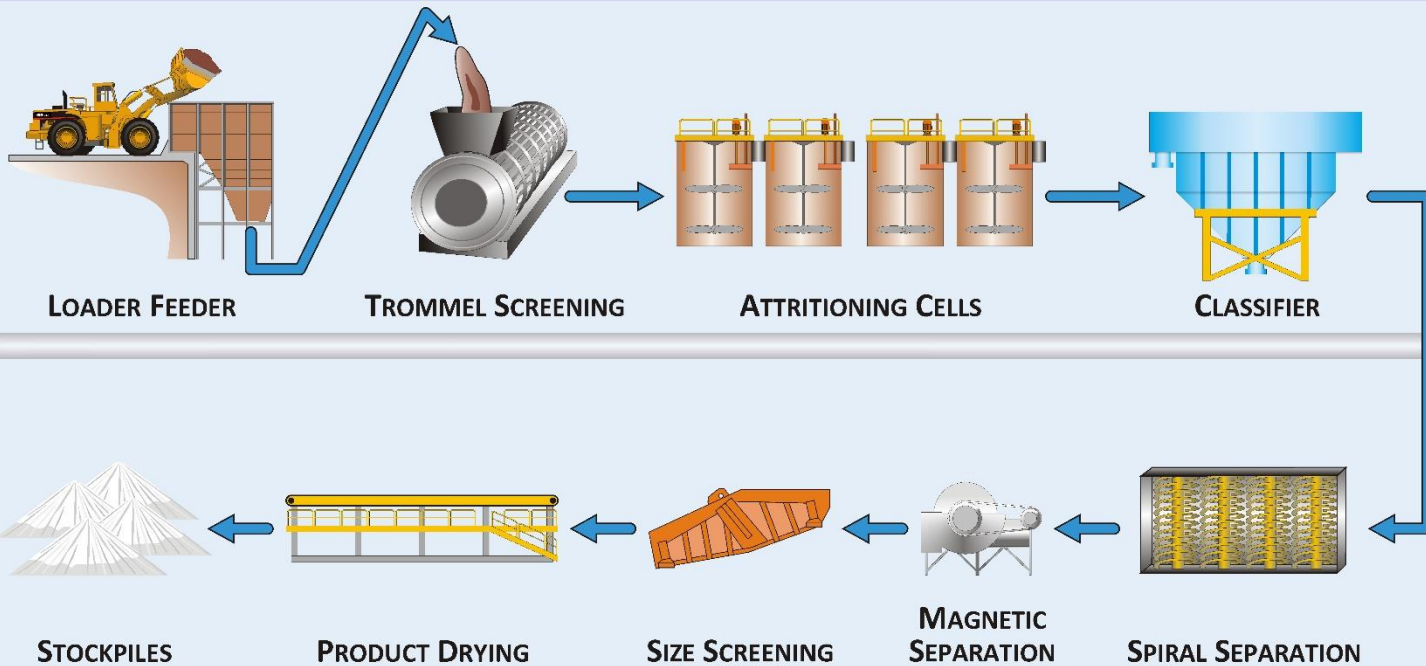
Arrowsmith Silica Sand Project - "Cream Sand"  
Size by Analysis Data



- Removes majority of impurities
- Upgrades to +99.5% SiO<sub>2</sub> product
- Delivers spec suitable for float and container glass market

Established processing techniques - **No chemicals & no dust**

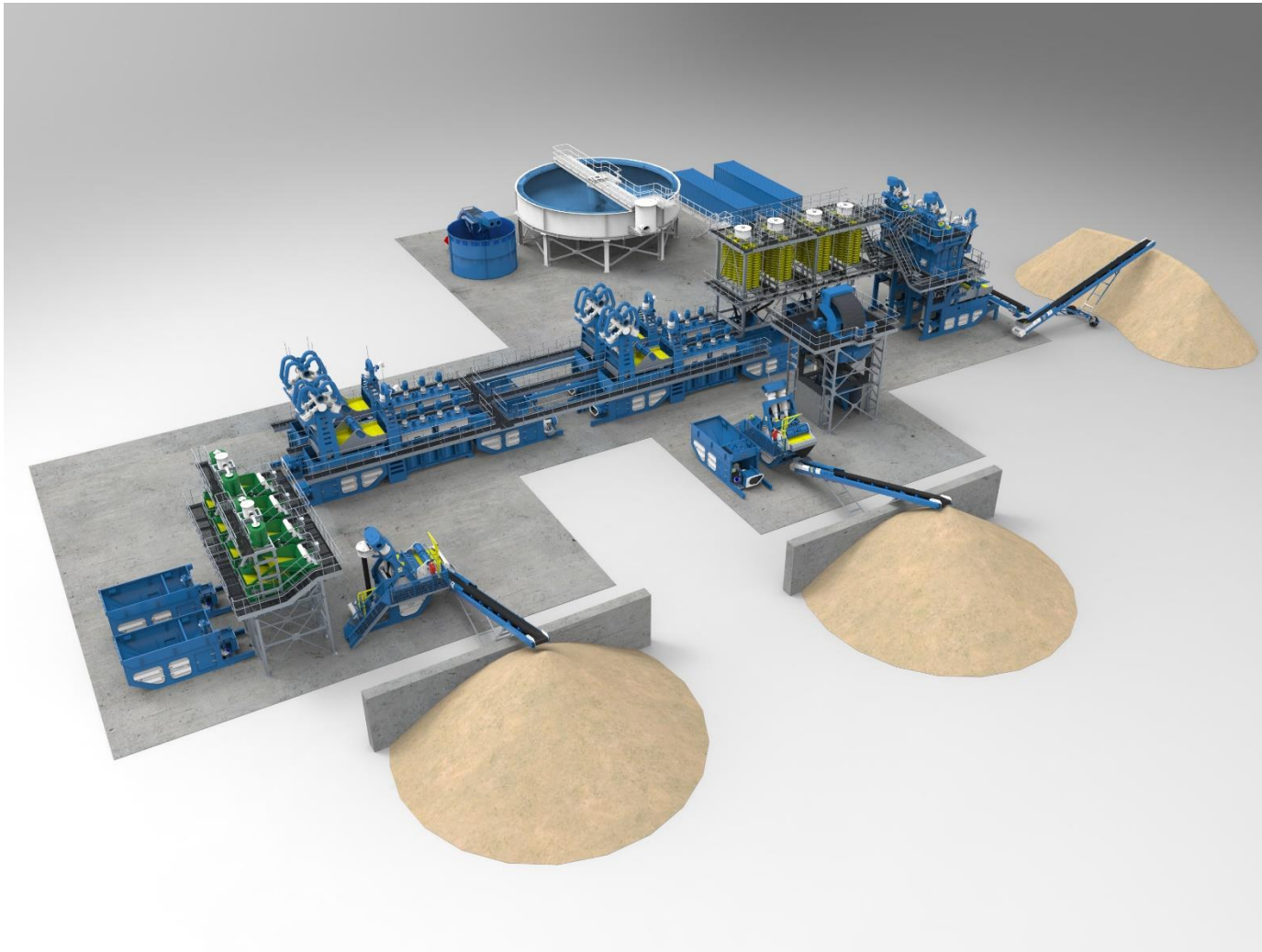
## SAND PROCESSING CIRCUIT



# Processing Plant Design



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Arrowsmith North

Kwongan Low Heath





# Muchea Project

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# Muceha – Strategic Location



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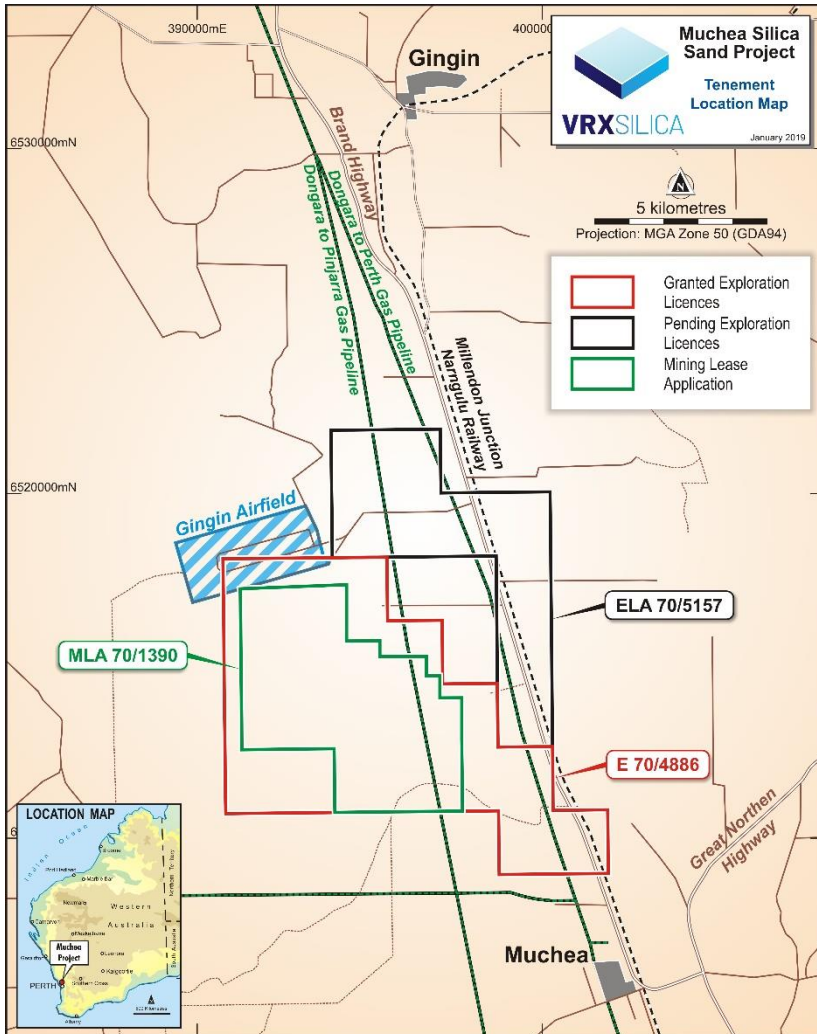
- Located on UCL
- 50 km north of Perth
- 14 km north of Muceha
- Transport logistics in place:
  - Adjacent to Brand Highway
  - Significant rail capacity - under-utilised with strong interest from operators
  - Export through Kwinana Port



# Muchea - Overview



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- Muchea is potentially a world class high-grade silica sand deposit
- Granted tenure 100% VRX
- Potential 100 year mine life:
  - Probable Ore Reserves of **18.7Mt @ 99.9% SiO<sub>2</sub>**
  - JORC Resource of **208 Mt @ 99.6% SiO<sub>2</sub>**
- BFS completed in Oct 2019 demonstrate exceptional economics:
  - Post Tax, ungeared NPV<sub>10</sub> – \$338m
  - Post Tax, ungeared IRR – 96%
  - Capex (2mtpa) – \$32.8m
  - BFS Study LoM – 25 years
- Mining Lease application lodged (3,000 Ha)
- NT Mining Agreement agreed terms
- Pre-referral discussion with EPA



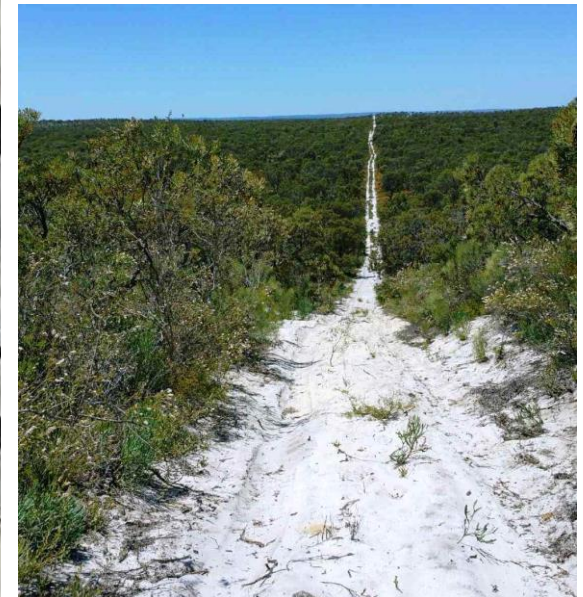
# Muchea – Product



**Very high quality +99.9% SiO<sub>2</sub> and <100ppm Fe<sub>2</sub>O<sub>3</sub>**



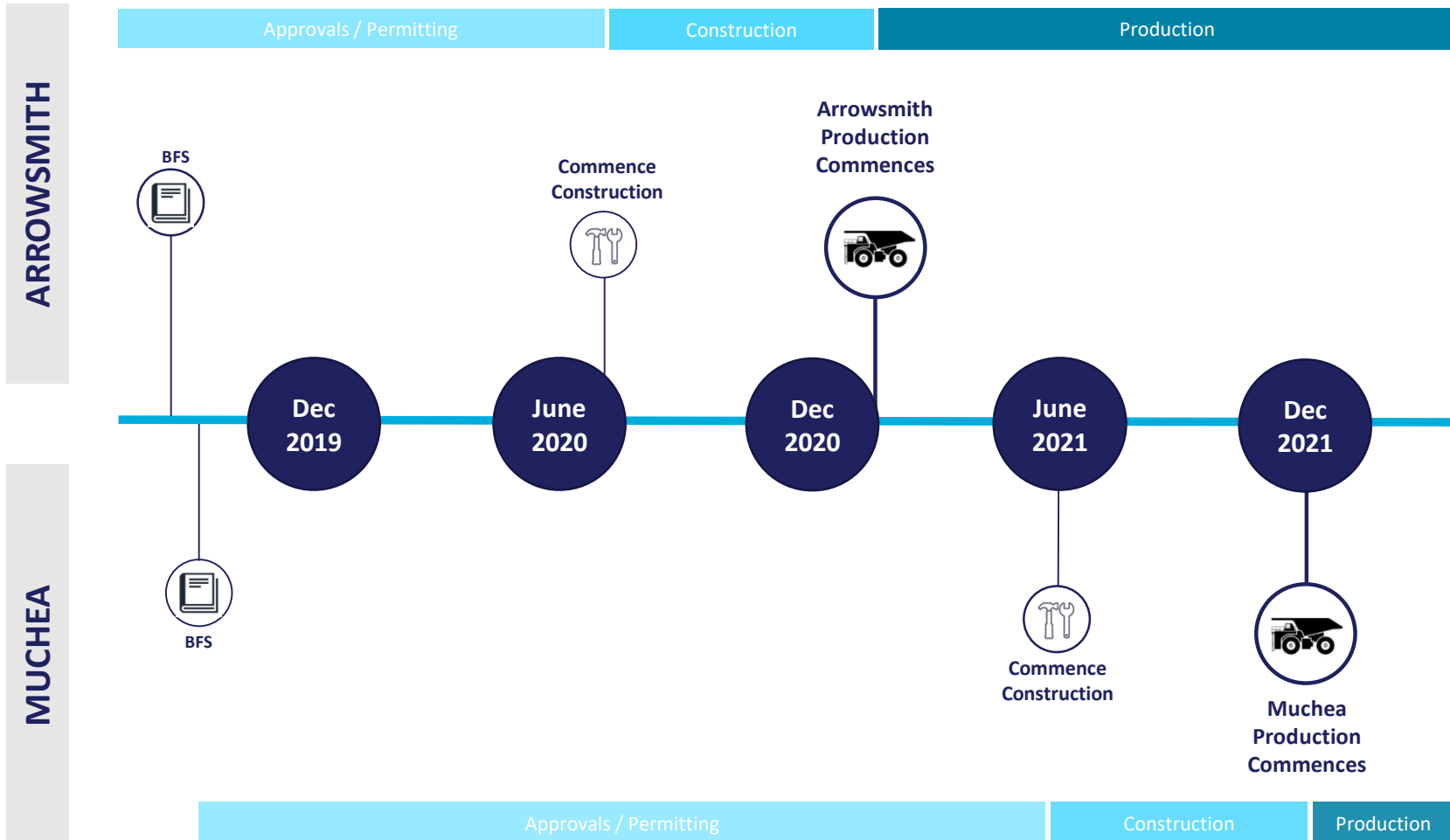
Significant testwork indicates simple processing can upgrade sand to **specialised glass quality**







# Silica Sand Development Timeline





# Investment Highlights

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**EMERGING  
AUSTRALIAN  
STRATEGIC  
SILICA SAND  
PRODUCER**

**OUTSTANDING  
PROJECT  
ECONOMICS  
AND LOGISTICS**

**RAPID PATHWAY  
TO FINANCING  
AND  
PRODUCTION**

**IDEALLY PLACED  
TO CAPITALISE  
ON ROBUST  
MARKET  
OUTLOOK AND  
DEMAND**

# Corporate & Capital Summary



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## Capital Structure

Shares On Issue	(m)	409
Options on Issue <sup>1</sup>	(m)	77
Share Price	cents	14.5
Cash (30 June)	A\$m	1.5
Debt	A\$m	Nil
Market Capitalisation	A\$m	59

## Directors

Paul Boyatzis	Non-Executive Chairman
Bruce Maluish	Managing Director
Peter Pawlowitsch	Non-Executive Director

<sup>1</sup> Volume weighted exercise price 10.67 cents

## Share Price (12 month)





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**Appendices**

# Arrowsmith North Resource



## Resource

Classification	Domain	Million Tonnes	SiO <sub>2</sub> %	Al <sub>2</sub> O <sub>3</sub> %	Fe <sub>2</sub> O <sub>3</sub> %	TiO <sub>2</sub> %	LOI%
Indicated + Inferred	White Sand	313	98.7	0.54	0.15	0.18	0.24
	Yellow Sand	458	97.6	1.08	0.40	0.17	0.52
	<b>All Sand</b>	<b>771</b>	<b>98</b>	<b>0.86</b>	<b>0.3</b>	<b>0.17</b>	<b>0.41</b>

## Products

Classification	Product	SiO <sub>2</sub> %	Al <sub>2</sub> O <sub>3</sub> %	Fe <sub>2</sub> O <sub>3</sub> %	TiO <sub>2</sub> %	LOI%
Probable	Arrowsmith-N20	99.7	0.2	0.05	0.035	0.1
	Arrowsmith-N40/NF500	99.7	0.2	0.05	0.035	0.1

\* Details of Arrowsmith North Resource Estimate are contained in the ASX announcement of 9 July 2019

\*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 Central Resource



## Resource

Classification	Domain	Million Tonnes	SiO <sub>2</sub> %	Al <sub>2</sub> O <sub>3</sub> %	Fe <sub>2</sub> O <sub>3</sub> %	TiO <sub>2</sub> %	LOI%
Indicated + Inferred	All sand	76.5	96.8	1.5	0.4	0.2	0.7

## Products

Classification	Product	SiO <sub>2</sub> %	Al <sub>2</sub> O <sub>3</sub> %	Fe <sub>2</sub> O <sub>3</sub> %	TiO <sub>2</sub> %	LOI%
Probable	Arrowsmith-CF400	99.6	0.25	0.04	0.03	0.1
	Arrowsmith-C20					
	Arrowsmith-C50					

\* Details of Arrowsmith Central Resource Estimate are contained in the ASX announcement of 15 August 2019

*\*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 Resource



## Resource

Classification	Domain	Million Tonnes	SiO <sub>2</sub> %	Al <sub>2</sub> O <sub>3</sub> %	Fe <sub>2</sub> O <sub>3</sub> %	TiO <sub>2</sub> %	LOI%
Indicated + Inferred	All sand	<b>208</b>	99.6	0.06	0.02	0.1	0.23

## Products

Classification	Product	SiO <sub>2</sub> %	Al <sub>2</sub> O <sub>3</sub> %	Fe <sub>2</sub> O <sub>3</sub> %	TiO <sub>2</sub> %	LOI%
Probable	Muchea-F80	99.9	0.02	0.008	0.03	0.1
	Muchea-F80C	99.9	0.02	0.005	0.03	0.1
	Muchea-F150	99.8	0.07	0.015	0.035	0.1

\* Details of Muchea Resource Estimate are contained in the ASX announcement of 17 June 2019

*\*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.*

# Thank you

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