



**BLACKEARTH**

Specialising in Critical Commodities

**UPDATED  
SCOPING STUDY**

**DECEMBER 2021**

**ASX:BEM**



## CAUTIONARY STATEMENT

BlackEarth Minerals NL (“BlackEarth or “the Company”) now presents details regarding its updated Scoping Study

The Scoping Study (“the Scoping Study” or “the Study”) referred to in this announcement is based on further studies following a scoping study (“the Original Study”) released in February 2019. This study remains at the level of a Scoping Study based on preliminary technical and economic study of the viability of developing the Maniry Graphite Project (“Maniry”) by constructing an open cut mine and processing facility to produce graphite concentrate for export. The Study outcomes, production target and forecast financial information referred to in this release are based on low accuracy level technical and economic assessments that are insufficient to support estimation of Ore Reserves.

The Scoping Study has been completed to a level of accuracy of +/- 35% in line with a scoping level study accuracy. While each of the modifying factors was considered and applied, there is no certainty of eventual conversion to Ore Reserves or that the production target itself will be realised. Further exploration and evaluation work and appropriate studies are required before Maniry will be in a position to estimate any Ore Reserves or to provide any assurance of an economic development case. Given the uncertainties involved, investors should not make any investment decisions based solely on the results of the Scoping Study.

The Company has reasonable grounds for disclosing a Production Target, given that 80% of production of the mill feed is scheduled from the Indicated Resource category. Approximately 80% of the Life-of-Mine (LOM) Production Target is in the Indicated Mineral Resource category, and 20% is in the Inferred Mineral Resource category. There is a lower level of geological confidence associated with Inferred Mineral Resources. The Company has only applied 20% of its Inferred mineral resource to the Study assessment and we believe this to be a fair and conservative approach.

Also included within this Scoping Study document are production projections are related results in relation to the Company’s 50% interest in a Joint Venture Expandable Graphite with existing leading manufacturer, Metachem Industries Pte Ltd of India.

The scoping study is based on the material assumptions outlined below. These include assumptions about the availability of funding. While the Company considers all the material assumptions in this Study to be based on reasonable grounds, there is no certainty that they will prove to be correct or that the range of outcomes indicated will be achieved.

The Mineral Resources underpinning the production target in the Scoping Study have been prepared by a competent person in accordance with the requirements of the JORC Code (2012). The Competent Person’s Statement is found on page 3 of this study booklet within this ASX release. For full details of the Mineral Resources estimate, please refer to Company’s ASX release dated 17 November 2021. BlackEarth confirms that it is not aware of any new information or data that materially affects the information included in that release. All material assumptions and technical parameters underpinning the estimates in that ASX release continue to apply and have not materially changed.



## FORWARD LOOKING STATEMENTS

Certain statements contained in this presentation, including information as to the future financial or operating performance of BlackEarth Minerals NL (“the Company”) and its projects, are forward-looking statements. Such forward-looking statements are necessarily based on a number of estimates and assumptions that, while considered reasonable by the Company, are inherently subject to significant technical, business, economic, competitive, political and social uncertainties and contingencies, involve known and unknown risks and uncertainties that could cause actual events or results to differ materially from estimated or anticipated events or results reflected in such forward-looking statements, and may include, among other things, statements regarding targets, estimates and assumptions in respect of commodity prices, operating costs and results, capital expenditures, ore reserves and mineral resources and anticipated grades and recovery rates and are, or may be, based on assumptions and estimates related to future technical, economic, market, political, social and other conditions. The Company disclaims any intent or obligation to update publicly any forward-looking statements, whether as a result of new information, future events or results or otherwise. The words ‘believe’, ‘expect’, ‘anticipate’, ‘indicate’, ‘contemplate’, ‘target’, ‘plan’, ‘intends’, ‘continue’, ‘budget’, ‘estimate’, ‘may’, ‘will’, ‘schedule’ and other, similar expressions identify forward-looking statements. All forward-looking statements made in this presentation are qualified by the foregoing cautionary statements. Investors are cautioned that forward-looking statements are not guarantees of future performance and, accordingly, investors are cautioned not to put undue reliance on forward-looking statements due to the inherent uncertainty therein. Many known and unknown factors could cause actual events or results to differ materially from estimated or anticipated events or results reflected in such forward-looking statements. Such factors include, but are not limited to: competition; mineral prices; ability to meet additional funding requirements; exploration, development and operating risks; uninsurable risks; uncertainties inherent in ore reserve and resource estimates; dependence on third-party smelting facilities; factors associated with foreign operations and related regulatory risks; environmental regulation and liability; currency risks; effects of inflation on results of operations; factors relating to title to properties; native title and Aboriginal heritage issues; dependence on key personnel, and share-price volatility. They also include unanticipated and unusual events, many of which it is beyond the Company’s ability to control or predict. Photographs in this presentation may not depict assets of the Company.

Some of the information contained in this presentation has been derived from previously released information to the ASX refer: 30/1/2019 -“Positive Scoping Study Results”; 30/1/2019-“BEM Progressing to full feasibility”; 17/1/2021- “Significant increase in Graphite inventory at Maniry”.

## COMPETENT PERSONS STATEMENT

The information in this document that relates to Exploration Results, Exploration Targets and Mineral Resources is based on information compiled by Ms. Annick Manfrino, Principal of Sigma Blue and is a Competent Person who is a member of the Australasian Institute of Mining and Metallurgy and a consultant to the Company. Ms. Manfrino has sufficient experience that is relevant to the style of mineralization and type of deposit under consideration and to the activity being undertaken 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. Ms Manfrino consents to the use of the information included in this document in the form and context in which it appears.

# KEY SCOPING STUDY UPDATES

- The updated December 2021 Scoping Study (“the Study”) is based on the Company’s original Scoping Study (published 30 January 2019<sup>(1)</sup>) and updated following a material upgrade in the Company’s Resource<sup>(3)</sup> and other improved factors
- Significant progress has been made in the completion of BlackEarth’s Definitive Feasibility Study (“DFS”) and information from this has provided for certain Capex and non-mining OPEX savings
- The Study includes forecast share of revenue that is to be received from its JV Operations in India, with leading Expandable Graphite Producer, Metachem
- Accounts for certain improvements in Graphite Concentrate prices which are forecast to grow further as supply shortages potentially occur in the medium terms <sup>(2)</sup>
- The DFS is scheduled for completion in Mid-2022 and leading external advisers, CPC Engineering are participating in this process
- Strong business case for Maniry and Metachem JV operations in India
- *Appendix 1 – 3 providing important information relevant to the Scoping Study and should be read in conjunction with this report*

(1) Scoping Study published to ASX January 2019

(2) See Benchmark Minerals price and supply and demand projections – Appendix 2

(3) JORC Compliant Resource Statement – page 13



# Updated scoping study highlights & key assumptions



## Updates to the Scoping Study have been driven by the following key factors:-

1. The material Increase to Resource Size and Grade announced on 17 November 2021– the additional resource increased BEM's overall inventory by 22% in size with additional higher grade. The additional resource added 32% to the Company's Indicated Resource. 182,000 tonnes of contained graphite were added to the stated resource which increased the Company's mine life from 11 to 14 years
2. Small reductions in OPEX – the Company has reviewed many of the mining and non-mining OPEX costs from the original Scoping Study and have identified overall cost reductions of US\$900,000 pa.
3. The Company has undertaken a review of various Stage 1 and 2 CAPEX assumptions from the Original Scoping Study and have identified cost reductions of US\$2.7m in savings in Stage 1 costs and US\$2.4m in Stage 2 costs.
4. Modest increase in market prices – graphite concentrate prices have continued to improve over 2021 and are projected to increase over the medium to long term as demand pressures effect supply. As a result, the Company's Scoping Study overall basket price has been increased by 3% from US\$1,215/mt to US\$1,258/mt

# Key Highlights

## Post Updated Maniry Scoping Study

### Maniry Pre-Tax NPV

**c.US\$230m**

- 126% increase from 2019 Scoping Study of \$US103m
- DFS scheduled for completion Mid-2022



### Consolidated Project(s) NPV

**c.\$US255m**

*Combined Maniry & Metachem<sup>1</sup> pre-tax valuation*



### Maniry Payback Period

**1.2Yrs**

*Maniry payback (after-tax) from first ore has materially decreased from 4Yrs as reported in the 2019 Scoping Study*



### Maniry Internal Rate of Return (IRR)

**86.1%**

*Previously 41.9% in 2019 Scoping Study*



### Indicated Resource Upgrade

**32%**

*Increase in total graphite concentrate to overall production profile with an Exploration Target of 260Mt-380Mt at 6%-8% TGC*



### Maniry Life of Mine EBITDA

**US\$561m**

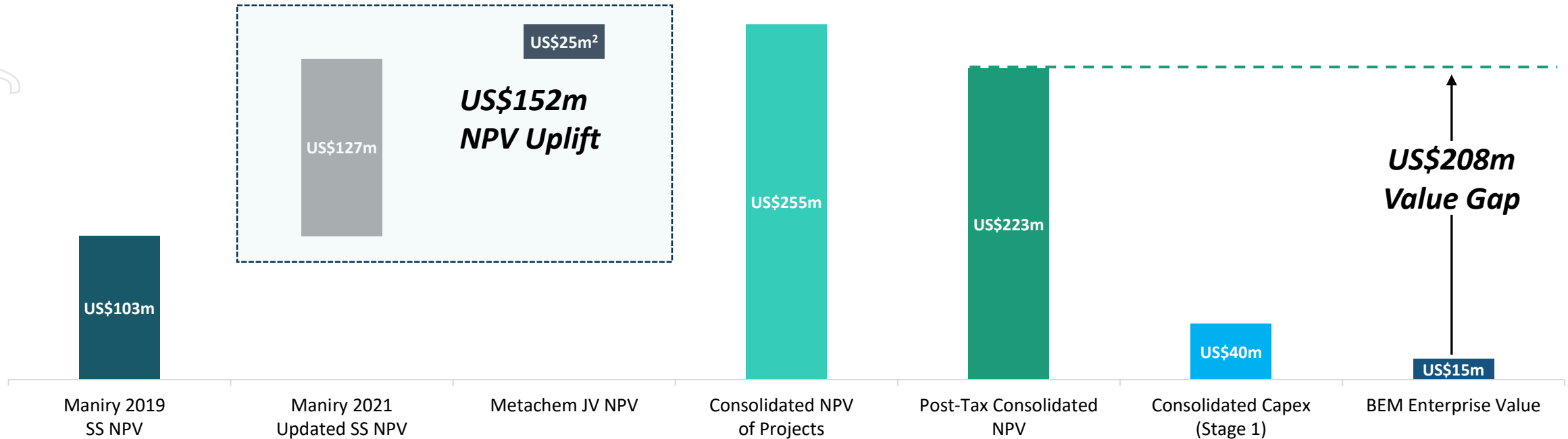
*81% increase from 2019 Scoping Study of \$US309m*



1. Based on BEM 50% ownership interest

# Significant NPV Uplift & Deep Value Proposition<sup>1</sup>

Combined Project Valuation Breakdown vs BlackEarth Combined Capex and Enterprise Value (EV)



## 2021 Scoping Study Updates



Material increase to resource size & grade, +32% to the indicated resource has added 3 years to Maniry mine life



Modest increase in market prices, overall basket price has been increased by 3% from US\$1,215/mt to US\$1,258/mt



Reductions in OPEX, overall cost reductions of US\$900,000 pa.



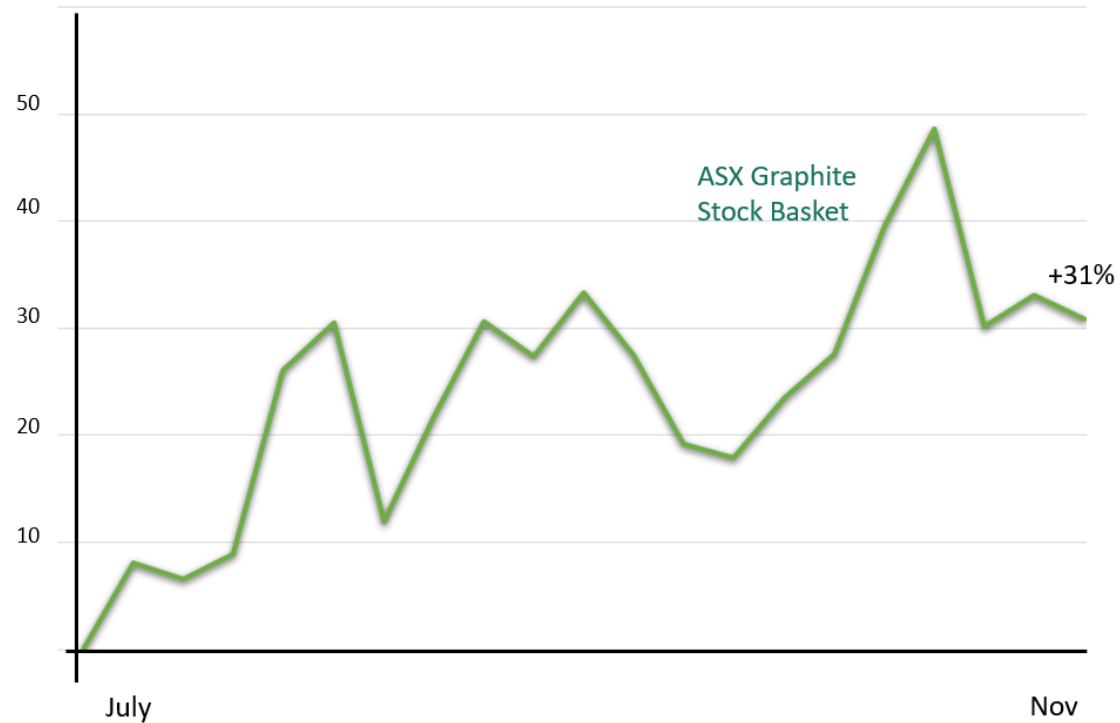
Capex cost saving of US\$2.7m in Stage 1 and US\$2.4m in Stage 2 costs

1. Pre-Tax NPV figures unless otherwise stated  
 2. Based on BEM 50% ownership interest



# Positive Graphite Market Sentiment

## GRAPHITE EQUITY PERFORMANCE SINCE JULY 2021



Basket of ASX graphite companies included: BEM, BKT, BSM, EGR, MNS, RNU, SYR, TLG, TON, WKT

## BOUYANT OUTLOOK AND INDICATORS

*"The commodities market is not in a so-called supercycle, rather it is at the start of an unprecedented and revolutionary cycle driven by the rise of green energy and electrification of "everything from a bus, to a skateboard and a Vespa"*

Robert Friedland (Feb 2021)

*"Alongside demand from energy storage applications, the battery industry is due to become the largest sector of demand for the graphite supply chain — the sector is seen aggressively increasing to around 15 times today's demand by 2030."*

Investing News (Jan 2021)

*Canadian listed NextSource Materials completes US\$29.5M financing of its Molo Graphite Project located 50km north of BlackEarth's Maniry Project and 5km south of BlackEarth's Ianapera Graphite Project*

TSX:NEXT Release, 8 Feb 2021

*"ESG issues are becoming more incorporated in the graphite supply chain as producers outside China look to develop environmentally friendly purification methods and product lines in increasingly integrated facilities, encompassing more steps of the value chain."*

George Miller, Benchmark Minerals (Jan 2021)

# CORPORATE OVERVIEW

## CAPITAL STRUCTURE

**BEM**

ASX Code

**\$26.1M**

Market Cap *(at \$0.12 per share)*

**8.0M**

Performance Rights

**\$5.77M**

Cash at  
30 Sep 21

**217m**

Shares on Issue

**\$20.3m**

Enterprise Value

## BOARD OF DIRECTORS & MANAGEMENT

**George Bauk**  
Non-Executive  
Chairman

- ▶ Over 30 years' experience in the resources industry including 14 years' experience as a listed resources company director
- ▶ Has held global operational and corporate roles with WMC Resources and Western Metals, and most recently was MD of Northern Minerals

**Tom Revy**  
Managing  
Director

- ▶ Qualified metallurgist with extensive experience in project development and EPCM services
- ▶ More than 30 years' experience within the resources industry
- ▶ Held senior operational and corporate positions at GRD Minproc, WorleyParsons, Ferrum Crescent and Empire Resources

**David Round**  
Finance Director

- ▶ Extensive M&A, Business Development and Corporate Advisory experience
- ▶ Was recently CFO and Head of Sales of an Australian listed Graphite production company with mine in Madagascar

**Heather Zampatti** Non-Executive  
Director

- ▶ Head of Wealth Management at Bell Potter Securities and has over 35 years in Stockbroking, Finance, Investment policy, strategy and funds management
- ▶ Extensive board experience including on the Federal Government Remuneration Tribunal and Takeovers Panel ,the Australian Institute of Management (WA), and ASIC Financial Services Consultative Committee.

# Environmental, Social and Governance

## Our Commitment and Development



### ENVIRONMENTAL

- ✓ Commitment to Green Energy Operation
- ✓ ESIA to be conducted in accordance with IFC Principles / World Bank Standards
- ✓ Compliant Environmental Study to be completed 2022
- ✓ Solar Power consulting team to be engaged



### SOCIAL

- ✓ Investing in our future leaders - Malagasy team trained in Australia over past 24 months
- ✓ Significant expenditure in local education, health and food supplies
- ✓ Commitment to engage and train local workforce
- ✓ 80%-90% of Maniry workforce to be locally sourced



### GOVERNANCE

- ✓ Leading ASX listed Graphite focused Company – regular stakeholder updates
- ✓ Independent Assessment of ESG Compliance underway by World Leading Consultants
- ✓ Committed “Women in leadership” Policy implemented for global operations



I. UPDATED  
MANIRY  
SCOPING  
STUDY



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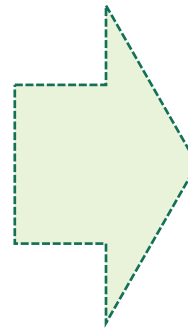
The details of Appendix 1 -3 are key assumptions underpinning many of the results of this section and should be read as part of this.

# Updated scoping study

## Significantly Improved Outcomes



Financial Metric	Unit	2019 Scoping Study	2021 Updated Scoping Study
Project Life	(Yrs)	11.0	13.6
Average Sales Price (LOM)	(US\$/t)	1,215	1,258
Total LOM Net Revenue	(US\$ M, real)	629.5	899.0
Total LOM EBITDA	(US\$ M, real)	309.7	561.2
Total LOM Net Cash Flows After Tax	(US\$ M, real)	177.8	388.2
IRR - before tax	(%, real)	41.9%	86.1%
NPV @ 10.0% - before tax	(US\$ M, real)	103.3	230.5
NPV @ 10.0% - after tax	(US\$ M, real)	78.4	184.4
CAPEX Stage 1	(US\$ M, real)	41.0	38.3
CAPEX Stage 2	(US\$ M, real)	29.1	26.3
Payback Period	(Yrs)	4.1	1.2



- BlackEarth Minerals NL is pleased to announce it has revised the 2019 Scoping Study to produce a new 2021 Scoping Study for its 100%-owned Maniry Graphite Project ("Project") in Southern Madagascar.
- The 2021 Scoping Study is part of a Definitive Feasibility Study ("DFS") for the Project, which is on track for completion in mid 2022.
- Engineering services firm CPC Engineering is undertaking Maniry Project DFS studies.
- Unless specifically mentioned, the terms and results of the 2019 Scoping Study shall apply to the results herein.
- Larger resource with higher grade Indicated Material has allowed BlackEarth to assess a longer project mine life.
- New assessed mine life based on mining 100% of the stated Indicated Resource and 20% of Inferred Inventory.
- Upside potential from ongoing infill drilling and other exploration programs

# Maniry Resource Upgrade

## MANIRY PROJECT ADDITIONAL MINERAL RESOURCES<sup>1</sup> & NEW TOTAL MINERAL RESOURCE

Maniry Mineral Resources				
Area	Classification	Tonnes (Mt)	TGC (%)	Contained Tonnes (t)
Razafy*	Indicated	8.0	7.2	677,600
	Inferred	3.2	6.8	217,600
Razafy North West*	Indicated	1.9	9.6	182,000
	Inferred	1.0	10.1%	101,000
Haja**	Indicated	-	-	-
	Inferred	9.0	5.8	521,100
Total	Indicated	9.9	7.7	758,000
	Inferred	13.2	6.4	841,000

Updated Scoping Study – comments in relation to new resource

- Significant grade and tonnage from new resource area Razafy North-West
- The increased resource, including higher grade, will result in the scheduling of higher-grade ores early in the mine schedule to maximise early cashflow and is the main driver for the improvement in the overall financial performance of the Maniry operations

**Exploration Target** <sup>(2)</sup>-  
**260Mt-380Mt at 6%-8% TGC**

1. Reported in accordance with the 2012 Australasian code for reporting of exploration results, Mineral Resources and Ore Reserves ('the JORC Code 2012'). See ASX Announcements dated 17 November 2021  
 2. Cautionary Statement: the Exploration Targets reported herein are not JORC compliant Mineral Resources The potential quantity and grade of the Exploration Targets are conceptual in nature, there has been insufficient exploration to determine a Mineral Resource and there is no certainty that further exploration work will result in the determination of a Mineral Resource. See ASX announcement date 14 August 2018

\*6% TGC cut-off grade \*\*5% TGC cut-off grade



# Updated Scoping Study - Maniry

## Highlights – CAPEX / OPEX updates



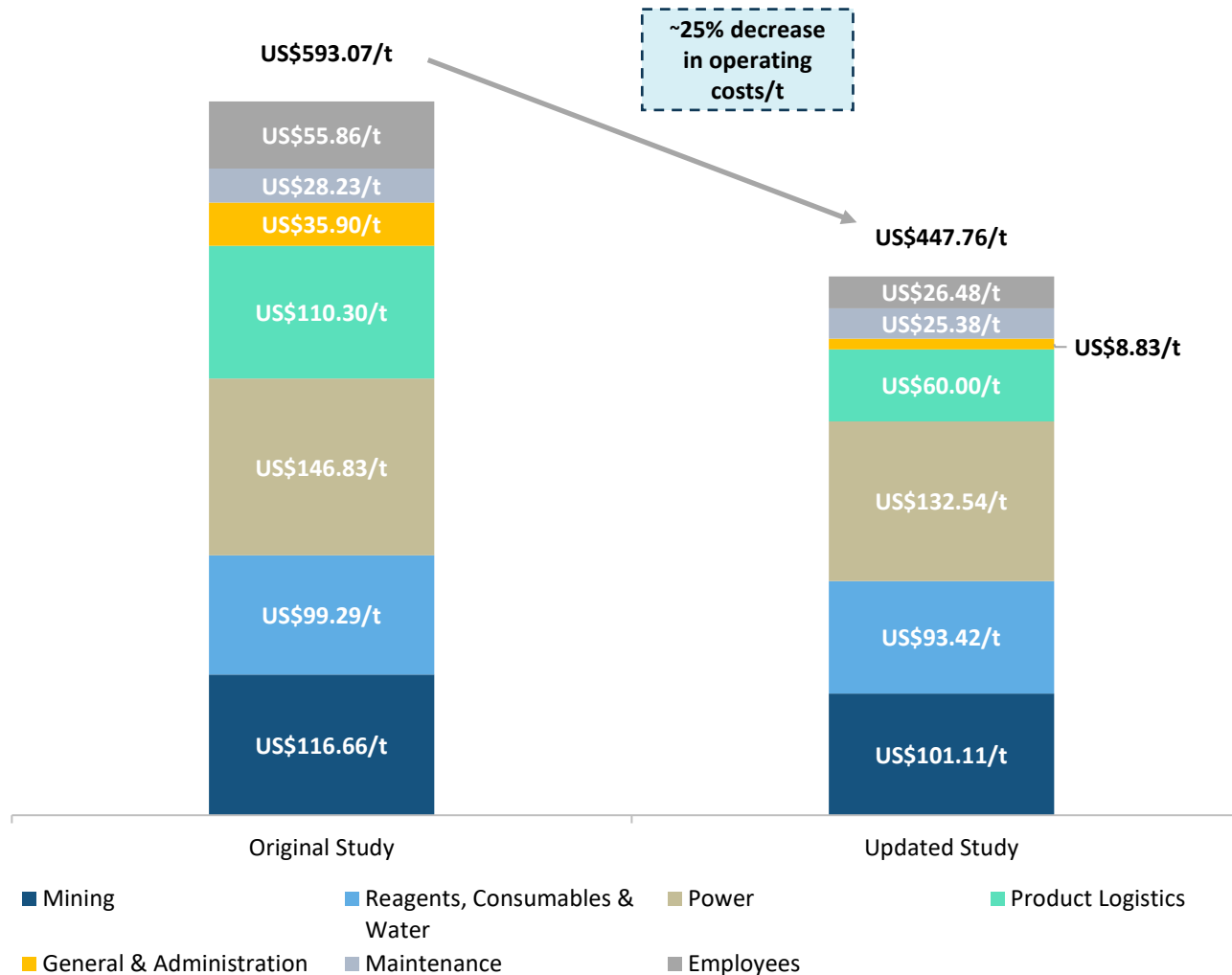
CAPEX / OPEX UPDATES	Original Scoping Study - US\$	Updated scoping Study - US\$	Change
First Stage CAPEX	\$41,030,490	\$38,313,440	6.62%
Second Stage CAPEX	\$29,143,966	\$26,745,336	8.23%
TOTAL LOM CAPEX	\$87,378,676	\$82,262,996	5.85%
Logistics US\$/mt	\$100	\$60	
Fixed Non - Mining OPEX Processing Labour	\$1,545,000	\$1,545,000	
Fixed Non – Mining OPEX - General Admin	\$1,465,413	\$900,000	
Fixed Non – Mining OPEX - Labour	\$917,500	\$500,000	

**Stage 1 CAPEX** analysis has resulted in reductions for some infrastructure and mine camp development costs. This has been achieved by assessing the cost of buildings on site and by allowing parts of the workforce to drive to site each day. Other infrastructure and consultants costs have been reduced in **Stage 1 and 2** following a review of these.

Non-mining costs are reduced as a result of an assessment of manning costs on site, within country and in Australia. The Company, as part of its ESG Policy is committed to employee 80 – 90% of its employees from the regional community.

# Updated Scoping Study

## Decreased Operating Costs



- Through implementing a large mineral resource, with higher grades, we have been able to achieve substantial operating cost efficiencies
- Savings in mining and mining related costs amount to around US\$35/t of concentrate produced
- Other savings relate to logistics costs, general administration costs and the cost of non-mining related employee costs

# Updated Scoping Study

## Highlights – Maniry – Costs Breakdown

LOM average annual operating cost					Original Scoping Study
Annual Operating Costs	Av. Total (US\$ k/y)	Total Cost (%)	Feed (US\$/t)	Product (US\$/t)	Product (US\$/t)
Mining	5,306	22.6%	6.31	101.11	116.66
Reagents, Consumables & Water	4,903	20.9%	5.83	93.42	99.29
Power	6,955	29.6%	8.27	132.54	146.83
Product Logistics	3,149	13.4%	3.74	60.00	110.30
Total General & Administration	463	2.0%	0.55	8.83	35.90
Maintenance	1,332	5.7%	1.58	25.38	28.23
Employees	1,390	5.9%	1.65	26.48	55.86
<b>Total</b>	<b>23,498</b>	<b>100.0%</b>	<b>27.95</b>	<b>447.76</b>	<b>593.08</b>

By implementing a large mineral resource, with higher grades, in to the production plan, BEM have been able to achieve substantial operating cost efficiencies.

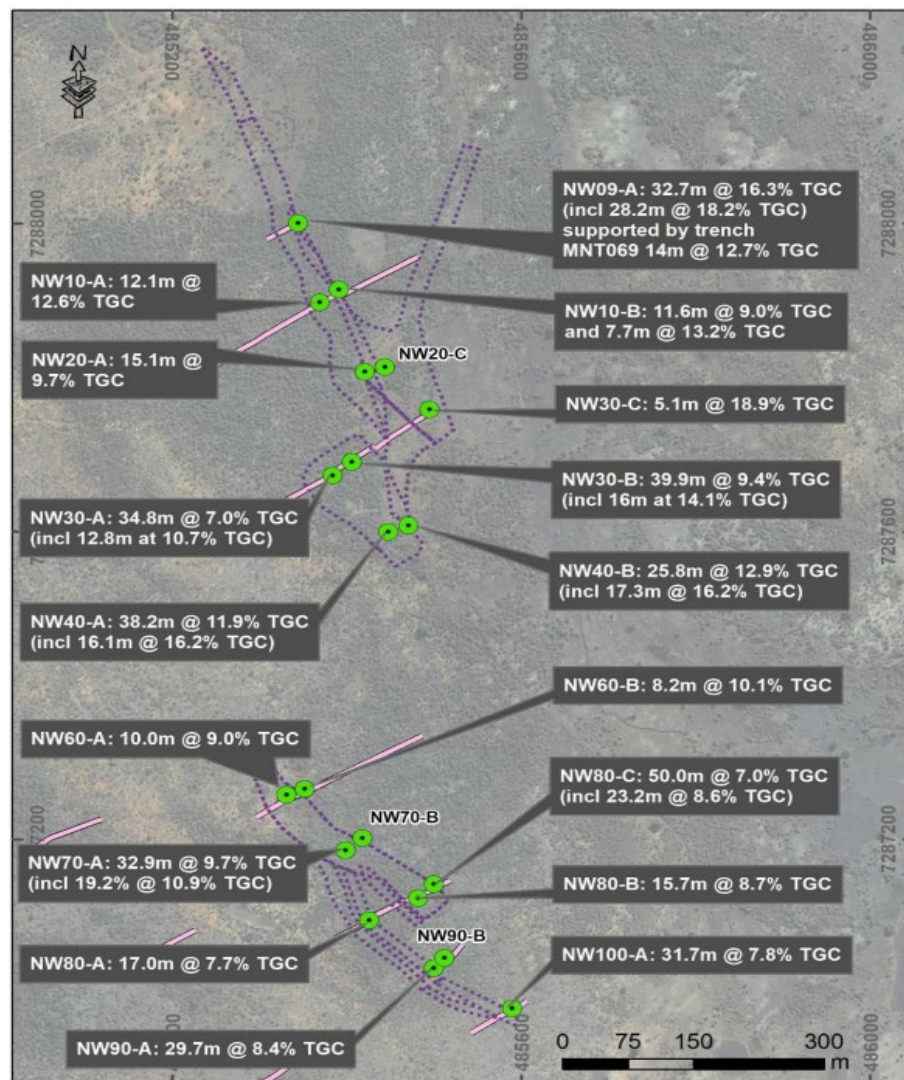
Savings in mining related costs amount to around US\$35/mt of concentrate produced.

Other substantial cost savings relate to logistics costs, general administration costs and the cost of non-mining related employee costs.



# Updated Scoping Study

## Maniry – Additional Resource – November 2021

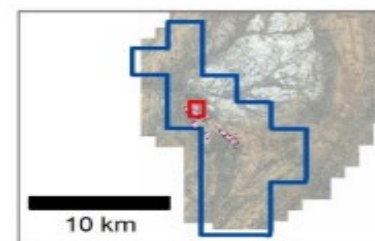


On 17 November 2021, the Company announced the results of its recent exploration program with the additional JORC compliant resource added. This additional data, along with other data, forms the basis for the updated scoping study

Area	Classification	Tonnes (Mt)	Total Graphitic Carbon (%TGC)	Contained (tonnes of graphite)
Razafy NW*	Indicated	1.9Mt	9.6%	182,000
	Inferred	1.0Mt	10.1%	101,000
	TOTAL	2.9Mt	9.8%	283,000

### Razafy NW Mineral Resource Estimates for Maniry Project

\*Reported at a 6% cut off grade; figures in the table above have been rounded, reported to the appropriate significant figures with graphite tonnages rounded to the nearest thousand, in accordance with the 2012 JORC Code.



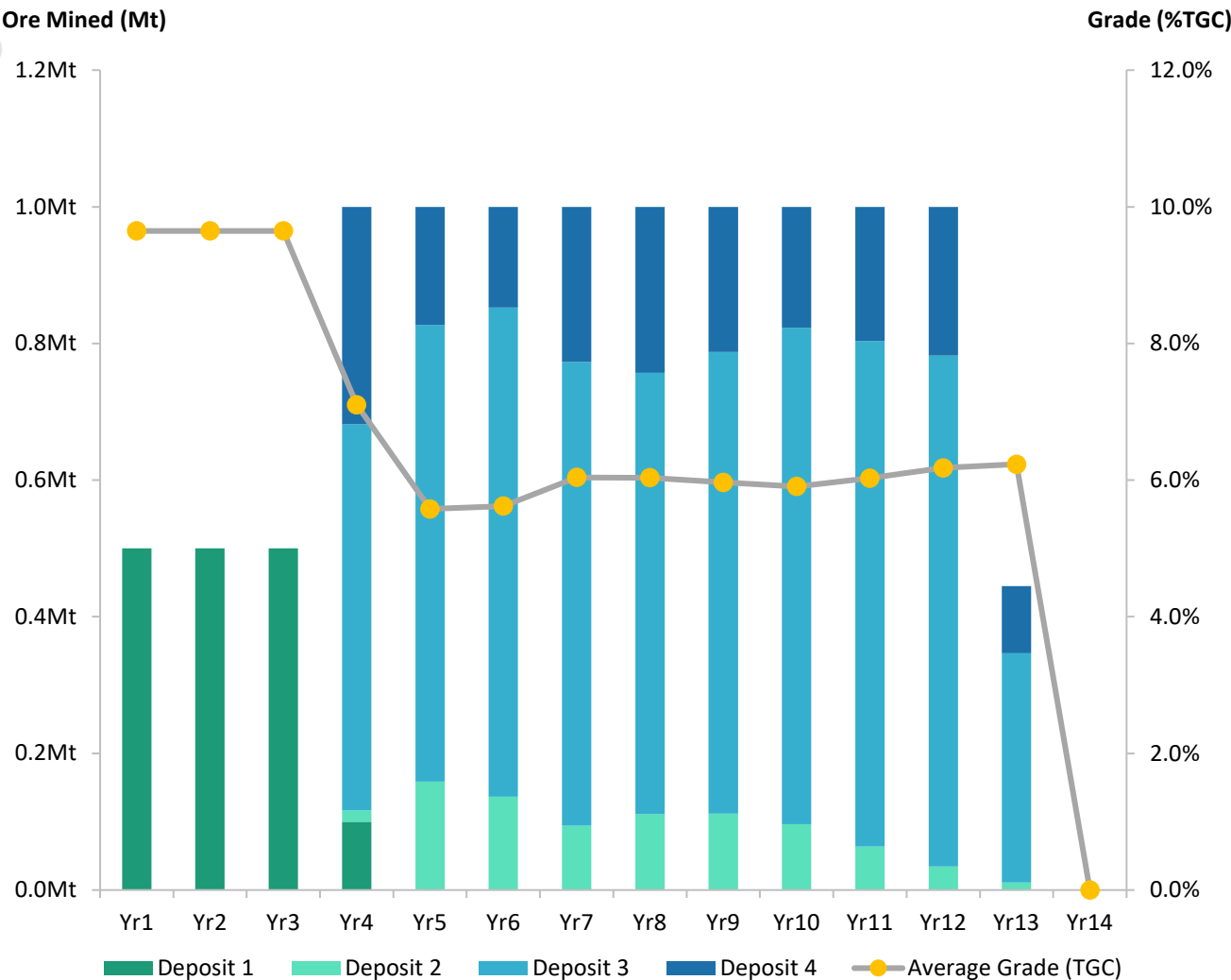
DH - assayed  
● DH - assayed

— Trench line  
--- Graphite lens outline

Razafy NW Drill Hole and Trench Line Locations as reported ASX 11 October 2021

# Updated Scoping Study

## MANIRY – Production / Mine Plan



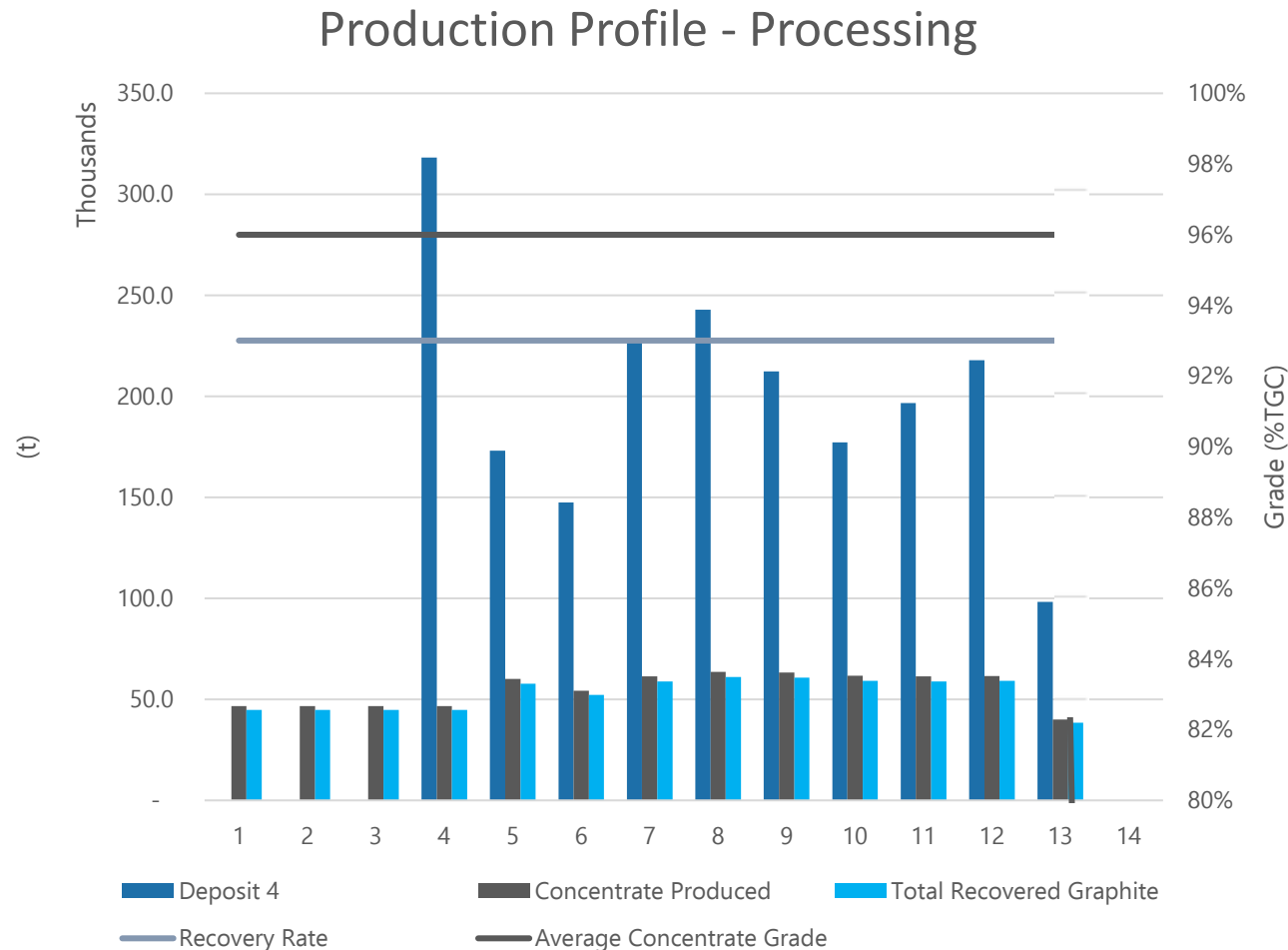
- Production profile assumes processing of 500,000tpa of graphite ore for Yr1-Yr3 (Stage 1) increasing to 1.0Mtpa for Yr4 onwards (Stage 2)
- Assumes mining 100% of the stated Indicated inventory Resource and only 20% of the Inferred Resource

### Maniry Flake Size Distribution

Flake Size	% of Total
+500um	2.8%
-500um+300um	17.3%
-300um+180um	29.8%
-180um+150um	9.1%
-150um+75um	23.6%
-75um	17.4%
Total	100.0%

# UPDATED SCOPING STUDY

## Maniry – Production – Processing Plan



The Company's production profile assumes processing of 500,000 tonnes of graphite ore per annum for years 1 -3 (Stage 1) increasing to 1,000,000 tonnes pa for years 4 onwards (stage 2).

This is consistent with the methodology applied to the original Scoping Study.

The Production Profile assumes mining 100% of the stated Indicated inventory resource and only 20% of the state Inferred Resource.

Extension from the stated mine life may be achieved only by increases in the Company's stated indicated or greater resource.

# Updated scoping study- Maniry

## Price Assumptions & Key Financial Parameters

Price Assumptions – only 3.5% increase		Original Scoping Study	Updated scoping Study
+500um – Jumbo Flake	Product (US\$/t)	2,500.00	2,500.00
-500um+300um – Very Large Flake	Product (US\$/t)	2,200.00	2,200.00
-300um+180um – Large Flake	Product (US\$/t)	1,400.00	1,500.00
-180um+150um – Medium Flake	Product (US\$/t)	950.00	1,100.00
-150um+75um – Fine Flake	Product (US\$/t)	700.00	700.00
-75um – Fine Flake	Product (US\$/t)	550.00	550.00
Average Sales Price (LOM)	Product (US\$/t)	1,215.15	1,258.15

### Graphite Product Specification and Pricing

For the purpose of this study, the price assumptions for the likely graphite produced have been based on an internal market study into potential graphite prices and investigations into forwarding prices adopted by peer companies.

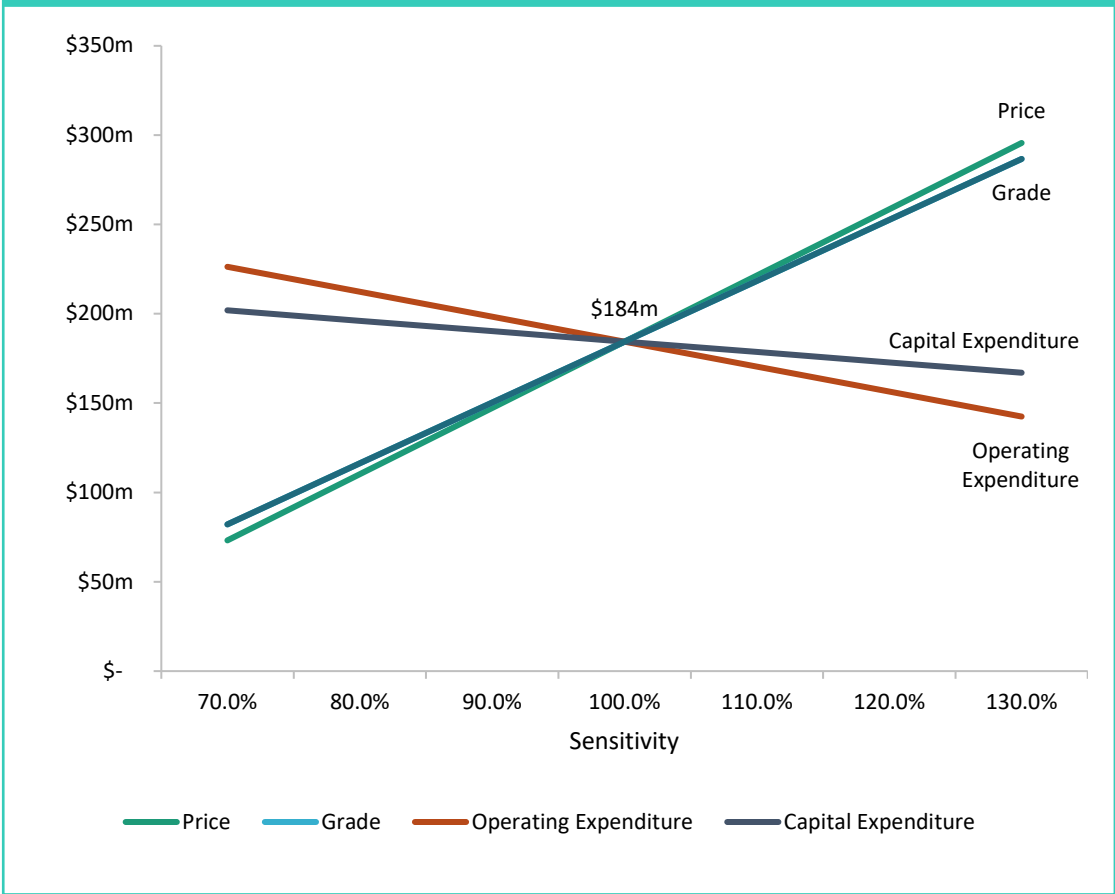
The Company has also relied on independent published analysis by Benchmark Minerals and a summary of projections is outlined in Appendix 1

Based on this analysis and the results of the initial test program product size distribution, BlackEarth has estimated the product prices for Maniry products as shown in this table with the resulting basket price estimated to now be \$1,258/t FOB equivalent.

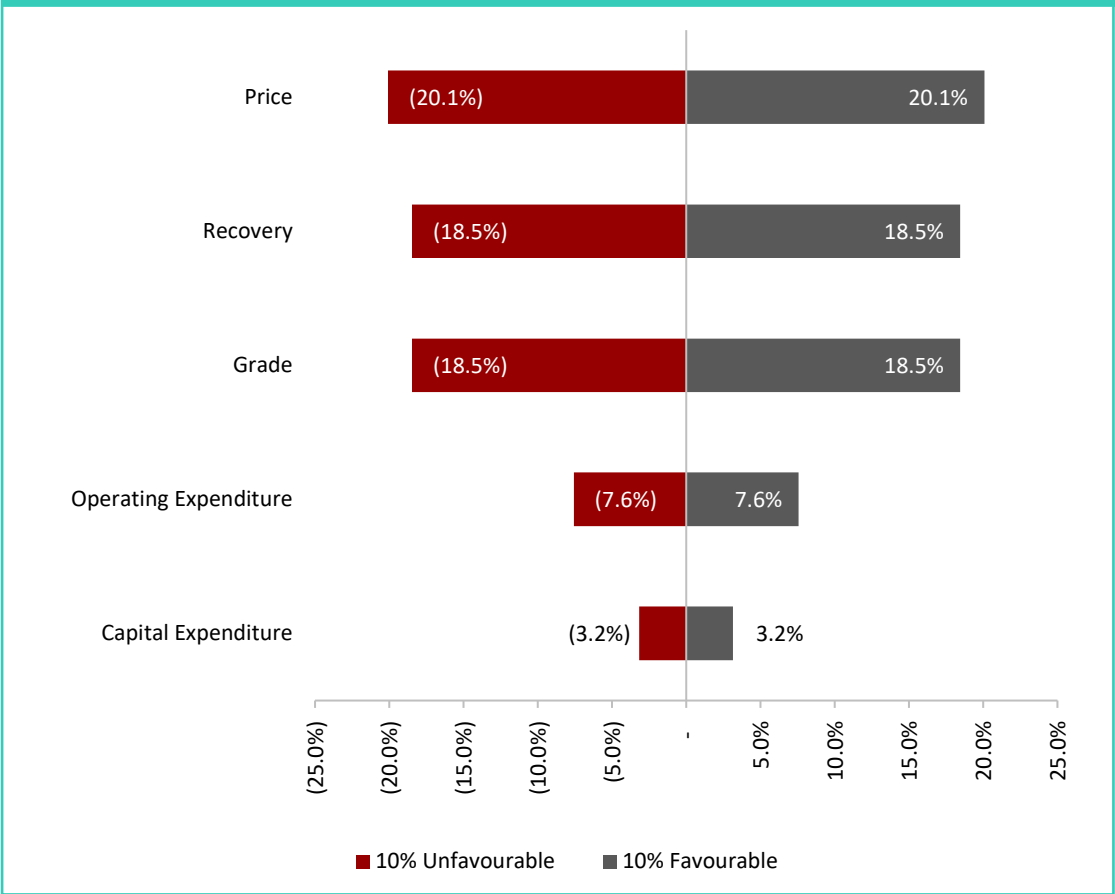
# Updated Scoping Study

## Maniry – Sensitivity Analysis Results

### Sensitivity Analysis (NPV @ 10.0%, after tax, US\$, real)



### Sensitivity Analysis - % Movement (NPV @ 10%, after tax, US\$, real)



II. METACHEM  
PROJECT &  
IMPACT ON  
COMPANY  
STUDY



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# Updated Scoping Study

## Impact From Joint Venture With Metachem

BlackEarth entered in to a JV Agreement with world leading expandable graphite producer in October 2021 and is on track to develop its plant and operations in the first half of 2022 and commence production in mid 2022.

Highlights of the assessment of this project and its impact on BlackEarth's Updated Scoping Study is as follows:

1. Detailed CAPEX and OPEX plan and budget developed
2. Site selection is well advanced with selection of the preferred site imminent
3. Metachem JV has an offtake agreement to sell all Stage 1 production to Grafitbergbau, Austria
4. The Company expects to commence production at around 2,000Mtpa– 2,500Mtpa with plans to increase to 4,500Mtpa as soon as possible.
5. BlackEarth will secure an independent supply of around 2,000 – 2,5000 Mtpa of graphite concentrate for the first 1 -2 years of operation then supply a portion of its graphite concentrate produced to the JV operations
6. It is projected that upon commencement of production, approximately 7 – 10% of Graphite Concentrate production from Maniry annually will be provided to the JV Operations.

# Updated Scoping Study

## Revenue And OPEX Projections – JV With Metachem

Financial Metric	Unit	Metachem JV
BlackEarth Ownership	(%)	50.0%
Project Life	(Yrs)	25.0
Total Net Revenue	(US\$ M, real)	176.3
Total EBITDA	(US\$ M, real)	107.7
Total Net Cash Flows Before Tax	(US\$ M, real)	103.6
Total Net Cash Flows After Tax	(US\$ M, real)	82.9
Discount rate	(%)	6.5%
NPV - before tax	(US\$ M, real)	49.0
NPV - after tax	(US\$ M, real)	38.9
IRR - before tax	(%, real)	1373.7%
IRR - after tax	(%, real)	405.00
Project Capital Expenditure - Stage 1 (Year 0)	(US\$ M, real)	1.5
Project Capital Expenditure - Stage 2 (Year 3)	(US\$ M, real)	1.5
Sustaining Capital Expenditure - (life of project)	(US\$ M, real)	1.3
Payback Period - after tax - from 1st feed	(Yrs)	1.2

- Metachem JV operation is a low CAPEX business model that will be established in a Special Economic Zone (“SEZ”) in India
- BlackEarth will secure a supply of graphite concentrate to provide to operations in the initial years before Maniry becomes operational.
- The JV has also secured a binding offtake agreement with Grafitbergbau, Austria whom are committed to buy 2,500mt of expandable graphite from the successful commencement of operations.
- The JV has forecast that production will commence at between 2,000Mt – 2,500Mt for years 1 – 3, increasing to 4,500Mt from year 4
- The JV has secured a license agreement with the JV operators for the Forecast life of operations

# Updated Scoping Study

## Revenue And OPEX Projections – JV With Metachem

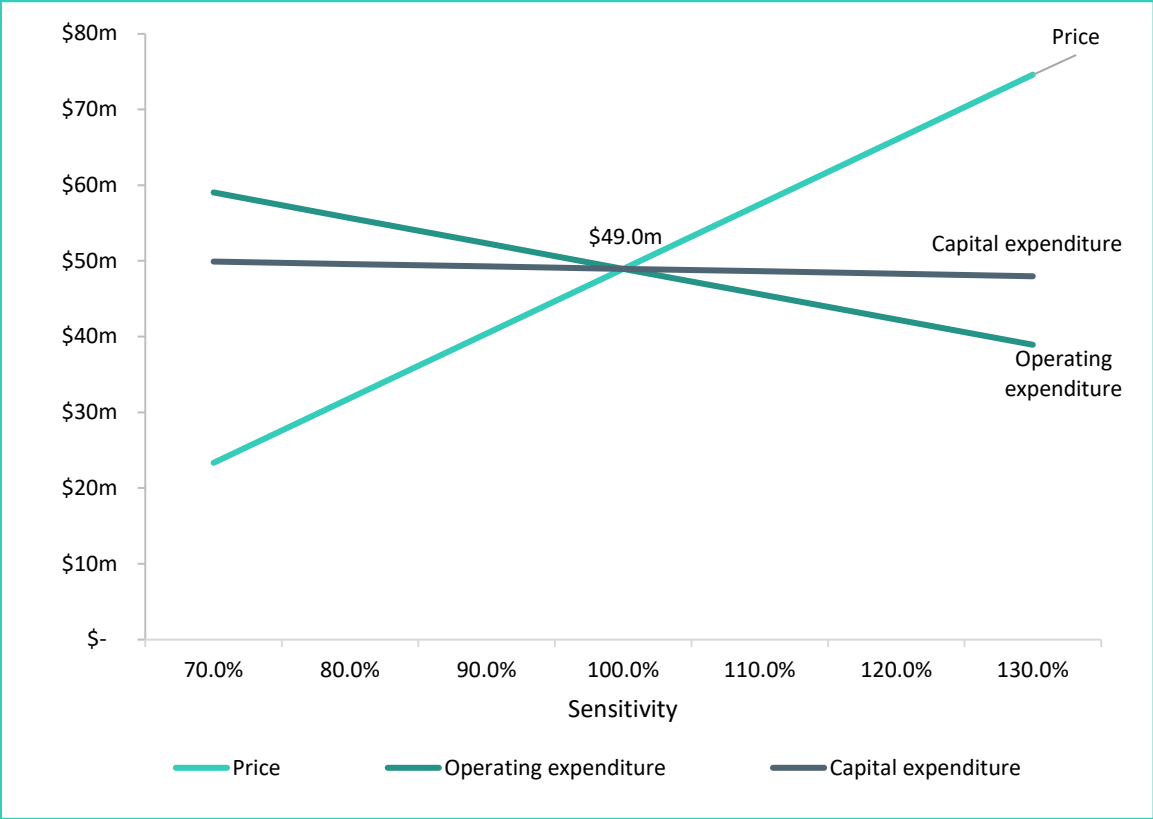
Price Assumptions		US\$/t
	Grade 1	\$4,000.0
	Grade 2	\$3,400.0
	Grade 3	\$2,800.0
Grade (to spec)		95%
Recovery rate - phase 1		95%
Recovery rate - phase 2		100%
<b>Opex Costs</b>		
	Concentrate	\$800.0
	Processing	\$300.0
	Packing Costs	\$30.0
	Sustaining Capex	\$25.00
<b>Other Costs</b>		
	Transportation	\$40.0
	Logistics	\$20.0
	Duties	\$10.0
	General & Administration	\$60,000pa

- Proposed that graphite concentrate will be sourced from external parties for years 1 -2 of operations with product from Maniry supplying operations from years 3 onwards.
- Capex is scheduled to be US\$3.0m for the JV before production commences with BlackEarth committed to funding 50% of CAPEX and initial concentrate acquisition and other start up costs.
- Revenue and pricing assumptions are based on assessments made and price projections are conservative and up to 25% lower than other projections made by new market entrants.
- OPEX and other costs have been made after a rigorous assessment of the all factors and are consistent with Metachem current operations.
- The JV will largely employ local labour and has recently appointed a CEO to commence operational planning.

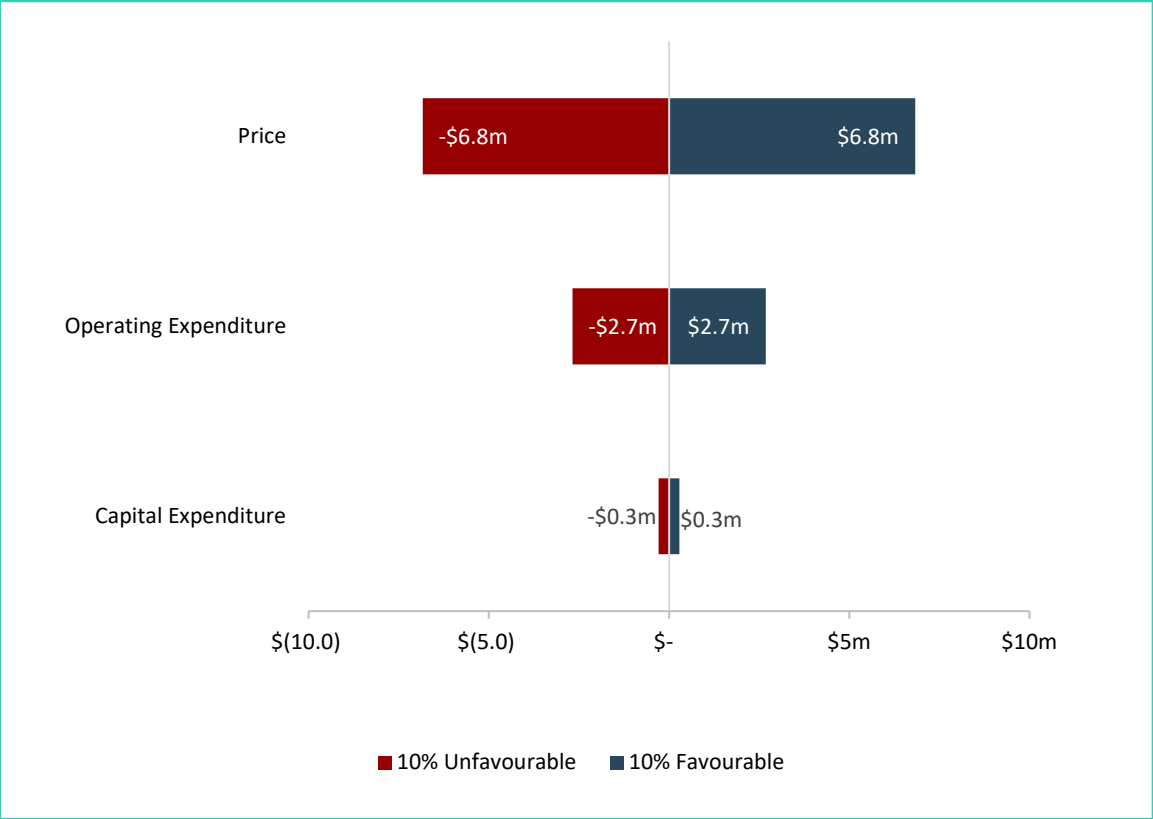
# Updated Scoping Study

## Sensitivity Analysis - Metachem

### Sensitivity Analysis (NPV @ 10.0%, before tax, US\$ real)



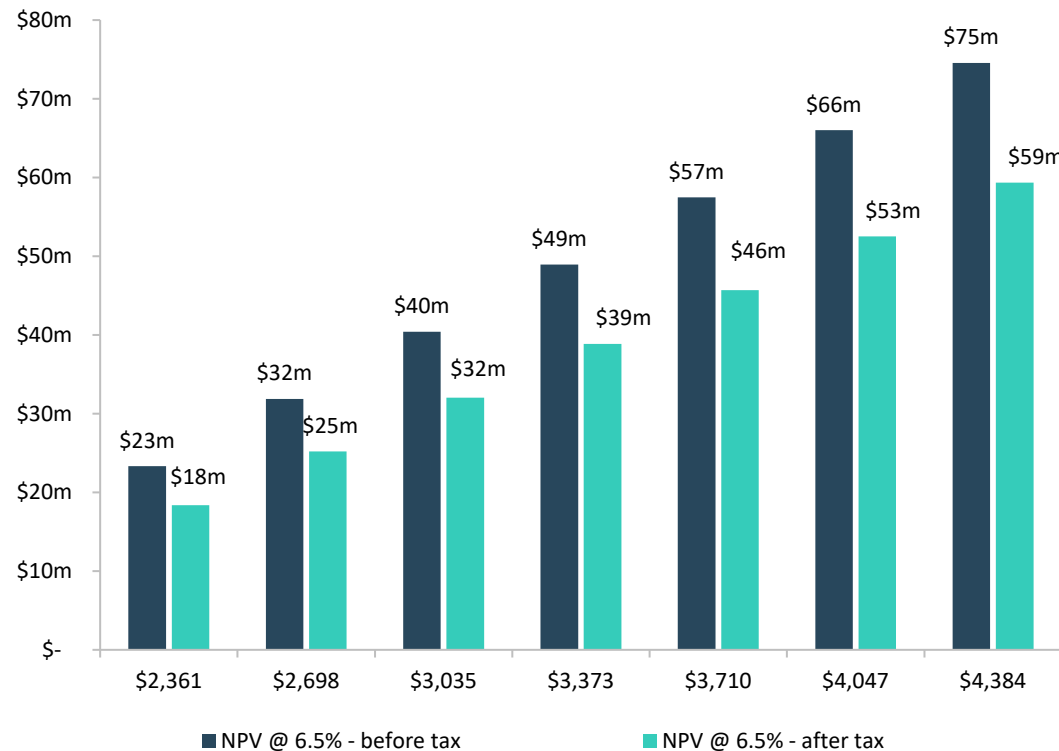
### Sensitivity Analysis - US\$ Movement (NPV @ 10%, after tax, US\$, real)



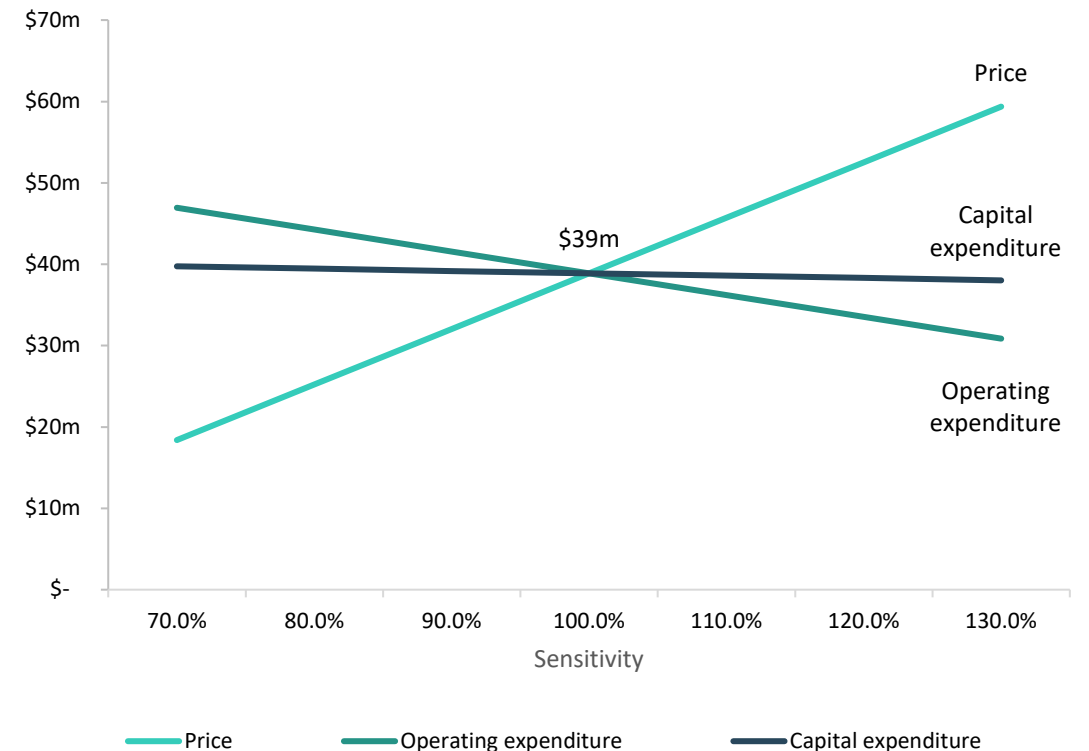
# Updated Scoping Study

## Sensitivity Analysis - Metachem

### Commodity Price Sensitivity Analysis (NPV @ 10.0%, US\$, real)



### Sensitivity Analysis (NPV @ 10.0%, after tax, US\$, real)



III. OVERALL  
CONSOLIDATED  
COMPANY  
UPDATED  
SCOPING STUDY



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# UPDATED SCOPING STUDY HIGHLIGHTS - CONSOLIDATED



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Financial Performance Summary		Maniry	Metachem JV	Consolidated
Financial Metric	(%)	100%	50%	
Project Life	(years)	13.6	25.0	
Total Net Revenue	(US\$ M, real)	899.0	176.3	<b>1,075.3</b>
Total EBITDA	(US\$ M, real)	561.2	107.7	<b>668.9</b>
Total Net Cash Flows Before Tax	(US\$ M, real)	478.9	103.6	<b>582.6</b>
Total Net Cash Flows After Tax	(US\$ M, real)	388.2	82.9	<b>471.0</b>
Discount rate	(%)	10.0%	6.5%	
NPV - before tax	(US\$ M, real)	230.5	49.0	<b>279.5</b>
NPV - after tax	(US\$ M, real)	184.4	38.9	<b>223.3</b>
IRR - before tax	(%, real)	86.1%	1,373.7%	<b>92.2%</b>
IRR - after tax	(%, real)	75.2%	405.0%	<b>79.8%</b>
Project Capital Expenditure - Stage 1	(US\$ M, real)	38.3	1.5	<b>39.8</b>
Project Capital Expenditure - Stage 2	(US\$ M, real)	26.3	1.5	<b>27.5</b>
Sustaining Capital Expenditure	(US\$ M, real)	16.6	1.3	<b>17.9</b>
Payback Period (After Tax)	(years)	1.2	1.2	-

IV. MANIRY  
PROJECT  
OVERVIEW

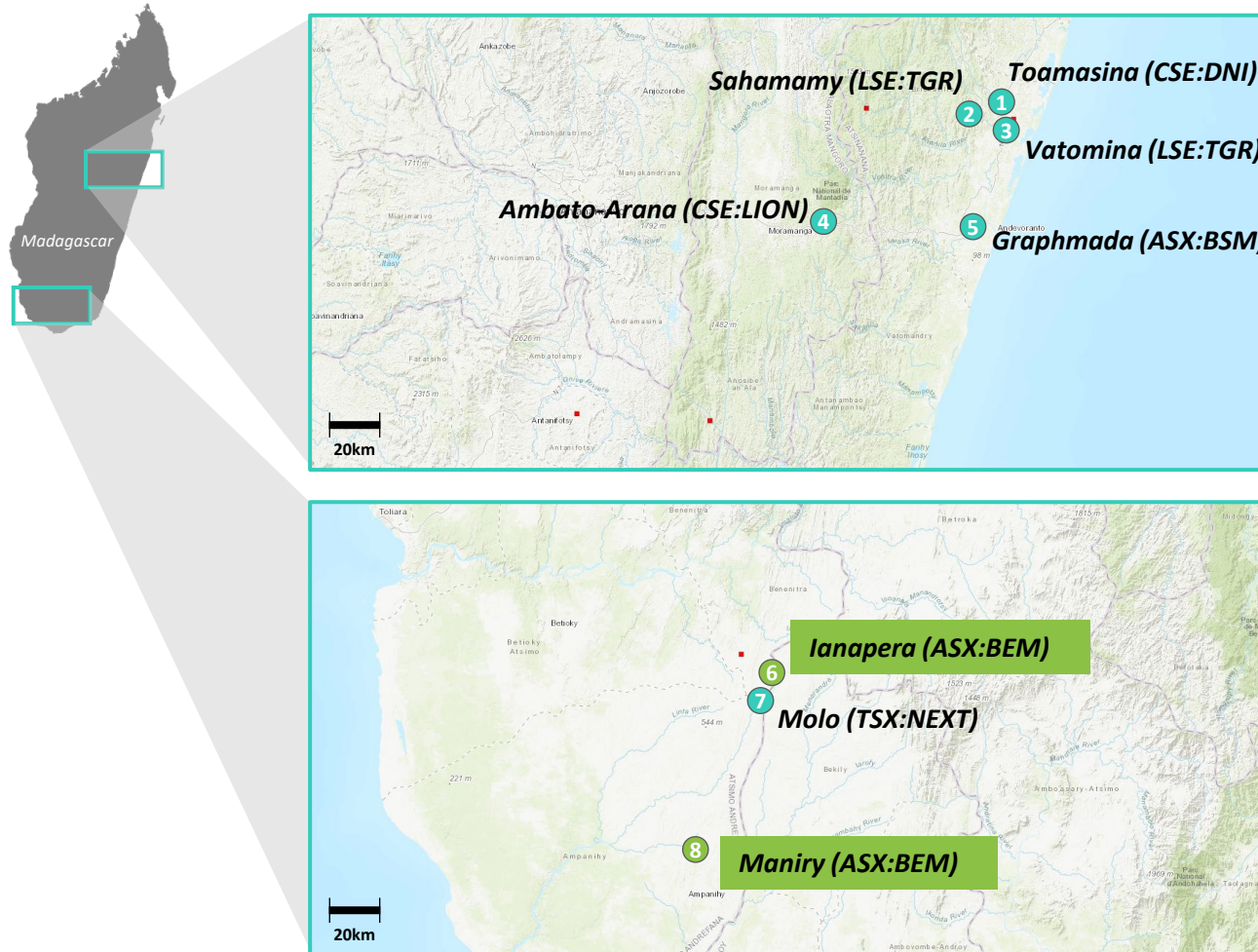


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# Madagascar Graphite

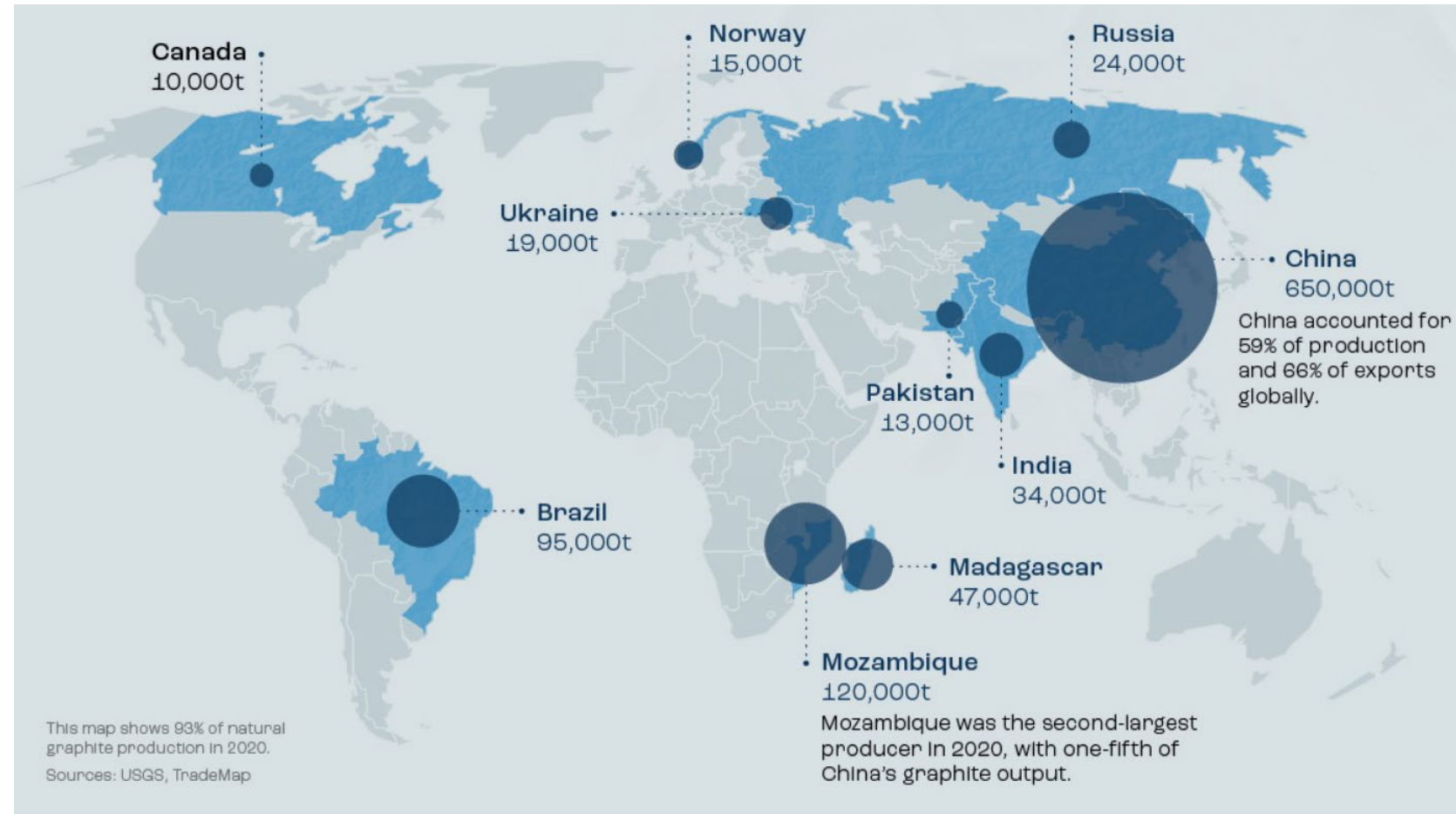
*Significant in-country graphite mines and a long term producer and exporter*



- 1 Toamasina – DNI Metals (CSE:DNI)**
  - ▶ Mineral Resource 4.0Mt grading 5% TGC
  - ▶ Historic producing graphite property
- 2 Sahamamy – Tirupati Graphite PLC (LSE:TGR)**
  - ▶ Mineral Resource 7.1Mt grading 4.2% TGC
  - ▶ Currently producing 3,000 tonnes per annum
- 3 Vatomina – Tirupati Graphite PLC (LSE:TGR)**
  - ▶ Mineral Resource 18.4Mt grading 4.6% TGC
  - ▶ On track to be commissioned in June 2021 to produce 9,000tpa
- 4 Ambato-Arana (CSE:LION)**
  - ▶ Historic mines with free digging graphite production beginning in 1910
- 5 Graphmada – Bass Metals (ASX:BSM)**
  - ▶ Mineral Resource 20.2Mt grading 4.0% TGC
  - ▶ Produced 1,836 wmt of graphite concentrate in FY20
  - ▶ Currently in care & maintenance
- 6 Ianapera – BlackEarth Minerals (ASX:BEM)**
  - ▶ Exploration Target: 20 – 34Mt at 10-20% TGC
- 7 Molo – NextSource Materials Inc (TSX:NEXT)**
  - ▶ Ore Reserves 22.4Mt grading 7.02% TGC
  - ▶ Financing package for US\$29.5m received in February 2021 to construct the Molo mine imminently
  - ▶ Production to be 17,000 tonnes pa for first 2 years
- 8 Maniry – BlackEarth Minerals (ASX:BEM)**
  - ▶ Mineral Resource 23.2Mt grading 7.0% TGC
  - ▶ Exploration Target: 260 – 380Mt at 6-8% TGC

# Madagascar A Critical Global Graphite Supplier

- Madagascar continues to grow as a major global supplier of natural graphite
- Exports rose by > 50%\* between 2018 and 2020.
- This number is expected to grow significantly over the next 2 years as a result of the expansion to Tirupati and Gallois operations and the development of both the Molo and Maniry graphite projects



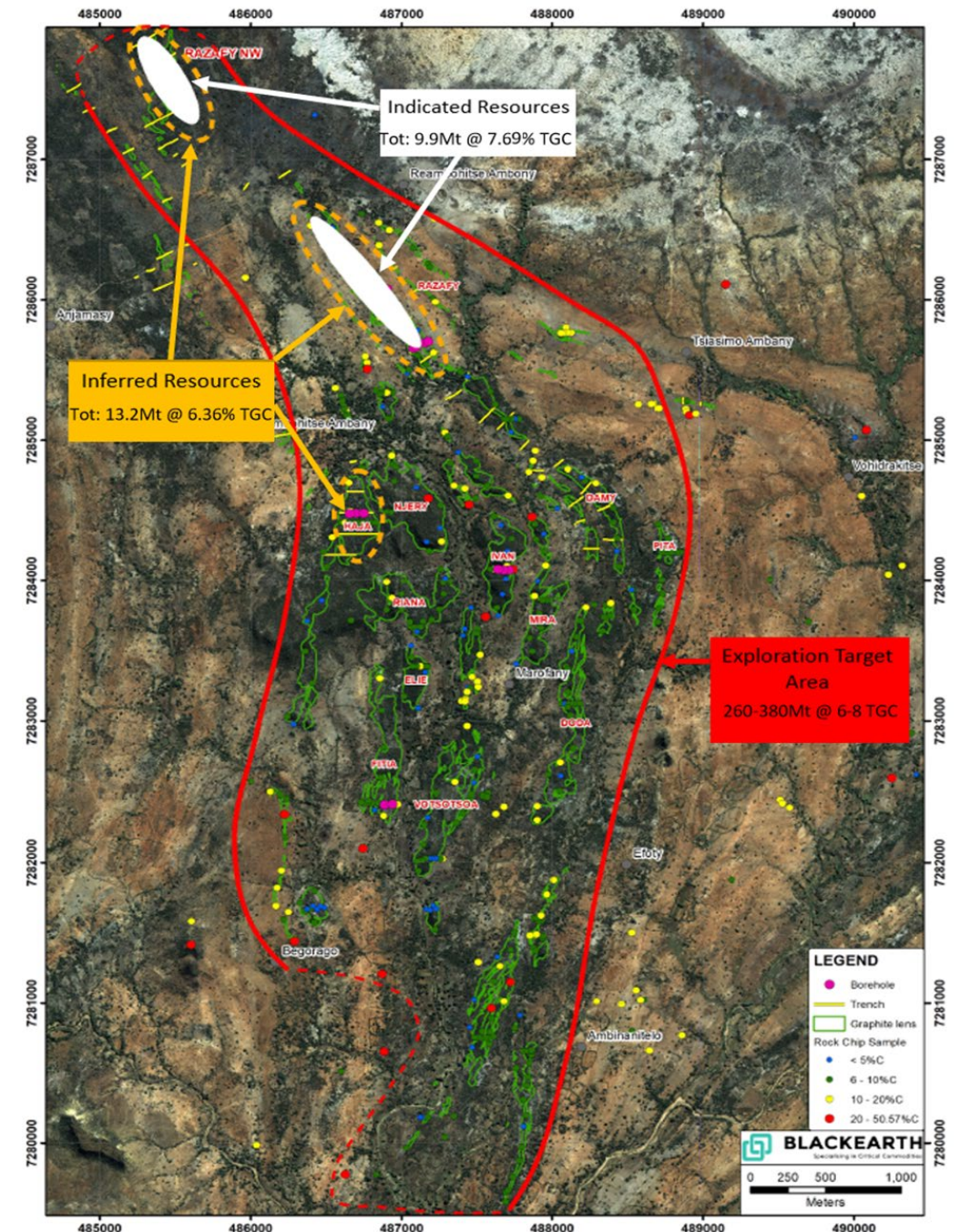
\*Source:



# Maniry Project Area

## Significant expansion potential

- ▶ Project Area (Razafy); >14 yrs mine life based on 100% Indicated and 20% Inferred Resources
- ▶ Granted 40-year Mining Lease over the Razafy Resource
- ▶ Maniry tenements stretch over 20km<sup>2</sup>
- ▶ 35 large outcropping graphitic areas cover the Maniry tenements
- ▶ Only ~10% has been extensively explored



# Maniry Graphite Specs

Graphite from BlackEarth's Maniry project meets the specifications required for applications in the expandables, refractory and lithium-ion battery industries.

## Expandables

- ▶ NGS (Germany) achieved results of 400 cm<sup>3</sup>/g which exceeded the industry benchmark rate of 250 cm<sup>3</sup>/g. (Refer ASX: BEM Announcement 13/6/19)
- ▶ Positive test results and quality approval from largest expandable graphite producer in the world
- ▶ Formal JV signed with Metachem to build a new expandable graphite facility in India

## Refractory

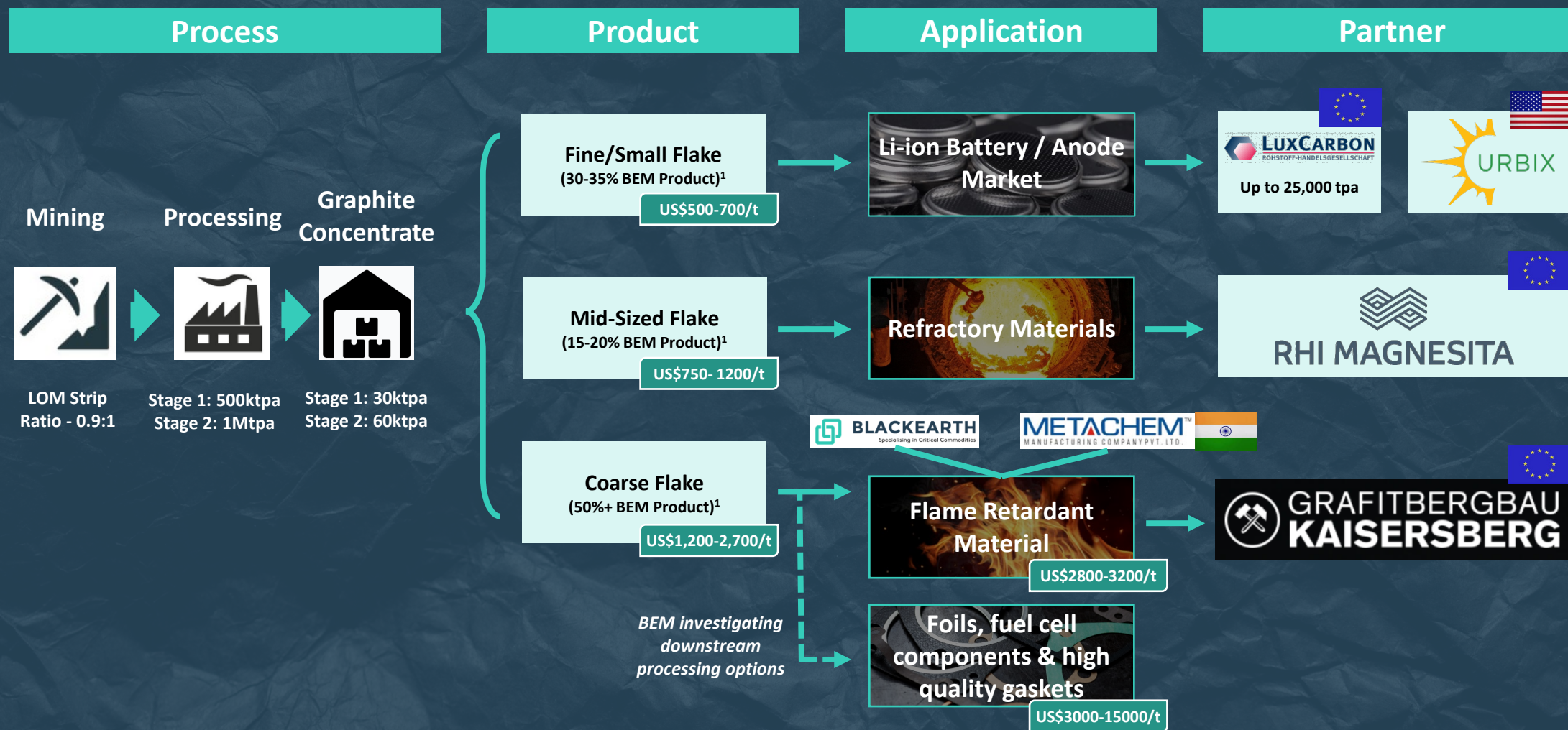
- ▶ Following successful testing, BlackEarth entered binding MOU with the world's largest refractory group, RHI Magnesita ("RHIM"), the leading global supplier of high-grade refractory products, systems and solutions, and a large consumer of natural flake graphite for various refractory products and materials.

## Li-Batteries






- ▶ In February 2021, BlackEarth signed an MOU with Urbix, Inc – a US based Company leading the development of EV related graphite products.
- ▶ Maniry meets all specifications required by lithium-ion anode material manufacturers, based on independent lab tests and tier 1 end-user results



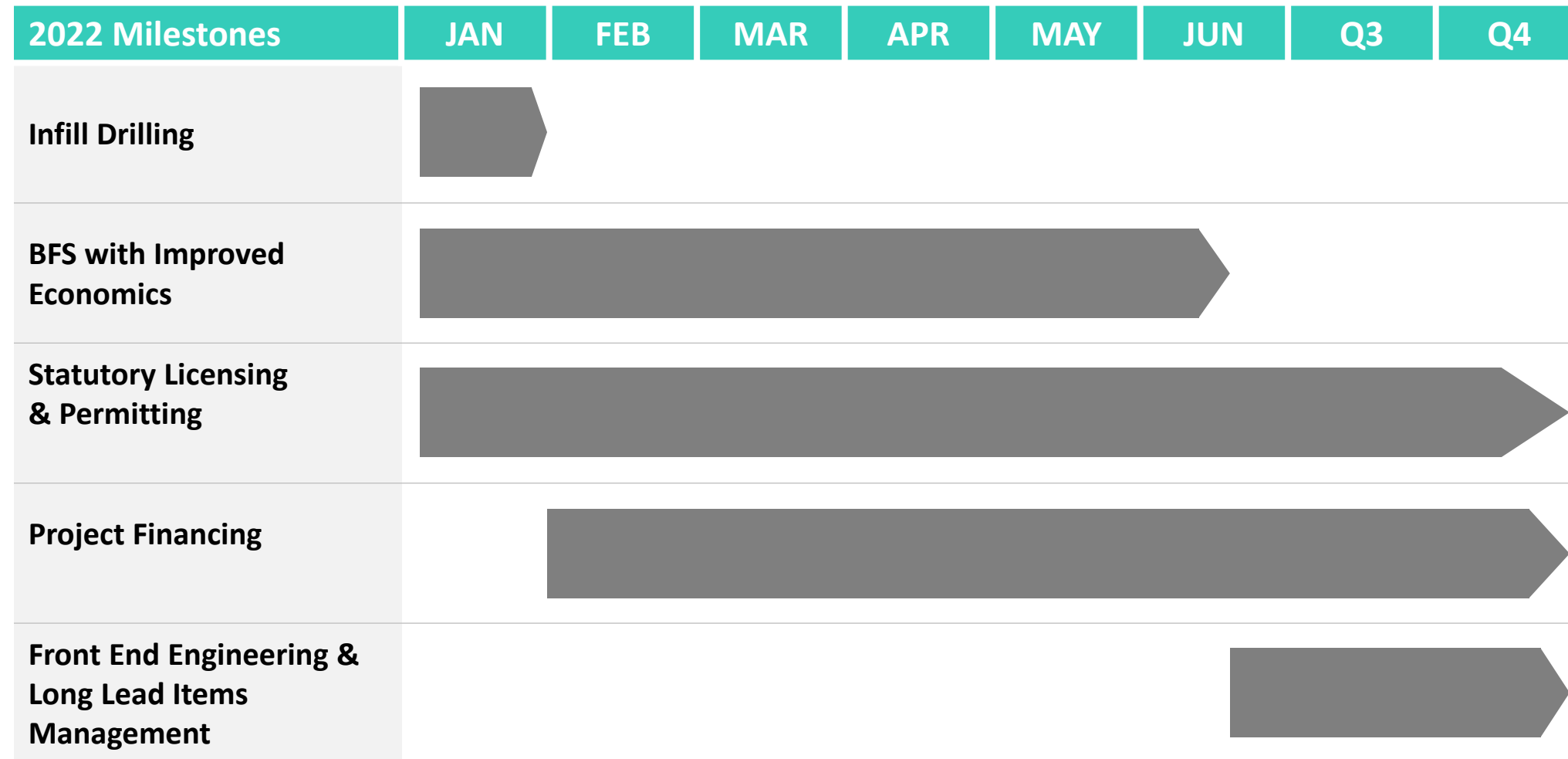
# Maniry Graphite Project



# Product Partners

	1 	2 	3 	4 	5 
Nature of agreement	<b>MOU to fasttrack downstream production</b>	<b>Binding Offtake MOU</b>	<b>Graphite Supply and Marketing Agreement</b>	<b>50/50 JV to Produce Expandable Graphite</b>	<b>Binding Offtake for Expandable Graphite Product</b>
About Partner	<ul style="list-style-type: none"> <li>US-based, premier provider of refined graphite powders globally</li> <li>Proprietary technology for purifying graphite in an efficient &amp; green way</li> <li>Building the largest natural graphite purification facilities in North America</li> </ul>	<ul style="list-style-type: none"> <li>World's largest refractory group</li> <li>£1.8b market capitalisation</li> </ul>	<ul style="list-style-type: none"> <li>One of Germany's major suppliers of graphite and carbon products to top tier suppliers of Volkswagen, Mercedes, Ford and chemical corporations</li> </ul>	<ul style="list-style-type: none"> <li>An Indian diversified company experienced in producing 1000tpa of expandable graphite for over 20 years</li> </ul>	<ul style="list-style-type: none"> <li>Based in Austria, the company has developed over the last 50 years into a globally active graphite oriented player</li> </ul>
Details of arrangement	<ul style="list-style-type: none"> <li>BEM will source high grade graphite concentrate to supply Urbix's downstream processing facility in USA</li> <li>Proposed JV including potential development of a facility in Madagascar or Western Australia producing purified graphite</li> </ul>	<ul style="list-style-type: none"> <li>BEM to produce "tailor-made" concentrate samples</li> <li>RHIM to test and evaluate products</li> </ul>	<ul style="list-style-type: none"> <li>BEM will sell up to 25,000 tpa of downstream products from its operations into the European market</li> <li>Agreement assists Urbix in completing plant development</li> </ul>	<ul style="list-style-type: none"> <li>To engineer then build a new expandable graphite JV processing facility in India</li> </ul>	<ul style="list-style-type: none"> <li>Under the BlackEarth / Metachem JV, the company will buy up to 2,500tpa of product on commencement of production</li> </ul>
Relevant spec / product use	<b>Li-ion batteries</b> (fine/small flake)	<b>Refractory products</b> (mid-sized flake)	<b>Li-ion batteries</b> (fine/small flake)	<b>Expandable Graphite</b> (Coarse flake)	<b>Fire Retardant Material</b> (Expandable Graphite)

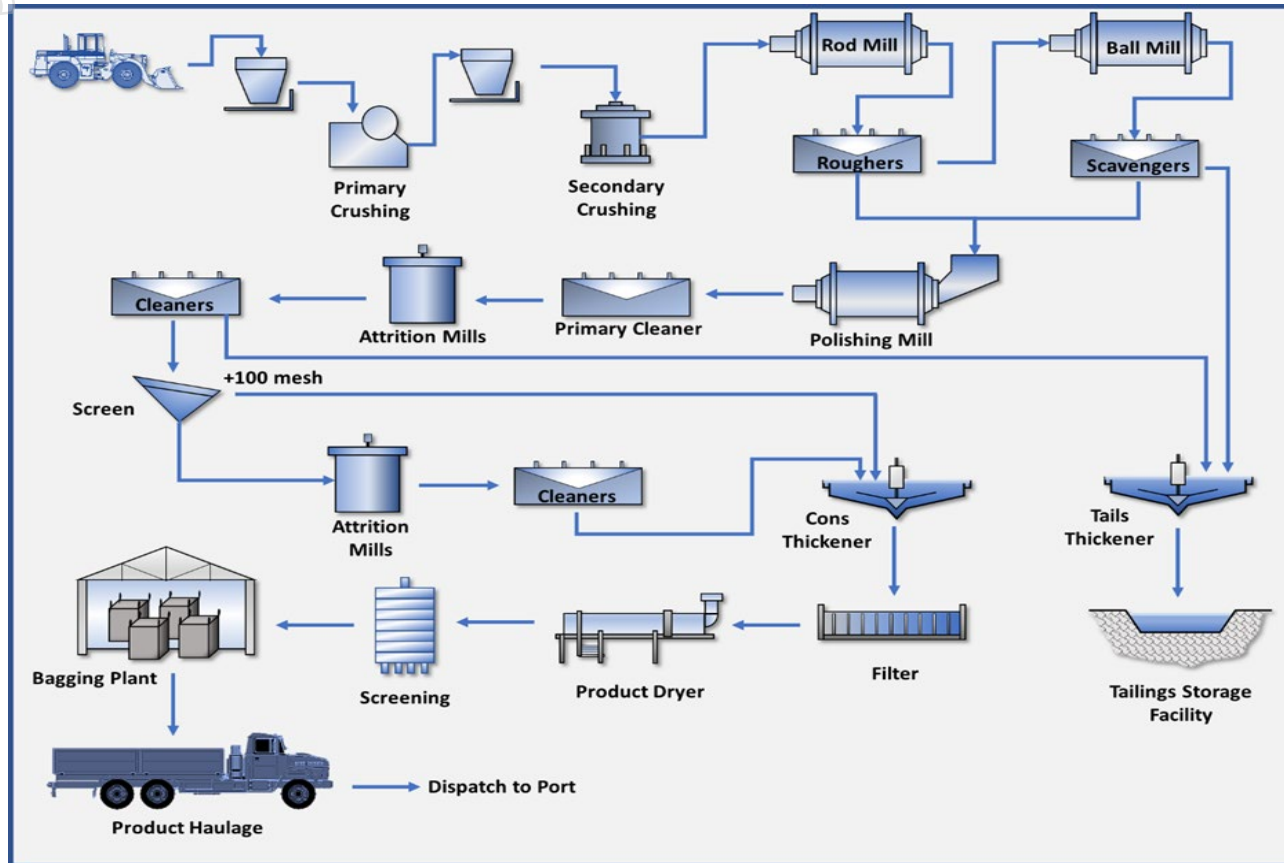
# Project Development





# Updated Scoping Study

## Maniry – Process Flowsheet\*

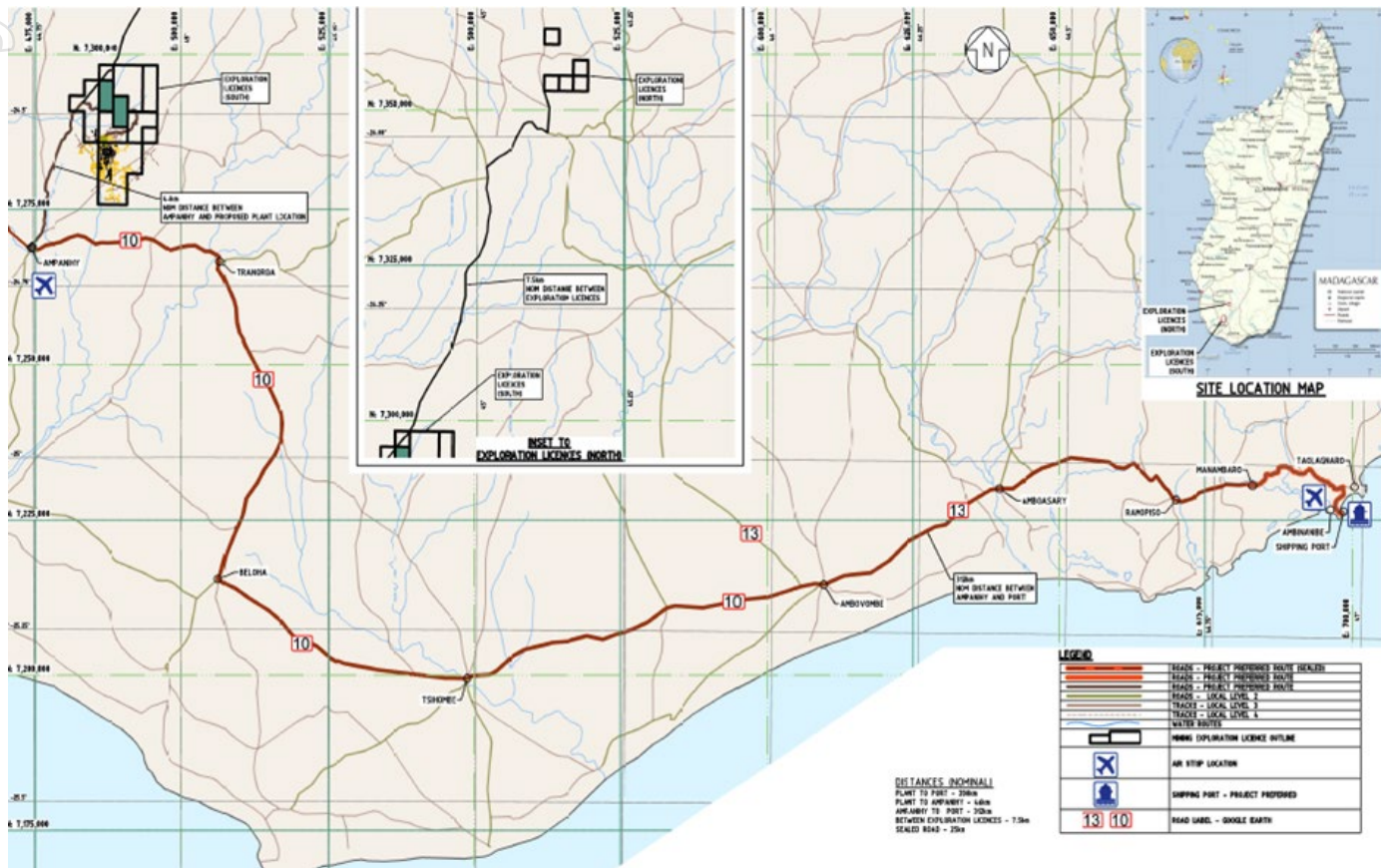


The basic process flowsheet proposed to treat the Maniry ore will include:

- 2 – Stage crushing
- Primary Rod mill to feed the rougher flotation cells with rougher tails being reground in a ball mill prior to a scavenging circuit
- Coarse and fine flotation with the screening of coarse material followed by inter-stage re-grind milling of the undersize to improve liberation and product purity
- Concentrate dewatering by thickening, filtration and drying
- Screening and bagging plant to produce the final products
- Stage 2 project expansion involves the installing of a second equivalent processing plant module:
  - Stage 1 comprising a 0.5 Mt/y plant
  - Stage 2 comprising an identical 0.5 Mt/y plant to be constructed adjacent to the Stage 1 plant increasing capacity to 1.0 Mt/y.
- The Stage 2 plant construction to be completed in year 3 commencing operation in year 4, with a resulting mine life based on the current indicated resource of 14 years
- Both stages to be independent with no significant capital pre-investment in Stage 1.

\*Flowsheet taken from Maniry Scoping Study released to the ASX 30 Jan 2019

Personal use only



The Maniry Graphite Project is in southwest Madagascar approximately 180 km south-east of Toliara, the capital of the Toliara Region. The Ianapera Project is located 70 km north-northeast of Maniry.

Access to the Maniry Project is initially via the arterial sealed road 'Route 7' to Andranovory and then via unsealed road to Ampanihy, the local township to the project. The Project is located 20 km northeast of this town via unsealed road.

The Maniry Project is located within the classified semi-desert southern zone, with elevated temperatures year-round peaking in the hot season, December to March, at an average maximum of over 30°C. The climate is dominated by south-eastern trade winds orientating in the Indian Ocean anticyclone, a centre of high atmospheric pressure that seasonally charges. Madagascar has two seasons, a hot, rainy season from December – April, and a cooler dry season from April – November. Total rainfall is sparse within the Molo area, with yearly precipitation ranging from 30-50 cm.

The Maniry Project is covered by sparse vegetation. Grass cover is widespread and trees are widely spaced overall, with accumulations near drainage lines and streambeds. In areas of lower relief, the alluvial cover is generally shallow and bedrock readily observable.





# BLACKEARTH

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# Appendix One

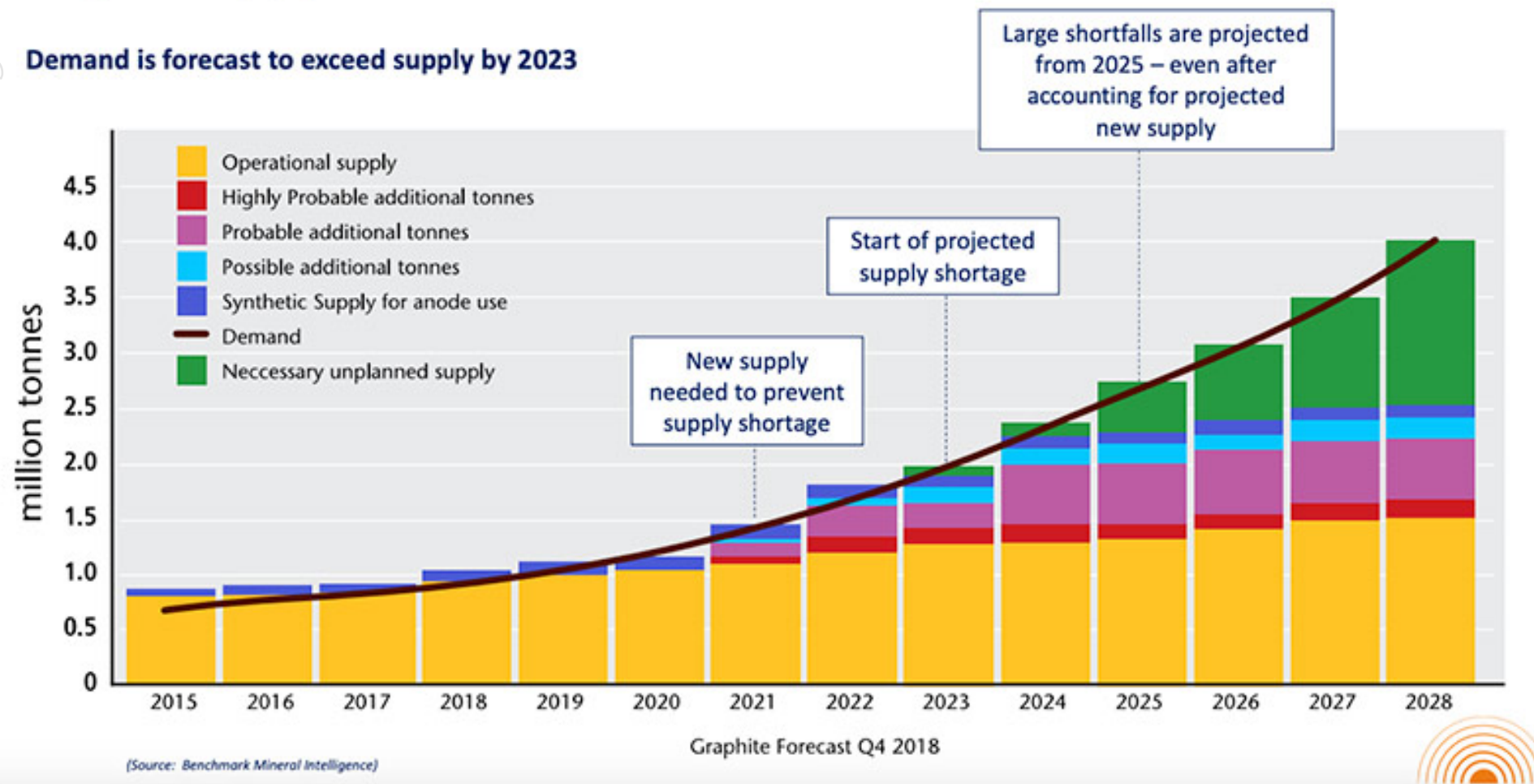


**BLACKEARTH**

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## Graphite Supply and Demand Forecast

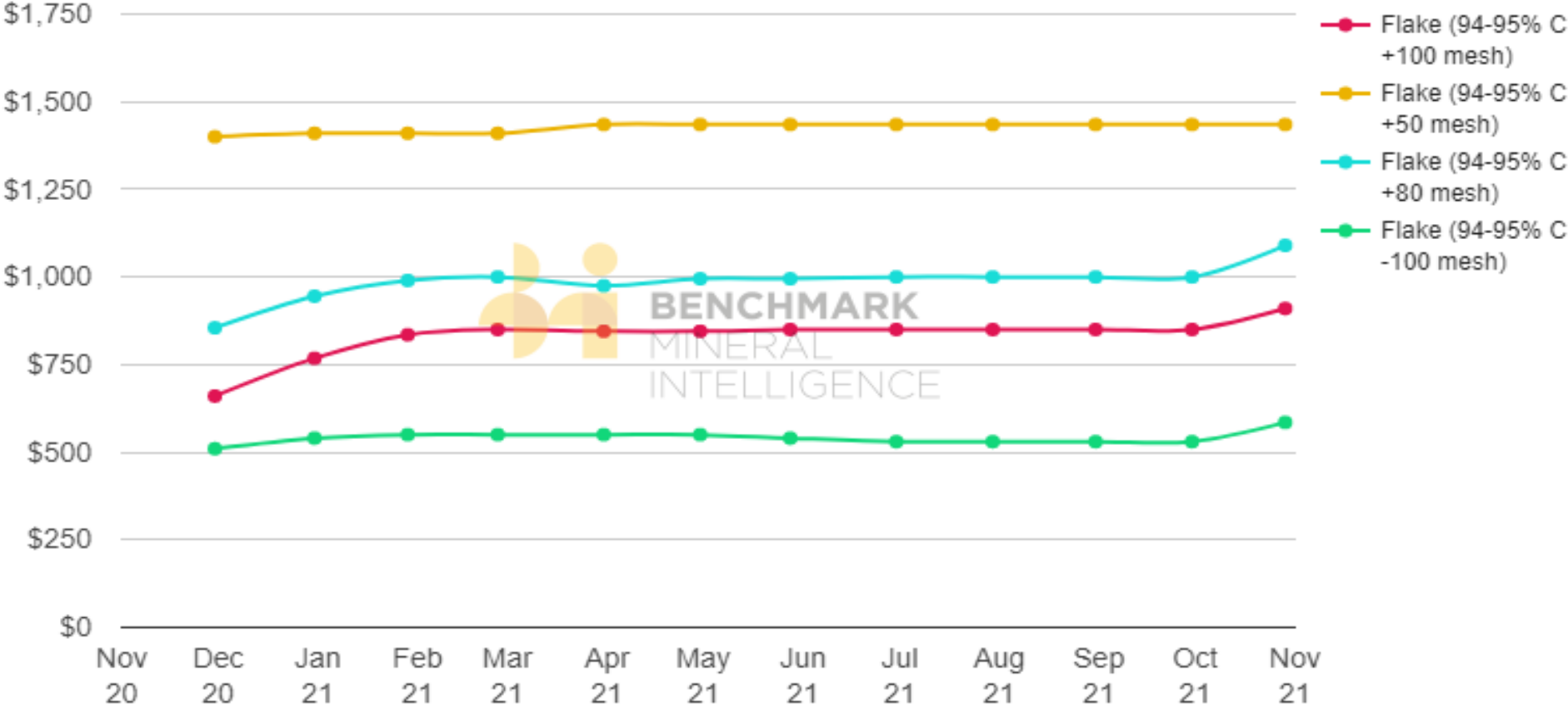
Demand is forecast to exceed supply by 2023



Source: Benchmark Mineral Intelligence

# Appendix Two

Graphite Prices: November 2020 - October 2021



Source: Benchmark Mineral Intelligence - 30 November 2021

# Appendix Three

## Mining

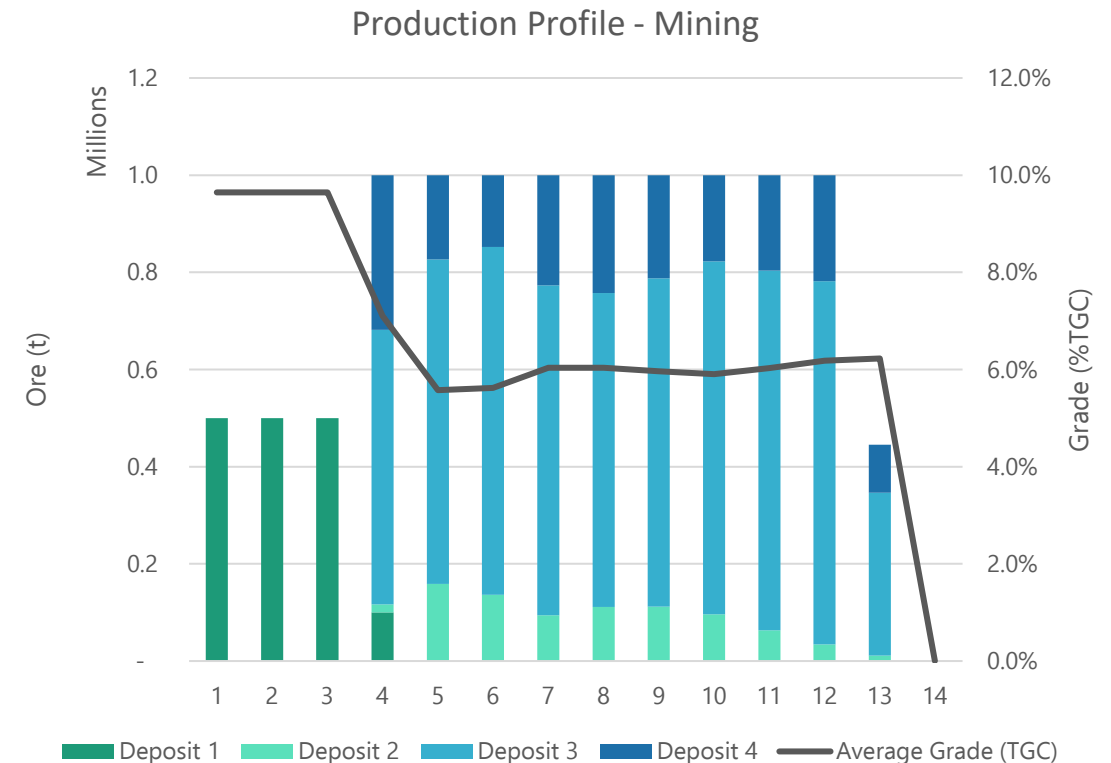
For the Scoping Study, preliminary pit optimisation was undertaken based on the BlackEarth provided Resource block model. The work undertaken included pit optimisations of several scenarios to create pit shells which were used to prepare a mining and processing schedule and mining costs.

A preliminary optimisation was run on Indicated and Inferred Resources. The preliminary optimisation run included graphitic carbon revenue and assumed processing of all material above the cut-off.

Six scheduling scenarios were run based on a 500 kt/y ore production rate and a staged expansion from 500 kt/y to 1 Mt/y ore production rate with a combination of pit shells based on both indicated and inferred resources and indicated resource only. The production schedule adopted for the study was based on the staged ore production rate 500 kt/y to 1 Mt/y comprising indicated resources only resulting in a 14-year mine life.

The revised projection Mining Plan outlines mining of each part of the stated resource as follows:-

### Updated Scoping Study Production Profile –



### Timing for mining of each of the above stated resource is identified as –

- Deposit 1- Razafy NW Indicated
- Deposit 2 – Razafy Inferred
- Deposit 3 – Razafy Indicated
- Deposit 4 – Haja Inferred

See JORC Compliant resource details on the following page

# Appendix Three

## Mining (cont)

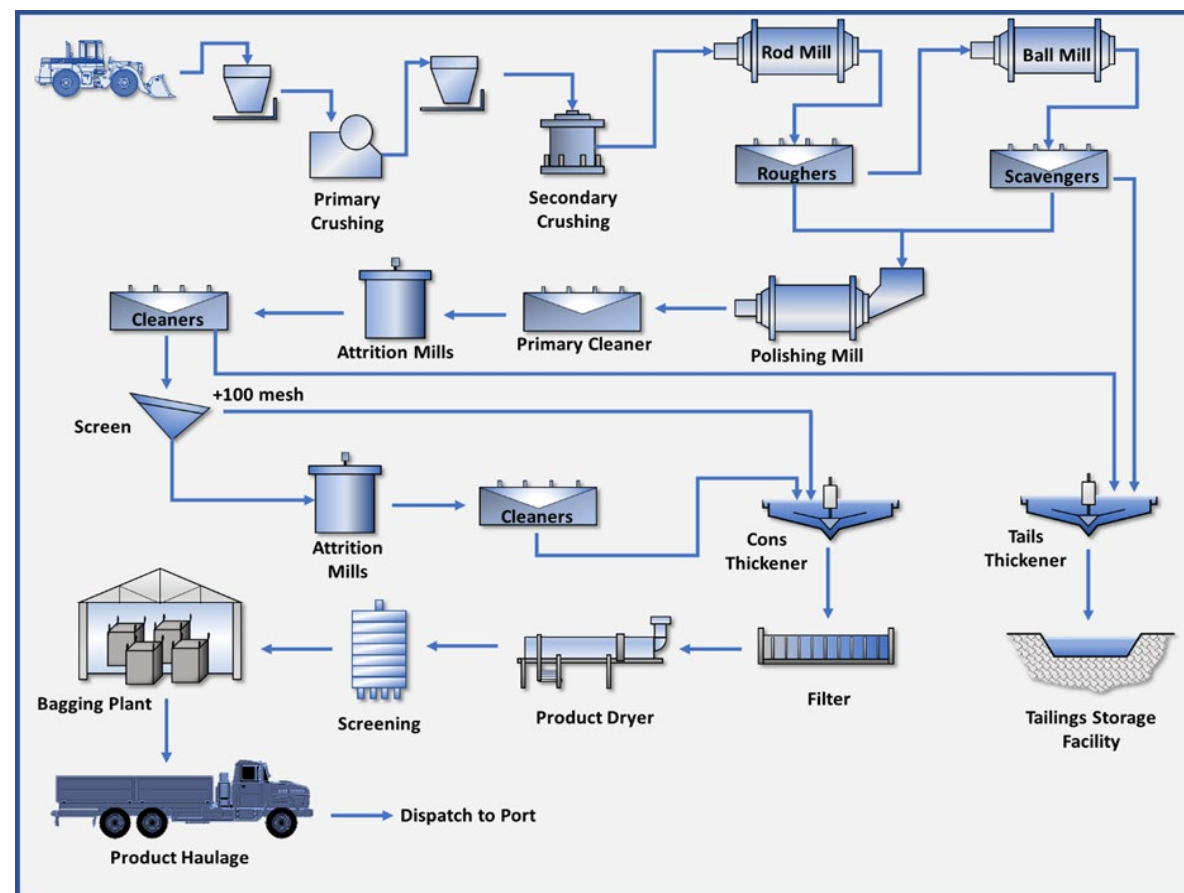
Updated JORC Compliant Resource as described in market release of 17 November 2021 and outlined below -

Maniry Mineral Resources				
Area	Classification	Tonnes (Mt)	TGC (%)	Contained Tonnes (t)
Razafy	Indicated	8.0	7.2	677,600
	Inferred	3.2	6.8	217,600
Razafy North West	Indicated	1.9	9.6	182,000
	Inferred	1.0	10.1%	101,000
Haja	Indicated	-	-	-
	Inferred	9.0	5.8	521,100
Total	Indicated	9.9	7.7	758,000
	Inferred	13.2	6.4	841,000

## Processing Flowsheet

The basic process flowsheet proposed to treat the Maniry ore is based on initially treating 500ktpa of ore. An expansion (Stage 2) is planned to be constructed in year 3, commencing operations in year 4 at a treatment rate of 1Mtpa. No changes have been made to the original flowsheet as described in the Company's initial Scoping Study announcement released to the ASX 30 January 2019.

A summary flow sheet is shown below -



# Appendix Three

## Metallurgical Testwork

### Introduction

Diamond core drill programs were conducted in early 2018 and 2021 to generate samples for metallurgical testwork. From these drill programs, sampling and compositing were undertaken to generate representative samples to assess the ore's amenability to beneficiation by froth flotation and to identify the nature, flake size and occurrence of the graphite in a selection of drill core samples and flotation products. The metallurgical testwork program was managed by Battery Limits and the Company, and was undertaken at ALS Laboratory (ALS) in Perth. Subsequent metallurgical test work has been undertaken at BGRIMM's facility in Beijing (refer ASX release, 9 August 2021)

### Flotation Test Results

The preliminary flotation tests were planned with the intent to maintain the graphite flakes as coarse as possible while achieving high recovery to concentrate. Generally, notwithstanding liberation effects, the larger the graphite flake size, the higher the carbon content in the concentrates. The general flotation objectives were to:

- Produce graphite concentrates >95% TGC
- Produce coarse flake size
- Recover >90% of the graphite to a concentrate.

An optimisation program was conducted on a Master Composite with results indicating:

- The coarse flakes needed grinding to liberate the gangue material
- In order to retain coarse flakes and achieve acceptable recovery the coarse rougher flotation tails had to be reground to  $P_{100}$  500  $\mu$ m before running through a scavenger circuit
- Good recovery and upgrade were achieved at coarse particle size with typical concentrate PSD in the size range of  $P_{80}$  300  $\mu$ m
- Screening out the +150 $\mu$ m earlier allowed for the finer material to be reground with more intensity to achieve TGC grades +96% TGC
- The general trend observed increased overall concentrate grade with increased grind time (fineness) and increased graphite liberation
- Flotation using site water was conducted with no detrimental effects observed.

Test work continues to be undertaken as part of the DFS. Changes may occur to the final flowsheet as part of this optimisation program

# Appendix Three

## Metallurgical Testwork (cont).

### Comminution Test Results

Bond Rod, Bond Abrasion and SMC (SAG Mill Comminution) tests were conducted. From the comminution test data, the Razafy material would be considered soft and not abrasive. Further work is currently being undertaken as part of the DFS for the purposes of finalising the process flow sheet.

### Metallurgical testing Summary and Conclusions

For the purposes of the update to the Scoping Study, no changes have been made to the initial flowsheet as described in the Company's release to the ASX dated 30 January 2019.

Initial optimisation testwork has demonstrated high graphite recovery to high-grade coarse concentrates can be achieved using separate coarse and fine flotation streams.

Subject to final metallurgical test work, the basic process proposed to treat the Razafy ore will include:

- 2 Stage crushing
- Primary Rod mill to feed the rougher flotation cells with rougher tails being reground in a ball mill prior to a scavenging circuit
- Screening of coarse material followed by inter-stage re-grind milling of the undersize to improve liberation and product purity
- Concentrate dewatering by thickening, filtration and drying
- Screening and bagging plant to produce the final products.

## Processing, Infrastructure and Logistics

The plant and infrastructure will comprise:

- Process plant complete with complementary equipment, office and plant buildings
- Diesel power station
- Tailings storage facility
- Water supply/ Water catchment dam
- Accommodation village
- Access roads within the plant and the project site.

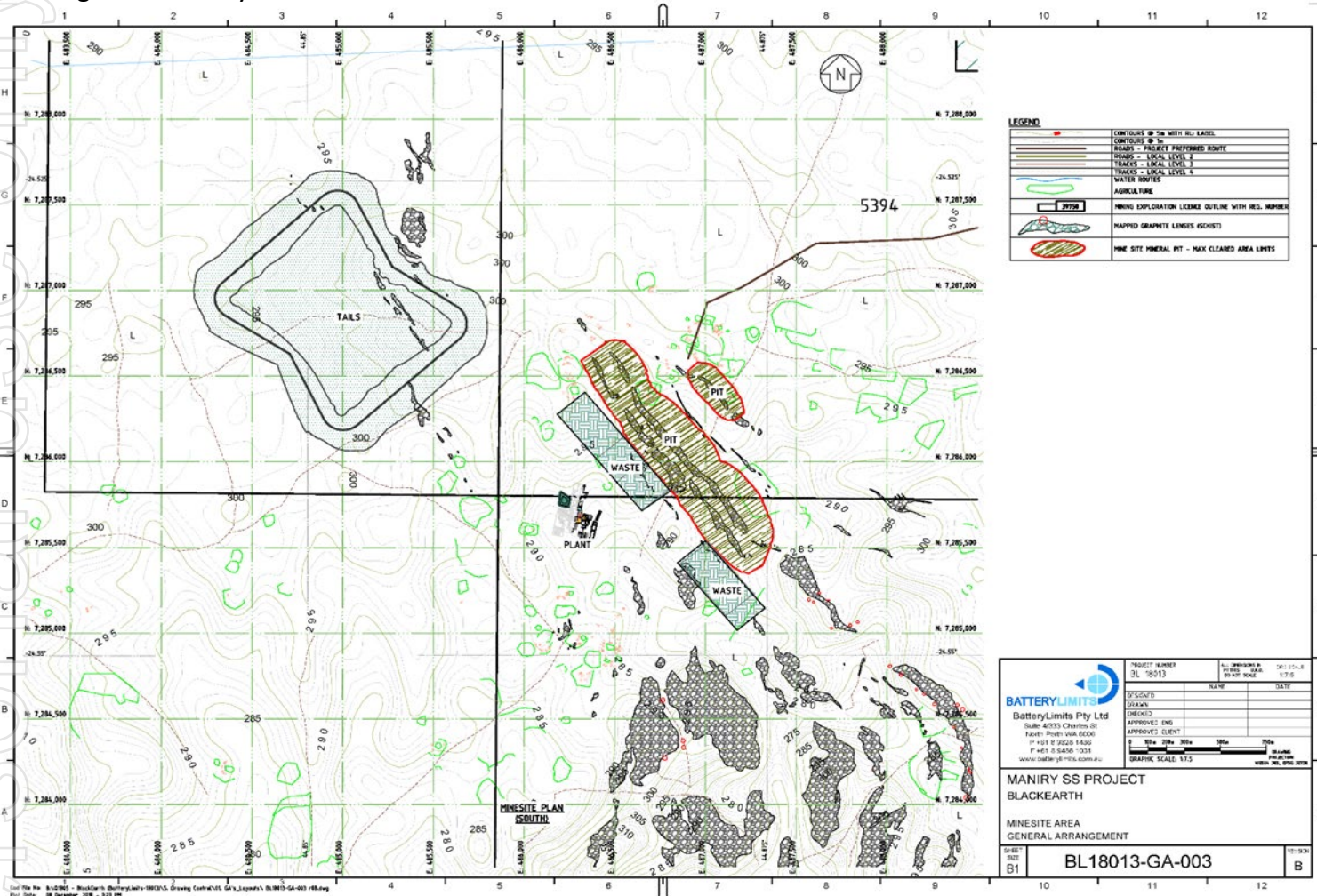
For the staged expansion there will be an increase in the TSF size to accommodate the higher deposition rate, increased on site power generation, water supply and camp facilities and an allowance for access roads upgrade.



# Appendix Three

## Processing, Infrastructure and Logistics (cont)

A general site layout is shown below:-



## Laboratory

A laboratory for sample preparation and to assay the various products generated through mining, crushing, milling and flotation will be located onsite.

The laboratory will be supplied, operated and managed by a reputable service provider with offsite facilities to provide analytical methodology beyond the capability of the onsite laboratory. Provisions for capital and operating costs have been included in the financial model.



# Appendix Three

## Power

### Process plant

A power station comprising diesel generator sets (gensets) rating with an N+1 strategy (number of sets required plus one for maintenance/standby) will supply power to the plant at low and medium voltage.

Diesel gensets were initially selected for this duty because of their low capital cost, availability and reliability. As part of the DFS the Company is currently reviewing hybrid options however these options are yet to be finalised and have not been incorporated into the capital and operating costs for this Scoping Study Update. It is believed that this may result in both environmental and further economic benefits to the Project.

For Stage 2 second processing plant the power station will be expanded as required.

### Accommodation village

Power for the accommodation village will be provided by the service provider assigned to manage the camp facility.

### Water Supply and Tailings Storage Facility

Power supply for the borefield water supply pumps, accommodation village and the tailings return water pump will be via diesel fuel gensets with fuel supplied by service vehicle from the secure bulk storage within the plant site. This may change as part of the DFS program currently underway.

## Water Supply

For a design basis, make-up water requirement was estimated at 0.7 m<sup>3</sup>/t of mill feed resulting in a total make-up water required for the operation at 0.35 GL/y per stage.

For this Scoping Study Update, it has been assumed that adequate groundwater will be available within a 5-10 km radius of the process plant to operate an effective borefield.

At the plant, raw water will be supplied via a raw water tank. Supply to the potable water treatment plant and make-up to the process water circuit, which includes the process water pond, are supplied directly from the raw water tank.

The plant will have tailings and concentrate thickeners where overflow from both thickeners will gravitate to the process water pond for re-use within the process plant.

As part of the Company's DFS activities, a detailed site water balance will be developed following site hydrology studies, estimation of tailings water recovery rates and the acquisition of local evaporation data.

# Appendix Three

## Tailings and Water Recovery

The plant will have tails and graphite product thickeners where overflow from both thickeners gravitates to the process water pond for re-use within the process plant. A suitably experienced tailings consultant has been recently appointed to undertake an appropriate DFS level study to identify the most appropriate TSF type and location and design. For this study, it is proposed that a starter TSF will be built within the mining lease area.

## Roads

The road to the site is currently passable but will require some upgrades for both the construction and operational phases of the Project. An allowance for this work has been included capital estimate and is based on the costs of other road upgrade projects in the area.

## Port

The closest accessible port to the Project site is the Madagascar Port of Taolagnaro (Ehoala) owned 80% by Rio Tinto and 20% by the Malagasy State. This port is considered the most appropriate port for the Project because of its accessibility by road and current under-utilisation.

Port of Taolagnaro, shown in Figure 0.1, was built by Rio Tinto to export product from its nearby mineral sands mine and as a public utility, the port is open to national and international maritime traffic. The port has 2 container berths and storage for 1000 TEU 20 ft containers .

On the 29 July 2021 the Company announced to the ASX that it received confirmation from the Port d'Ehoala SA that the Company had been granted a right to export its graphite concentrate from the port.

### Port of Taolagnaro



# Appendix Three

## Supply Chain and Product Transport

All supply-chain activities will be managed by BlackEarth. The transport of product to the port, loading of containers, delivery to the ship and stevedoring will be done through a contract arrangement with a freight company.

There will be a warehouse dispatch and storage centre on site. To gain the greatest efficiency from the trucks, the product will be loaded into 1-tonne bags at the Project site. Twenty bags will then be transported by truck to the port. At this location, the bags will be loaded into shipping containers and stored in preparation for export.

## Buildings and Operations Village

### Overview

Most of the buildings within the plant, administration, and infrastructure areas will be of the demountable/portable office type and have been priced on this basis.

Large plant buildings will be provided as deconstructed dome kits transported to the project site in 40-foot shipping containers. These buildings are:

- Processing maintenance workshop
- Maintenance and consumables warehouse
- Product warehouse and packing shed housing the Product bagging facility.

These sections will have offices in the workshops.

### Accommodation village

A camp consisting of modular prefabricated buildings will be constructed for non-local and expatriate personnel.

Camp facilities will be complete with generators and water treatment plants. The camp will be managed by a contract service provider with appropriate experience.

Other workers will be sourced from within the Ampanihy area and as such will be housed in local accommodation.

## Environment, Social, Community and Permitting

### Introduction

BlackEarth has engaged an Environmental consulting group for the Maniry Graphite Project to conduct different studies as a process in obtaining additional mining permits. The group will conduct all aspects of the study which include project registration and screening, scoping and preparation of terms of reference, conducting the environmental and social impact assessment (ESIA) and resettlement action plan (RAP).

# Appendix Three

## Environment, Social, Community and Permitting (Cont)

### Regulatory Requirements

There are several regulatory bodies providing the regulation of mining activities in the country including but not limited to:

- Ministry of Mines
- Mining Cadastre Bureau of Madagascar
- L'Office National pour l'Environnement (ONE)

In order to progress to mining operations, the Environmental consulting group in conjunction with BlackEarth will provide:

- A formal operating plan
- Production estimates
- Projected job creation estimates
- List of equipment used to mine
- Final Terms of Reference (ToR) and Final Memorandum of Understanding (MOU) between BlackEarth and ONE
- Environmental and Social Impact Assessment and Management Plan (ESIA & ESMP) including residual baseline
- Relocation Action Plan (RAP)
- National Environmental Action Plan (NEAP)
- Environmental Program for Sustainable Development (ESDP)

All works will be undertaken in line with current IFC and World Bank standards.

## Capital Cost Estimate

### Estimate Overview and Qualifications

The capital cost estimate for the original Scoping Study (refer ASX release 30 January 2019), was prepared by BatteryLimits based on the design, supply, fabrication, construction and commissioning of a new graphite plant in Madagascar and included supporting infrastructure and indirect costs. The estimate for the process plant facility was based on the preliminary process design, process design criteria, process equipment list, and process flowsheets. This information has been used as the basis for the Scoping Study Update however may change as part of the Company's current DFS activities planned to be completed in 2022.

The plant estimate was based on an equipment list derived from the process flow diagram and design criteria, and experience with graphite flotation plants. Prices for key process equipment plus estimates of complete plant installation costs were from a pre-qualified Chinese vendor.

Direct infrastructure costs were estimated with reference to their size parameters and prior estimate unit rates and benchmarks.

Indirect costs were estimated using conventional factoring and bottom-up methods appropriate to each element. A contingency allowance was included in the estimate, which was set to 20% of the estimated direct costs.

# Appendix Three

## Estimate Overview and Qualifications (cont)

For the Stage 2 development, based on doubling of the ore rate and duplication of the process plant, costs were estimated by applying factors to reduce component costs where these are lessened by the existing Stage 1 facilities.

The estimate **excludes** working capital, financing costs, escalation allowances, rehabilitation and closure costs.

A detailed estimate of these costs is as follows:-

Cost Component	Stage 1 Capex (US\$ k)	Stage 2 Capex (US\$ k)
Process Plant		
Process plant total	11,309	11,309
Plant-site bulk earthworks and PW pond	1,066	1,066
Process plant infrastructure	1,213	910
Process plant buildings (Workshop, stores, etc)	929	743
Plant EPCM (15%)	2,178	1,683
<b>Total Process Plant</b>	<b>16,695</b>	<b>15,711</b>
Project Infrastructure		
TSF (2-year starter cell)	2,240	
Raw water supply - borefield	1,087	1,087
Diversion structures for run-off	0	0
Roads	1,190	179
Power	1,305	1,305
Camp (100 man)	1,000	500
Plant vehicles & mobile equipment	1,000	901
Mine site establishment and infrastructure.	2,576	1,152
<b>Total Infrastructure</b>	<b>10,398</b>	<b>5,124</b>
Indirect costs		
Construction facilities and expenses	500	500
Infrastructure EPCM (12.5%)	1,299	590
Owner's costs incl RAP (excl vehicles & mine prestrip)	1,895	1,137
Prestrip	1,372	0
Spares	643	623
Project Insurance	527	248
Contingency (20% of direct costs only)	4,982	2,812
<b>Total Indirect Costs</b>	<b>11,218</b>	<b>5,910</b>



# Appendix Four

## Madagascar's Economy\*

- Agriculture, including fishing and forestry, is a mainstay of the economy, accounting for more than one-fourth of GDP and employing roughly 80% of the population.
- Madagascar produces around 80% of the world's vanilla and is largely reliant on this commodity for most of its foreign exchange
- Export partners : United States 19%, France 18%, United Arab Emirates 7%, China 6%, Japan 6%, Germany 5%, India 5% (2019)
- Export commodities : vanilla, nickel, gold, clothing and apparel, gemstones (2019)
- Subject to ongoing effects of COVID in the first half of 2021, the outlook is favourable for a return to growth, with real GDP projected to grow 3.5% in 2021 and 4.5% in 2022

*\*Information largely sourced from CIA World Fact Book*

