21 March 2022

CAPE FLATTERY SILICA PFS CONFIRMS EXCELLENT ECONOMICS AND MAIDEN ORE RESERVE

Highlights

- Cape Flattery Silica Sand Project's (CFS) Pre-Feasibility Study (PFS) confirms the Project can be a long-life silica sand project producing high-quality silica sand for the booming Asia-Pacific glass manufacturing markets supplying the solar panel industry.
- The PFS returns pre-tax **Net Present Value (NPV[8]) of A$290 million** (M), **Internal Rate of Return (IRR) of 34.9%** and life of **Project cash revenue of A$2,127M**. This compares with the Updated Scoping Study (10 November 2021) which had an NPV[8] of A$253M.
- The Capital Cost of CFS is estimated to be $79M (including a 15% contingency of $10M) with a payback period from commencement of production of 3.9 years. All production is based on the Maiden Ore Reserve (refer table 2 – Ore reserves).
- The **Maiden Ore Reserve of 46 million tonnes (Mt) @ 99.18% SiO_2** (within a Mineral Resource of 53.5Mt @ 99.19% SiO_2, refer to table 3 - Mineral Resource) is exploited over a 25 year Project life producing saleable product of 1.35Mt per annum.
- **Sensitivity and scenario analysis demonstrate the Project is financially robust and can maintain a positive Net Present Value (NPV) through stress-testing of the various scenarios.**
- Both the sand extraction area and the industry standard processing facility will have a small footprint and low environmental impact.
- A purpose-built jetty is planned to be constructed (subject to Development Approval (DA)) to allow barge loading and transhipping operations. This infrastructure, importantly, is located within the Port Limit of Cape Flattery.
- Development of CFS will deliver employment, apprenticeship and training opportunities to the Hope Vale and Cooktown communities, particularly the local indigenous communities.
- CFS will contribute to delivery of the Queensland Government's commitment to the **development of new economy minerals** in Far North Queensland.
- The results from the PFS demonstrate a strong financial case and the Company's Board has approved **commencement of a Definitive Feasibility Study (DFS)**, which is expected to commence in Q2 2022 following a Board review.

Queensland-based silica sand developer, Metallica Minerals Limited (Metallica, ASX: MLM) is pleased to announce the completion of its PFS of its 100%-owned Cape Flattery Silica Sand Project. The PFS includes reporting of a Maiden Ore Reserve of 46Mt @ 99.18% SiO_2 (refer table 2 – ore reserves).

The PFS has built upon the 2021 Scoping Study (Scoping Study) (refer ASX release 10 November 2021) and incorporated significant third-party information on key project components including processing plant design, mine operations and construction of the Project's 100%-owned jetty. The PFS also reports C1 operating costs of $33.77/t, which are comparable with the Scoping Study results.

Metallica Minerals Executive Chairman, Theo Psaros said the company is extremely pleased with the results of the PFS:

"With an impressive Ore Reserve, robust financial outcomes and a modest capital cost from this important pre-feasibility work, the Company is excited about the Project's potential and the next steps in its development. We are moving forward to undertake a DFS with confidence and are keen to take our place as an important contributor to Queensland's strategy to deliver new economy minerals to a growing global Silica Sand market.

The world's markets are transitioning to lower-carbon energy products, so there's booming demand for the high-quality silica sand CFS plans to export. That will bring benefits and opportunity not only for CFS's local communities in Hope Vale and Cooktown, but to Queensland and Australia. We are already building strong and supportive partnerships locally, and are embedding high environmental, social and governance standards in our decision-making and operational process planning.

Advances like the improved design of our own jetty – now 100m shorter than in our initial planning – demonstrate our commitment to practical innovation. We also respect there is further work to do in the DFS phase on transhipping operations and final metallurgical processing plans, and have an experienced team assembled to drive the next stages.

CFS is an outstanding opportunity to develop an efficient, environmentally responsible and financially successful silica sand export operation for the benefit of all our stakeholders. We will now progress with further evaluation and approvals processes, including undertaking the Definitive Feasibility Study this year. Our goal is to be exporting silica sand towards the end of 2024."

Table 1: Summary of key outcomes – Pre-feasibility study (A$ — Australian dollars)

Key Financial Metrics	Unit	Total
NPV - pre-tax (8%)	A$M	290.1
IRR - pre-tax	%	34.9
NPV – post tax	A$M	189.3
IRR – post tax	%	27.1
Payback (start of production)	Years	3.9
Initial Capital Expenditure (CapEx)	A$M	79.4
Life of Mine (LOM) CapEx	A$M	113.9
Average annual revenue	A$M	85.1
LOM revenue	A$M	2,127
Average annual OpEx	A$M	46.4
LOM OpEx	A$M	1,159
Average annual EBITDA	A$M	38.1
LOM EBITDA	A$M	952
C1 OpEx (FOB)	A$/t product	33.77
Average silica sand price (US$47.50)	A$/t (FOB)	63.63

Key Sand Extraction & Processing Metrics	Unit	Total
Mineral Resources (see Table 3)	Tonnes M	53.5
Ore Reserve (see Table 2)	Tonnes M	46
LOM	Years	25
Sand mined & processed	LOM Tonnes M	45
Silica sand production	LOM Tonnes M	33.4
Plant operating capacity	Mtpa	1.8
Plant yield	%	75
Silica product sold	Mtpa	1.35

Notes

» The PFS Financial Model assumes 100% equity funding with no gearing. Financing the Project will be further explored in the DFS process.

» All figures are presented in Australian dollars, unadjusted for inflation.

» Assumed exchange rates USD/AUD of approximately $0.75.

» The plant is designed to process 1.8Mtpa.

» The CapEx estimate includes a contingency of $9.6M (15%).

» Production is assumed to commence approximately 13 months after the first drawdown of capital.

» The Probable Ore Reserve and Measured and Indicated Mineral Resource underpinning the above production assumption targets has been prepared by a Competent Person in accordance with the requirements of the JORC Code 2012 (refer Table 2 – Ore Reserves; and Table 3 – Mineral Resources).

Project site layout

The CFS Project will comprise a conventional resource extraction and 'off the shelf' processing plant with a small footprint. The key components of the Project are:

» the overland conveyor from the product stockpile to the Jetty Infrastructure Facility (JIF)

» the Barge Loading Facility (BLF) and associated jetty (located two-three nautical miles to ship-loading basin)

» a purpose-built accommodation facility

» barging and transhipment operations

» a site access road to the jetty

» site-wide services

» Mine Infrastructure Area (MIA) facilities

» a product stockpile

» process plant pad.

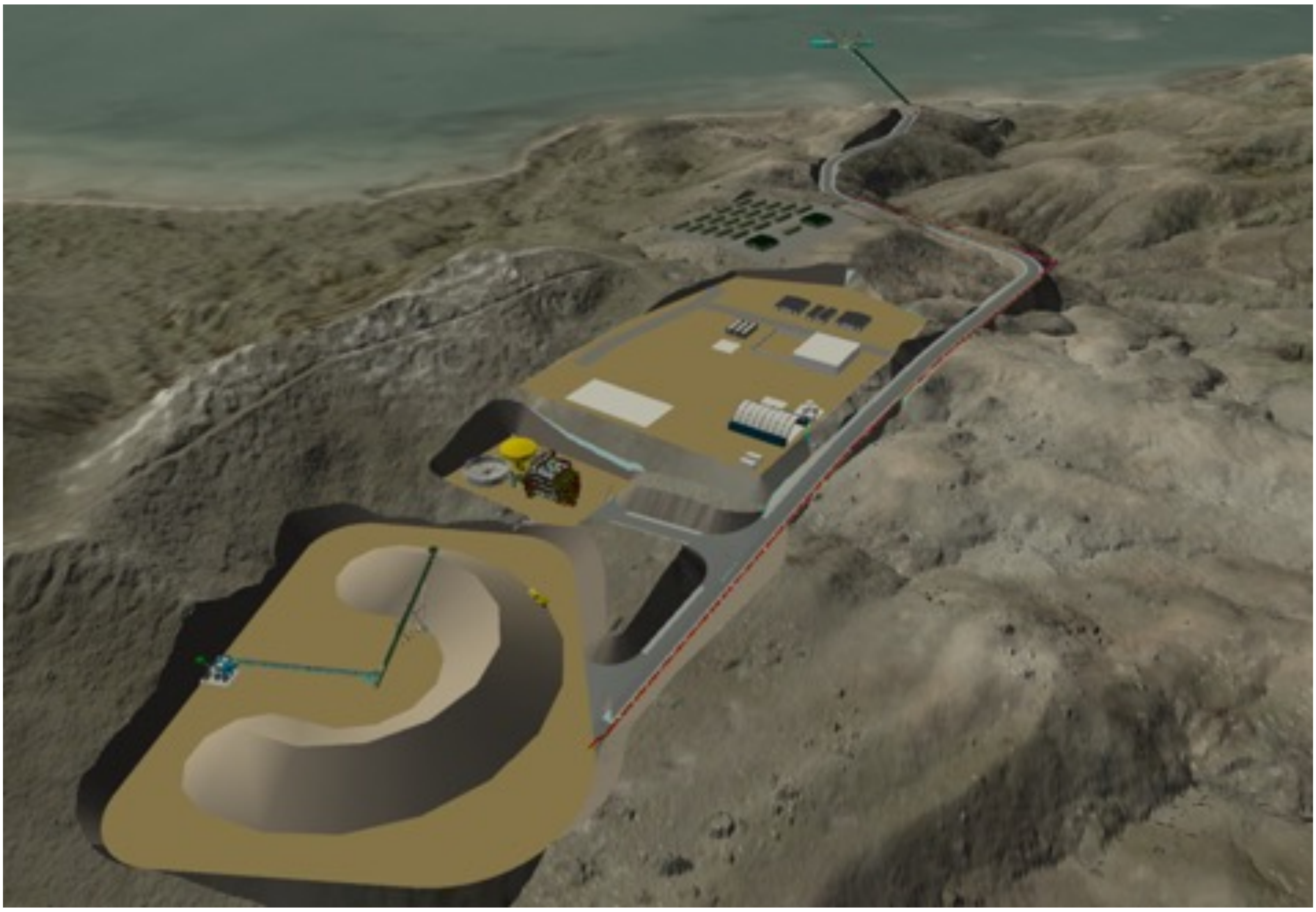

Figure 1: Mine infrastructure looking northeast

Maiden Ore Reserve

The Maiden Ore Reserve has been reported by the independent firm, Ausrocks Pty Ltd (Ausrocks). The Ore Reserve of 46Mt at 99.18% SiO_2 represents 86% of the Mineral Resource of 53.5Mt at 99.19% SiO_2 (see Tables 2 & 3).

Figure 2: CFS Project – Eastern Resource Area with Mining Lease (ML) boundary and completed drill holes

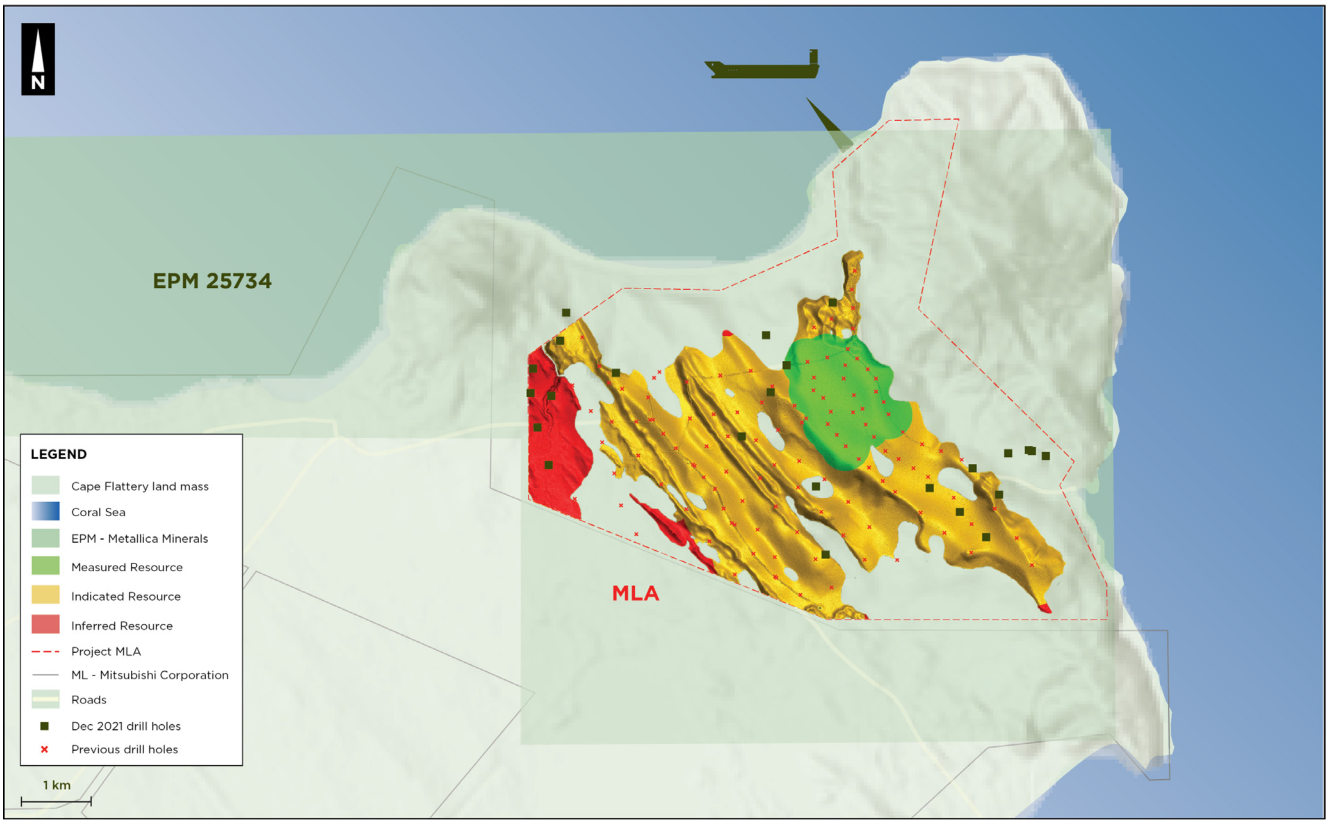

Table 2: Maiden Ore Reserve

Ore Reserve Category	Tonnage Mt	SIO_2 %	FE_2O_3 %	TIO_2 %	AL_2O_3 %	LOI %	Waste Mt	Silica Sand Mm³
Probable Reserve	46	99.18	0.12	0.14	0.11	0.19	2.6	28.76

The Mineral Resource of 53.5Mt has resulted from drilling campaigns in December 2020 and August 2021. Drilling completed in December 2021 (see ASX release 23 February 2022) has not been assessed for inclusion in the Resource and Reserve.

Table 3: Mineral Resource for the Cape Flattery Silica Project

Resource Category	Silica Sand Mt	SIO_2 %	FE_2O_3 %	TIO_2 %	LOI %	AL_2O_3 %	Density t/m³	Silica Sand Mm³
Measured	9.55	99.29	0.10	0.13	0.18	0.08	1.6	5.97
Indicated	38.25	99.15	0.13	0.14	0.19	0.12	1.6	23.91
Inferred	5.66	99.26	0.11	0.11	0.18	0.16	1.6	3.54
Total	**53.46**	**99.19**	**0.12**	**0.14**	**0.19**	**0.12**	**1.6**	**33.41**

For further details, refer to ASX Release: 21 October 2021 'Revised 40% increase of the Cape Flattery Silica Sand Resource to 53.5Mt'.

The Mineral Resource Estimate has been reported in accordance with the JORC Code 2012. A cut-off grade 98.5% has been defined based on the surrounding data. These results show there is good potential to produce a premium grade silica product using standard processing techniques.

Metallurgical bulk testing

Metallica Minerals Limited engaged Mineral Technologies (MT) to complete several detailed metallurgical sample characterisations for the Project, with the objective of confirming the product grades that could be produced. Processing test work on a sub-sample of material from a 914kg composite sample was executed as part of the characterisation studies for the PFS. Further work is underway at the MT Carrara laboratory, with the objective to validate the performance of the flowsheet and supply information to underpin a detailed engineering study. Previous work was also carried out by IHC Robbins on a 2 tonne composite sample.

The results of metallurgical test work completed to date have been highly positive, demonstrating high-purity silica sand suitable for photovoltaic glass manufacturing can be produced: high-grade 99.9% SiO_2 and relatively low contaminant silica sand with an attractive narrow particle-size distribution can be generated with a high-to-moderate yield.

The non-magnetic product process delivered very positive results of 99.9% SiO_2, 330ppm Al_2O_3, 160ppm Fe_2O_3, 210ppm TiO_2 and 2.6% – 125-micron particles. This quality of silica sand was achieved with a mass yield of 91.7% (note – the PFS has assumed a mass yield of 75% on the basis that the Project is pursuing an Fe_2O_3 target of ≤120ppm).

Table 4: PFS feed and product samples

Elements in %	TiO_2	Fe_2O_3	SiO_2	Al_2O_3	Cr_2O_3	MgO	CaO	K_2O	LOI_{1000}	Cu	Na_2O
Prepared -600µm + 106µm fraction	0.068	0.045	99.7	0.056	0.0002	0.002	0.003	0.003	0.06	<0.001	0.002
IRMS NM	0.021	0.016	99.9	0.033	0.0001	0.001	0.004	0.003	0.03	<0.001	0.002
HAL +106µm	0.016	0.005	99.9	0.027	<0.0001	0.001	0.003	0.003	0.04	<0.001	0.002

Importantly, from a marketing perspective, Hot Acid Leaching (HAL) was also tested and this reduced the Fe_2O_3 to 50ppm. HAL will not be undertaken at CFS and it is a process undertaken by some prospective purchasers of the CFS silica sand as this outcome demonstrates CFS product can meet their expected quality requirements.

Specific metallurgical test work to confirm process pathways to reduce Fe_2O_3 content to less than 120 ppm in our product is planned to be incorporated into the DFS metallurgical programme.

Sand Extraction

Sand extraction is planned to commence in the Reserve area closest to the Mine Infrastructure Area. The extraction sequence will progress south and to the west over the course of the life of mine.

Following vegetation clearing, topsoil will be removed across a small initial footpring using a dozer or grader with separation of the soil and sub-soil horizon to an average depth of 500mm. Topsoil is planned to be stockpiled in 2m high (maximum) piles at the boundary of the clearing area to be used for progressive rehabilitation.

Following removal of the topsoil, silica sand extraction can commence with direct loading from the working face by a wheel loader. The loader will load silica sand into a mobile feeder unit. Quality control processes will be employed at the working face to maintain quality of the feed into the processing plant. Areas of poorer quality silica sand are planned to be encountered and this sand will be relocated into rehabilitation areas and is not planned to be processed.

Water is added to the silica sand passing through the mobile feeders and the slurry is pumped to the processing plant.

The Wet Concentration Plant (WCP) is designed to refine the sand to reduce heavy minerals, Fe_2O_3 and Al_2O_3 contaminants. It is located to the northeast of the sand extraction area, near to the BLF. No chemicals are added to the sand as it is processed through the WCP.

The reject material from the WCP will contain low-grade silica sand including Fe_2O_3 and Al_2O_3 and other minerals. These all occur naturally in the Cape Flattery region at concentations similar to the reject grade and do not pose a threat to the environment. The rejects will be pumped back to the active rehabilitation faces to progressively rehabilitate the extraction area.

Processing

The WCP will utilise an industry standard process and is designed for continuous operation 24-hours per day, 365-days per year (other than designated non-working days), with approximately 82% utilisation resulting in the nominal operating parameters.

Capital expenditure

A capital cost estimate has been prepared based on the CFS Project scope of work. The capital cost estimate including contingency is A$79.4M. The level of effort for each of the line items meets the Class 4 estimate as defined by the AusIMM, and the extent of work performed allows for a ±20% to 25% accuracy. WAVE International (WAVE) has based its cost estimate on a combination of PFS-level engineering design, knowledge from recent historic projects, and pricing of work packages from vendors.

Sand extraction and other heavy fleet capital costs are included in OpEx as a lease arrangement and have not been capitalised.

The engineering design-supplied modular units and installation of plant components have been provided by MT. All remaining equipment, fabrications, logistics, procurement, site construction and commissioning have been derived from comparable recently estimated or undertaken projects in Queensland.

Table 5: Capital Expenditure Summary

Capital Expenditure Summary	Total A$M
Process plant	23.3
Barge loading facility	21.6
Conveyor & slurry pipeline	5.9
Camp & other surface infrastructure	9.3
Civils, roads & clearing	3.7
EPCM costs*	4.0
Construction barging logistics	2.0
Contingency (15%)	9.6
Total CapEx	**79.4**
Total CapEx excl. contingency	**69.8**

* Engineering, Procurement, Construction, & Management (EPCM).

Operating expenditure

Operating costs for CFS were developed based on work undertaken by WAVE including a 'bottom-up' estimate for some components of the Project. All significant and measurable items are listed in the main document, however smaller items are factored as per industry practice for PFS level assessment. Steady state operating costs are outlined in Table 6.

Table 6: C1 Operating cost summary

Total Opex Summary	AUD/t Product
Site overheads*	7.85
Sand extraction	4.80
Processing	3.73
Infrastructure	5.97
Barge loading	0.95
Marine	8.94
Marketing & other	1.54
C1 Cost Total	**33.77**

*Site Overheads expenditure includes Royalties, Workforce transportation, Camp Facilities and year-round equipment and supplies barging

Silica sand marketing

Increasing demand for high-grade silica sand is underpinned by global population growth, accelerating electrification, carbon neutrality objectives and Government policy, and the structural transition from fossil fuels to greener technologies, in particular solar energy.

CFS is planned to become a key supplier to this growing demand.

In Asia, demand for silica sand has been growing at a compound annual growth rate (CAGR) of 9.1% over the past five years, led by China. China's demand for silica sand has been growing at a CAGR of 41.1% over the same period.

Solar panels require photovoltaic (PV) glass — of which high-grade silica sand is a key raw material — and the leading global producer is China. Solar PV capacity has grown 20-fold over the past decade and is set to triple over the following decade. IMARC estimated the global silica sand market could grow from US$7bn to US$20bn in 2024[1].

Hong Kong-based marketing consultant, Prime Gain, was engaged to study current trends in demand and pricing for high-grade silica sand, with the quality of Cape Flattery's product highly regarded. Prime Gain performed a pricing analysis based on comparable high-grade silica sand products supplied from Australia, Indonesia, and Malaysia to Asian regional buyers. Prime Gain also examined the landed cost of product rather than the FOB price given the impact of ocean freight on future pricing. In addition, Automatic Identification Shipping (AIS) data was used to analyse the volume, frequency and destinations of silica sand exported out of Cape Flattery.

Prime Gain advised that "a high-grade Cape Flattery silica sand product could reasonably achieve FOB pricing of A$55.56 to $A75.00 per tonne, subject to various market conditions and variables."

1 Silica Sand Market: Global Industry Trends, Share, Size, Growth, Opportunity and Forecast 2022-2027

Table 7: Prime Gain pricing analysis – Supply of high-grade silica sand FOB and CIF commencing 2023/Q4 from Australia to the China market using forward ocean freight rates

Pricing estimate for a high-grade Cape Flattery product onstream 2024	Low-range estimate	High-range estimate
FOB AUD/t	55.56	75.00
FOB USD/t	40.00	54.00
Ocean Freight USD/t	21.50	21.50
CIF USD/t China	61.50	75.50

For the purposes of the PFS, CFS has used US$47.50/A$63.63/t and FOB price for the financial modelling of the Project's economics.

CFS has noted shipping costs are currently high. Prime Gain consulted global ship owner-operators on the subject of ocean freight for a journey from Cape Flattery to China. Prime Gain requested a quote for shipments of approximately 50,000 metric tonnes commencing in late 2023 and the price quoted was US$21.50/t.

Environmental, social and governance (ESG)

As a key supplier to the new economy, CFS recognises the opportunity to make a positive global contribution as the world pivots towards a low-carbon future. ESG principles are being embedded in our business decision making processes and approach to the development and operation of CFS. We believe this will enhance both financial and non-financial returns over the short, medium and long term.

Environmental management will be comprehensive, with objectives including minimising the operation's footprint, protecting biodiversity, responsible water use, and rehabilitating disturbed areas after disturbance. Close and constructive relationships have already been established with Indigenous communities and Traditional Landowners in Cape York. CFS will continue to work with the communities of Hope Vale and Cooktown to nurture our beneficial partnerships and to maximise economic outcomes in the region. As part of early ESG strategy development, stakeholder research on material themes was undertaken, with complimentary feedback received on the Company's consultative approach to addressing environmental and social aspects of the proposed Project.

We seek to continually enhance our contribution and commitment to sustainable development mapped to the relevant UN Sustainable Development Goals.

Project risks

The principal risks for CFS include

- Capital and operating cost increases
- Future silica sand market pricing
- Environmental and social licences to operate, including delays to project approvals
- The ability to secure future funding for the Project
- Availability and pricing of shipping
- Construction delays
- Weather delays
- Disruption to shipping and increased shipping costs.
- Delay in vendor data on long-lead items to support engineering design and issue for construction information
- Delay in engineering design and issue for construction information

Additionally, increased output from existing and new producers and projects currently progressing through project development and approvals programs may present a market risk. CFS will continually review and respond to project risks as part of planning and operational management processes.

Next steps

The findings of the CFS Project's PFS are highly positive and provide solid financial results that underpin the basis for Metallica to further evaluate and continue to develop the Project. The Board of Metallica has approved progress to a DFS. The DFS is expected to commence in Q2 2022 following Board review of the DFS plan and scope of work.

Based on the metallurgy studies completed to date, Metallica is continuing to have samples from the CFS Project tested so as to achieve a level of Fe_2O_3 of less than or equal to 120ppm. Testing on a limited sample was completed by a potential offtake partner and this testing achieved this level of Fe_2O_3.

The Company will continue formal negotiations with the Traditional Landowners. Meetings are being held regularly and alternating between Cooktown and Hope Vale. The meetings are held with representatives of Hopevale Congress Aboriginal Corporation (Hopevale Congress), as agent for the Nguurruumungu Clan, and Walmbaar Aboriginal Corporation, as agent for the Dingaal Clan.

The Environmental Approval (EA) process with both State and Federal Government authorities will continue. The EA process requires Metallica to undertake further requisite studies before it is granted a Mining Lease (ML). The key component of work being undertaken is the preparation of a Progressive Rehabilitation and Closure Plan (PRCP).

Metallica has received interest from a number of potential offtake parties who have expressed a need to secure a high-purity silica sand product. This PFS provides data and planning necessary to progress engagement with potential offtakers. These discussions are expected to continue through the DFS.

Project approvals through the regulatory process is critical to CFS achieving execution schedule and cost targets. A detailed program will be developed during DFS.

Table 8: Conceptual project milestones

Milestone	Target Date
Pre-Feasibility Study	Qtr 1 2022
EA approval	Qtr 4 2022
ML and DA approvals complete	Qtr 4 2022
DFS	Qtr 1 2023
Construction and commissioning completion	Qtr 2 2024
Production start	Qtr 2 2024
First export	Qtr 3 2024

* Note the above table assumes a Site Specific EA approval with no need to undertake a full EIS.

Additional Information Below

Included below in this announcement are supporting material containing detailed information about the PFS and its outcomes. This information includes, as applicable, the material assumptions, underlying methodologies and detailed reasoning supporting and used to derive the financial and production outcomes and other forward-looking statements set out in this release (including above), such as the material price and operating cost assumptions. Accordingly, this announcement should be read together with these supporting materials.

The Company has concluded that it has a reasonable basis for providing the forward looking statements and forecast financial information included in this announcement. The detailed reasons for that conclusion are outlined throughout this announcement and all material assumptions including the JORC modifying factors, upon which the forecast financial information is based are disclosed in this announcement. This announcement has been prepared in accordance with JORC Code 2012 and the ASX Listing Rules.

The PFS discussed herein has been undertaken to study a range of options to further develop the technical and economic feasibility of the CFS Project. The production target incorporates the Maiden Ore Reserve that sits within the proposed sand extraction area. Drilling completed in December 2021 (see ASX release 23 February 2022) has not been assessed for inclusion in the Mineral Resource and Ore Reserve.

The Ore Reserve and Mineral Resource Estimate underpinning the PFS have been prepared by Competent Persons in accordance with the requirements of the JORC Code. Competent Persons' Statements are included in this document.

Previous ASX Announcements

The Company confirms that:

A. All the material assumptions underpinning the production target, or the forecast financial information derived from a production target, in initial public report referred to in Listing Rules 5.16 or rule 5.17 (as the case may be) that are cited in this announcement, continue to apply and have not materially changed; AND

B. In relation to ASX announcements cited in this announcement that contained exploration results or estimates, the Company is not aware of any new information or data that materially affects the information included in those announcements and that all assumptions and technical parameters underpinning the estimates in those announcements continue to apply and have not materially changed.

Investors should note that there is no certainty that the Company will be able to raise the funding required to commercialise the Project when needed. It is also possible that such funding may only be available on terms that may be dilutive to or otherwise affect the value of the Company's existing shares. It is also possible that the Company could pursue other 'value realisation' strategies to provide alternative funding options.

Given the uncertainties involved, investors should not make any investment decisions based solely on the results of the Project's PFS. Actual results and development of projects may differ materially from those expressed or implied by these forward looking statements depending on a variety of factors. A key conclusion of the PFS, which is based on forward looking statements, is that the Project is considered to have positive economic potential.

This ASX Announcement has been approved in accordance with the Company's published continuous disclosure policy and has been approved by the Board.

For further information, please contact:

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CFO & Company Secretary

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COMPETENT PERSON STATEMENT

Cape Flattery Silica Sand Exploration Results

The information in this report that relates to the Exploration Sampling and Exploration Results is based on information compiled by Mr Patrick Smith, a Competent Person who is a Member of the Australian Institute of Mining and Metallurgy.

Mr Smith is the owner and sole Director of PSGS Pty Ltd and is contracted to Metallica Minerals as its Exploration Manager. Mr Smith confirms there is no potential for a conflict of interest in acting as the Competent Person. Mr Smith has sufficient experience that is relevant to the style of mineralisation and type of deposits 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".

Mr Smith consents to the inclusion of this information in the form and context in which it appears in this release/report.

Cape Flattery Silica Sand Resource

The information in this report that relates to the Cape Flattery Silica Project – Eastern Resource Area is based on information and modelling carried out by Chris Ainslie, Project Engineer, who is a full-time employee of Ausrocks Pty Ltd and a Member of the Australasian Institute of Mining & Metallurgy. The work was supervised by Mr Carl Morandy, Mining Engineer who is Managing Director of Ausrocks Pty Ltd and a Member of the Australasian Institute of Mining & Metallurgy, and also by Mr Brice Mutton who is a Senior Associate Geologist for Ausrocks Pty Ltd. Mr Mutton is a Fellow of the Australasian Institute of Mining & Metallurgy and a Fellow of the Australian Institute of Geoscientists. Mr Morandy and Mr Ainslie and Mr Mutton are employed by Ausrocks Pty Ltd which has been engaged by Metallica Minerals Ltd to prepare this independent report, there is no conflict of interest between the parties.

Mr Morandy, Mr Ainslie and Mutton consent to the disclosure of information in the form and context in which it appears in this report.

The overall resource work for the Cape Flattery Silica Project – Eastern Resource Area is based on the direction and supervision of Mr Mutton who has sufficient experience that is relevant to the style of mineralisation and type of deposits 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".

Cape Flattery Silica Sand Ore Reserves

The information in this report that relates to Ore Reserves at the Cape Flattery Silica Sand Project is based on information reviewed or work undertaken by Mr Carl Morandy. Mr Morandy is a Mining Engineer, the Managing Director of Ausrocks Pty Ltd and a Member of the Australasian Institute of Mining & Metallurgy. Mr Morandy has relied on Metallica Minerals Limited for marketing, environmental, economic, social and government permitting. Ausrocks Pty Ltd have been engaged by Metallica Minerals Limited to prepare this independent report and there is no conflict of interest between the parties.

Mr Morandy has sufficient experience which is relevant to the style of mineralisation and type of deposit under consideration and to the preparation of mining studies to qualify as a Competent Person as defined in the 2012 edition of the Australasian Code for Reporting of Ore Reserves (The JORC Code). Mr Morandy consents to the inclusion in the report on the matters based on their information in the form and context in which it appears.

The corresponding JORC 2012 Table 1 is attached.

Cape Flattery Silica Sand metallurgy

The technical information in this report that relates to process metallurgy is based on work completed by Mineral Technologies and information reviewed by Etienne Raffaillac (MAusIMM), who is a Principal Process Engineer and employee of Mineral Technologies. The metallurgical aspects including process flowsheet design, product grades and recoveries and assumptions for the metallurgical sample processing and characterisation that relate to the Cape Flattery Silica Sand project have been reviewed and accepted by Mr Raffaillac.

Mr Raffaillac has sufficient experience that is relevant to the type of processing under consideration and to the activity being undertaken to qualify as a Competent Person as defined by the JORC Code 2012. Mr Raffaillac consents to the inclusion in the report of the matters based on his information in the form and context in which it appears.

Cape Flattery Silica Sand process design and engineering

The technical information in this report that relates to process design and engineering is based on work completed by Mineral Technologies and information reviewed by Matthew Allen (MAusIMM), who is a Principal Mechanical Engineer and employee of Mineral Technologies. The process design and engineering aspects including process plant design, capital and operating cost estimates and assumptions for the processing that relate to the Cape Flattery Silica Sand project have been reviewed and accepted by Mr Allen.

Mr Allen has sufficient experience that is relevant to the type of process plant design under consideration and to the activity being undertaken to qualify as a Competent Person as defined by the JORC Code 2012. Mr Allen consents to the inclusion in the report of the matters based on his information in the form and context in which it appears.

Reference to previous releases

The Company confirms that it is not aware of any new information or data that materially affects the information included in the original announcements. Metallica confirms that the form and context in which the Competent Person's findings are presented have not been materially modified from the original market announcements.

Forward-looking statements

Forward-looking statements are based on assumptions regarding Metallica, business strategies, plans and objectives of the Company for future operations and development and the environment in which Metallica may operate.

Forward-looking statements are based on current views, expectations and beliefs as at the date they are expressed and which are subject to various risks and uncertainties. Actual results, performance or achievements of Metallica could be materially different from those expressed in, or implied by, these forward-looking statements. The forward-looking statements contained in this presentation are not guarantees or assurances of future performance and involve known and unknown risks, uncertainties and other factors, many of which are beyond the control of Metallica, which may cause the actual results, performance or achievements of Metallica to differ materially from those expressed or implied by the forward-looking statements. For example, the factors that are likely to affect the results of Metallica include general economic conditions in Australia and globally; ability for Metallica to fund its activities; exchange rates; production levels or rates; demand for Metallica's products, competition in the markets in which Metallica does and will operate; and the inherent regulatory risks in the businesses of Metallica. Given these uncertainties, readers are cautioned to not place undue reliance on such forward-looking statements.

CAPE FLATTERY SILICA

PRE-FEASIBILITY STUDY

MARCH 2022

METALLICA MINERALS LTD


Research shows just one kilogram of polysilicon — a refined material made from silica — saves more than 7,000kg of CO_2 emissions during the lifetime of a solar panel and increasing the development of solar panels could reduce CO_2 emissions by 21% by 2050.
CAPE FLATTERY SILICA

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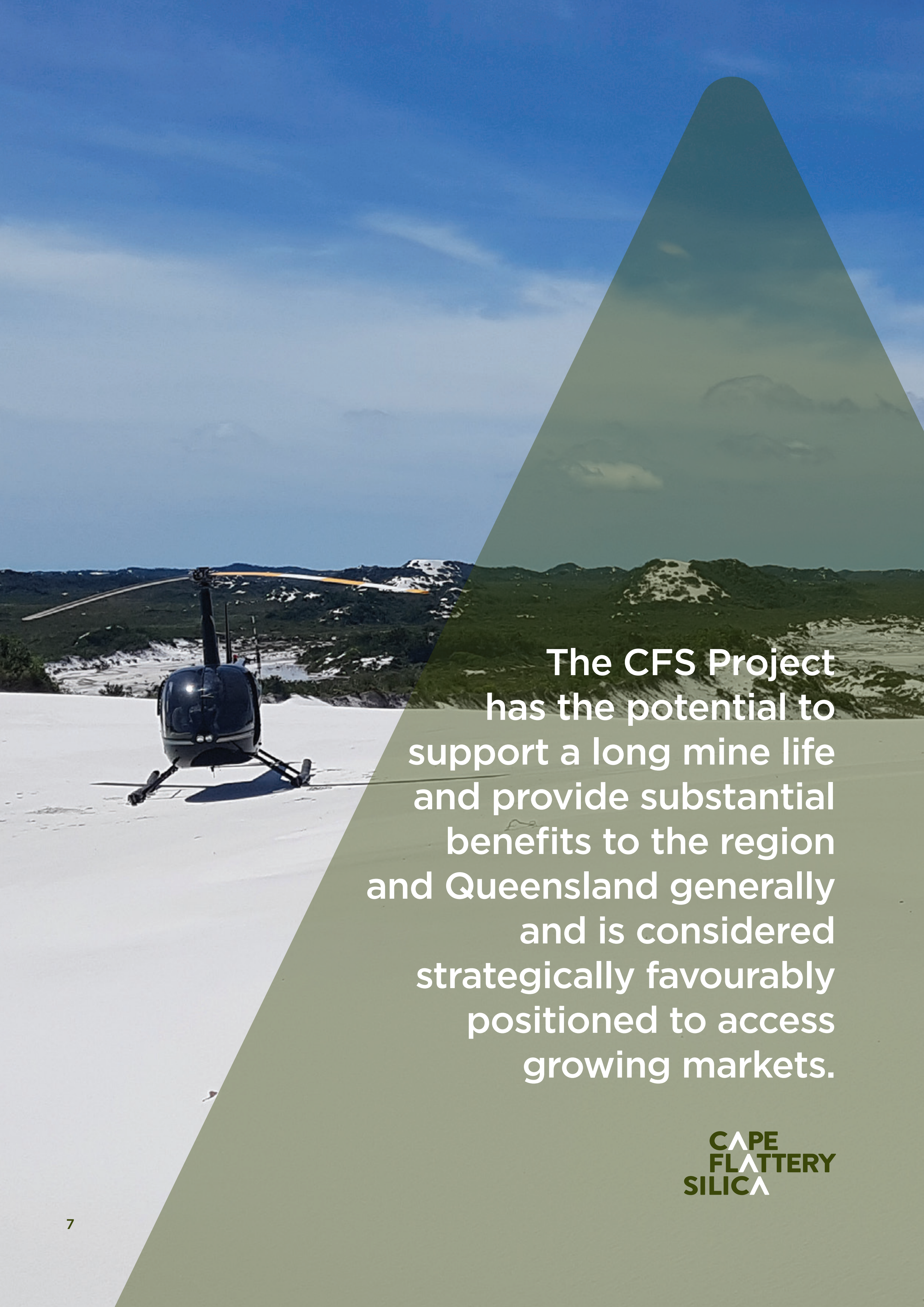


The CFS Project has the potential to support a long mine life and provide substantial benefits to the region and Queensland generally and is considered strategically favourably positioned to access growing markets.

CAPE FLATTERY SILICA

1.0 Introduction

Metallica Minerals Limited (Metallica) is an ASX-listed silica sand exploration and development company (ASX: MLM) developing silica sand assets in Queensland, Australia.

Metallica's Cape Flattery Silica Sand Project (CFS) is a highly prospective development being progressed at Cape Flattery in Far North Queensland (see Figure 1.1). Metallica's proposal is to extract and process raw sand to produce a silica sand product of suitable quality for glassmaking and foundry industries. Export by ship is planned from Cape Flattery to glass manufacturing and foundry companies, most likely in Asia.

The Project area is bounded by the Cape Flattery coastline in the Cape Flattery Port area (Figure 1.2), which is owned and operated by Ports North, a Queensland Government-owned corporation. Ports North owns the Mitsubishi-leased jetty, just south of the Project's tenement, with the jetty's ship-loading equipment primarily owned by Mitsubishi Corporation (Mitsubishi).

This Pre-Feasibility Study (PFS) builds on the 2021 Updated Scoping Study (ASX release: Cape Flattery Silica Sand Project Production Target, 10 November 2021). The Updated Scoping Study confirmed the CFS Project's high-quality silica sand can be delivered via a low-cost operation, with capacity to generate strong financial outcomes.

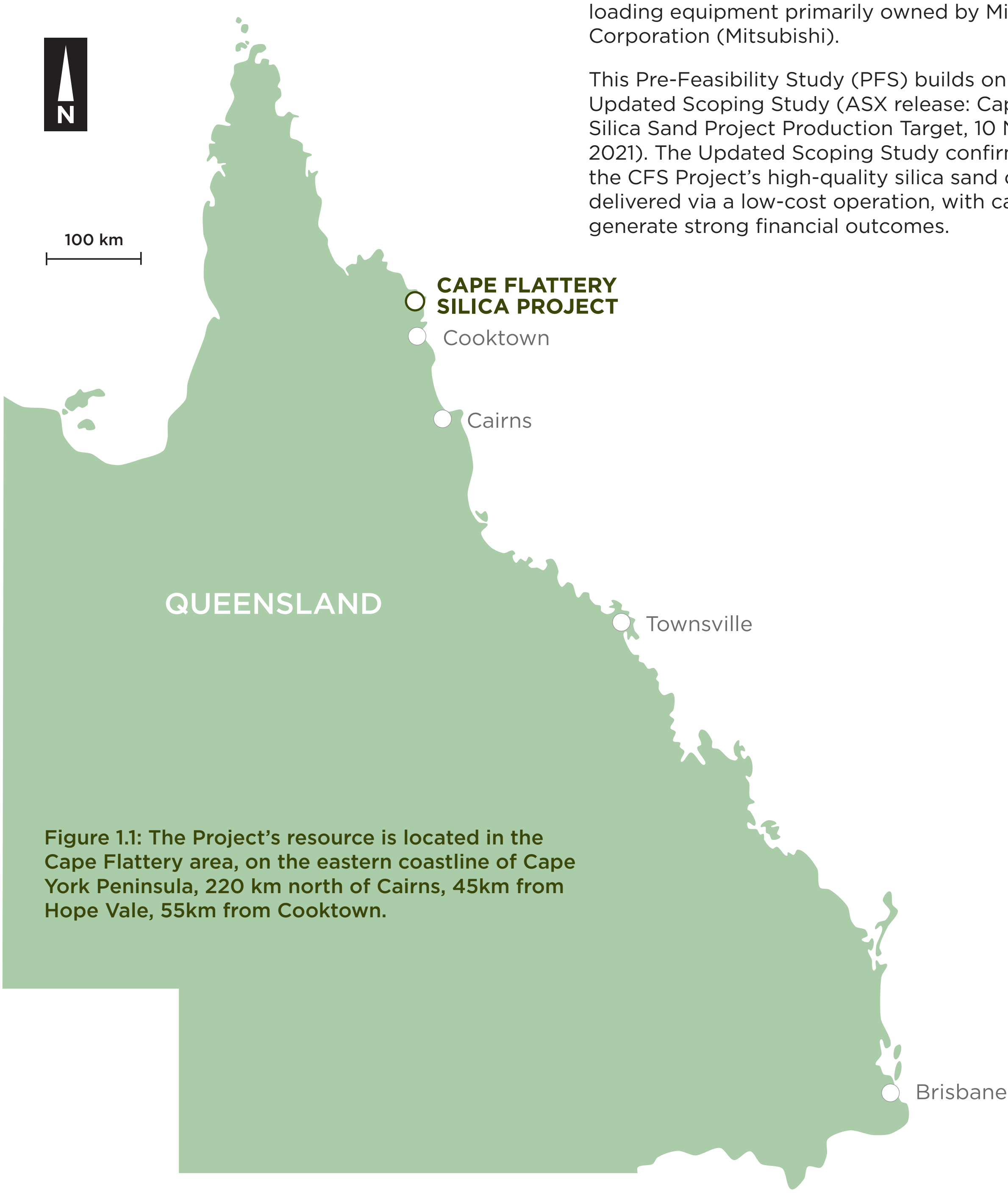


Figure 1.1: The Project's resource is located in the Cape Flattery area, on the eastern coastline of Cape York Peninsula, 220 km north of Cairns, 45km from Hope Vale, 55km from Cooktown.

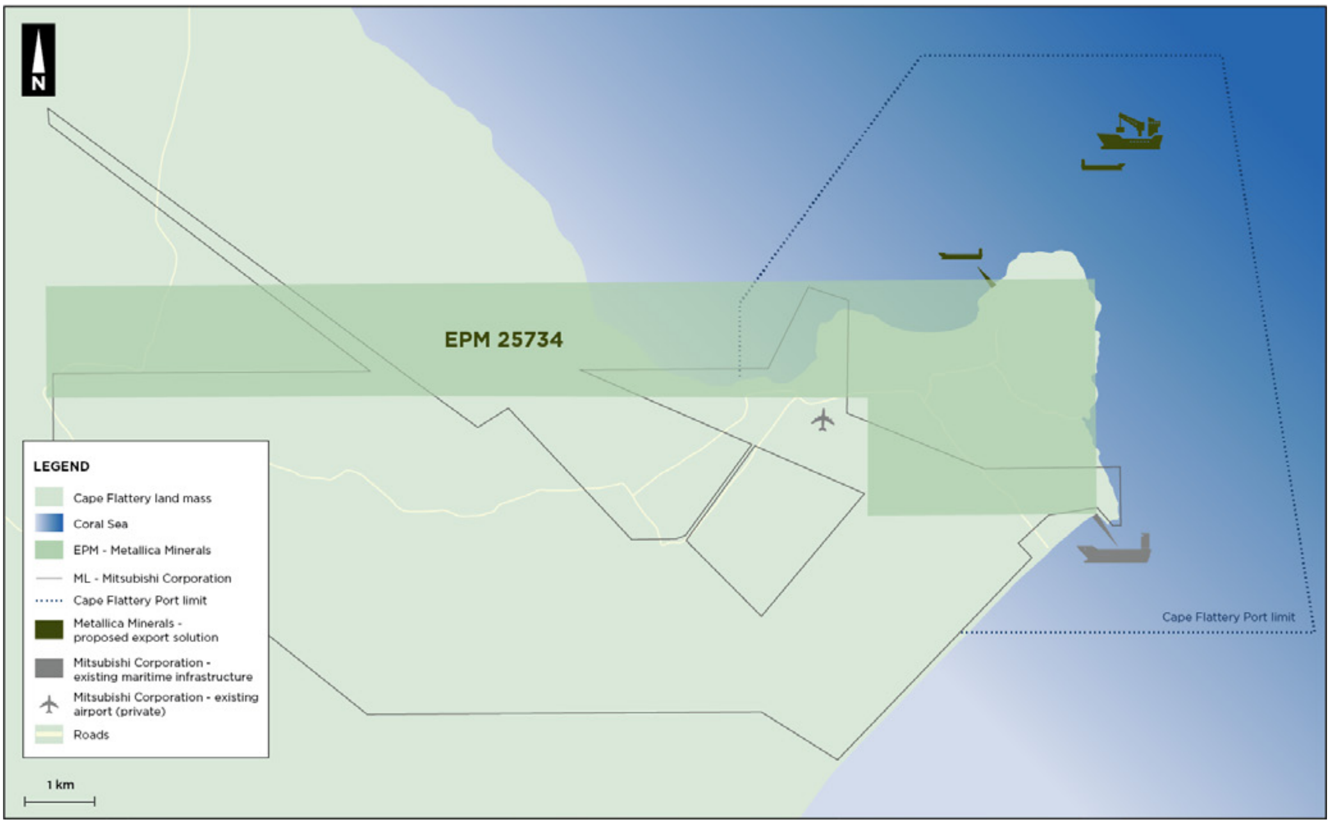


Figure 1.2: Cape Flattery Port location and Project proximity

2.0 Strategy

2.1 Introduction

CFS's clear vision is to become a leading Australian silica sand developer, producing and supplying high-quality silica sand, delivering shareholder value and benefits to all stakeholders. An important part of the transition to a low-carbon economy and the development of 'new economy' minerals in Australia, the Project's focus on fast-tracking development, scalability, size of the resource and expected high-quality silica sand product sets CFS apart from other silica sand developers. The aim is to exploit the forecast increasing demand for silica sand products, resulting in potential long-term improvements in prices and price stability.

2.2 Strategic scope

The CFS Project is a highly prospective development, proposing to extract and process raw sand from the extensive resource on the Cape Flattery site.

Mitsubishi is well-established in extracting and exporting high-purity silica sand from Cape Flattery. The CFS Project, adjacent to Mitsubishi's mining operations, has the potential to support a long mine life and provide substantial benefits to the region and Queensland generally, and is considered strategically favourably positioned to access growing markets.

Preliminary metallurgical analysis indicates the Project's silica sand attributes have the potential to produce saleable products that meet global glassmaking and foundry industries' specification requirements, however CFS expects glass manufacturing to be the primary market that is supplying solar panel manufacturers.

2.3 Strategic summary

The Project's development will transform CFS (and Metallica) from an exploration company into a producer with potential to be a significant player in silica sand industry.

Market factors supporting this strategic rationale and CFS's value opportunities for CFS are summarised in Section 3 - Market analysis (sales and marketing).

Silica Sand market growth

Used in glassmaking, foundry casting, water filtration, chemicals and metals, hydraulic fracturing process requirements, high-tech products, and solar panels.

Future global market

Forecast growth from US$7b to US$20B in 2024

Current global market

Compound annual growth rate of around 6% between 2010 and 2017, with 188Mt of silica sand produced in 2017

Strong demand for processed high-purity silica (>99.9% SiO_2) with low iron (100ppm) for high-tech products.

Source: IMARC Group (IMARC)

Key strategic benefits for CFS and the region

» Economic benefits for nearby townships of Hope Vale, Cooktown and Far North Queensland regions – employment, local contractors and service industries

» Contribute to growing global demand for silica for key industries including solar panel manufacturing (a key component of the renewable energy industry)

» Royalties for Traditional Landowners and the Queensland Government

Achieving the CFS vision

» Become a major producer supplying the emerging demand

» Capitalising on the Project's strategic location and geological resource

» Returning shareholder value based on forecast pricing for silica sand.

Advantages

» Australia is a Tier One global mining jurisdiction

» Silica sand product will match forecast customer demand

» Traditional processing will underpin reduced technical risk and speed to market

» Experienced Board and management team with expertise in mining sectors.

CAPE FLATTERY SILICA

3.0 Market analysis

3.1 Silica sand marketing

CFS has engaged a Hong Kong-based marketing consultant, Prime Gain, to study the current trends in demand and pricing for high-grade silica sand.

Demand is underpinned by global growth drivers, including accelerating electrification of the world, government carbon-neutrality policies, and the structural transition from fossil fuels to greener technologies, in particular solar energy.

Silica sand is used for glassmaking, foundry casting, water filtration, chemicals and metals, hydraulic fracturing and an increasing number of high-tech products, including solar panels. For example, in the global glassmaking industry, a major consumer of high-purity silica has experienced significant growth recently from the construction and automotive industries. IMARC also estimated the global silica sand market could grow from US$7bn to US$20bn in 2024[1].

Solar panels require photovoltaic (PV) glass, which uses high-grade silica sand as a key component. China is the leading global producer. Solar PV capacity has grown 20-fold over the past decade and is set to triple over the following decade[2].

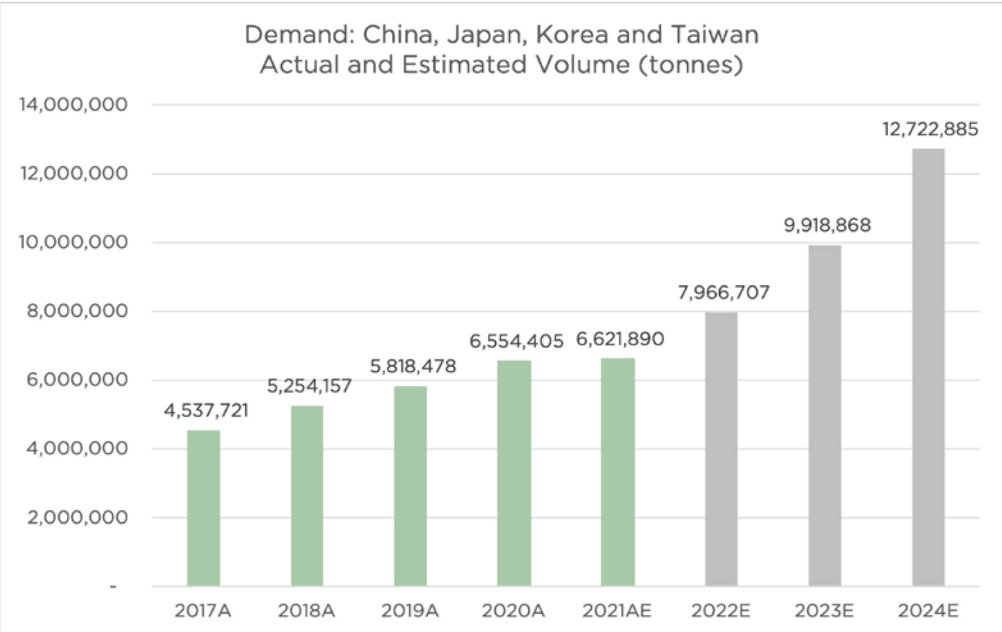


Figure 3.1: Actual and estimated demand for silica sand from the major Asian buyers (China, Japan, Korea and Taiwan), 2017 to 2024, in tonnes

The Asian demand for imported silica sand over the past five years has a Compound Annual Growth Rate (CAGR) of 9.1% by volume, with main buyers continuing to be China, Japan, Taiwan and South Korea. Total volume to be taken up by these main buyers for the full 2021 year is estimated to be 6.7Mt.

1 Silica Sand Market: Global Industry Trends, Share, Size, Growth, Opportunity and Forecast 2022-2027

2 Silica Sand Market Report, Prime Gain Limited, 6 December 2021

Figure 3.2: Imports of silica sand to major Asian countries over the period 2017 to 2021 (2021 to October extrapolated out to full year) in tonnes.

Demand has been led by China with a CAGR of 44.1% over the period, although demand tapered in 2020 to 2021. China will take up 52.3% of the demand volume in 2021[3], while demand from other major buyers has remain flat or softened.

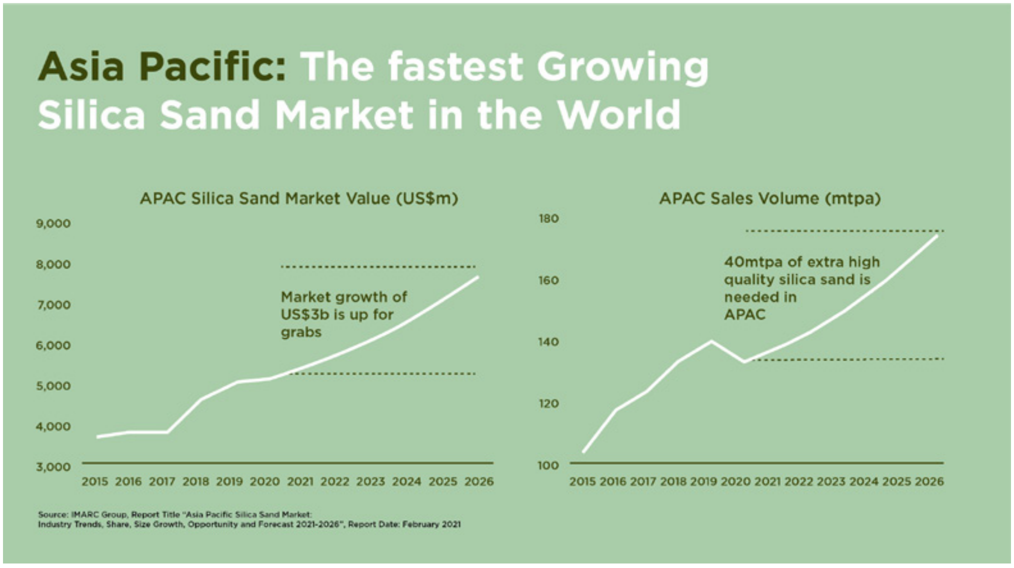
Using a 'sum-of-the-parts' methodology and aggregating forecast demand based on the CAGR of each major Asian buying country (China, Japan, South Korea, Taiwan), demand is estimated to reach 12.7Mt by the end 2024. This demand will continue to be largely driven by China.

China maintains a massive scale advantage in solar panel manufacture. In 2020, the top five Chinese solar glass producers had a 68.5% share of the global market's capacity. In terms of how much glass goes into the production of a solar panel, assuming 3mm glass, 96% of the weight of a thin-film module and 67% of a crystalline module is glass. The cost structure of solar glass is mostly split between soda ash and quartzite ore estimated as 37 – 41%, and power 40 – 41%[4].

Technology advancement in bi-facial solar cells — estimated to account for 40% of all production by 2025, looks to further underpin the demand for PV glass and suitable high-grade silica sand.

3 Silica Sand Market Report, Prime Gain Limited, 6 December 2021

4 Silica Sand Market Report, Prime Gain Limited, 6 December 2021



Supply competition in silica sand has increased from Malaysia, and more recently from Indonesia which entered the market in 2020 and exports almost exclusively to China. Indonesia has a moratorium on the export of silica sand unless it is at an $SiO_2 \geq 99.5\%$ but was on track to export 1.3Mt in 2021.

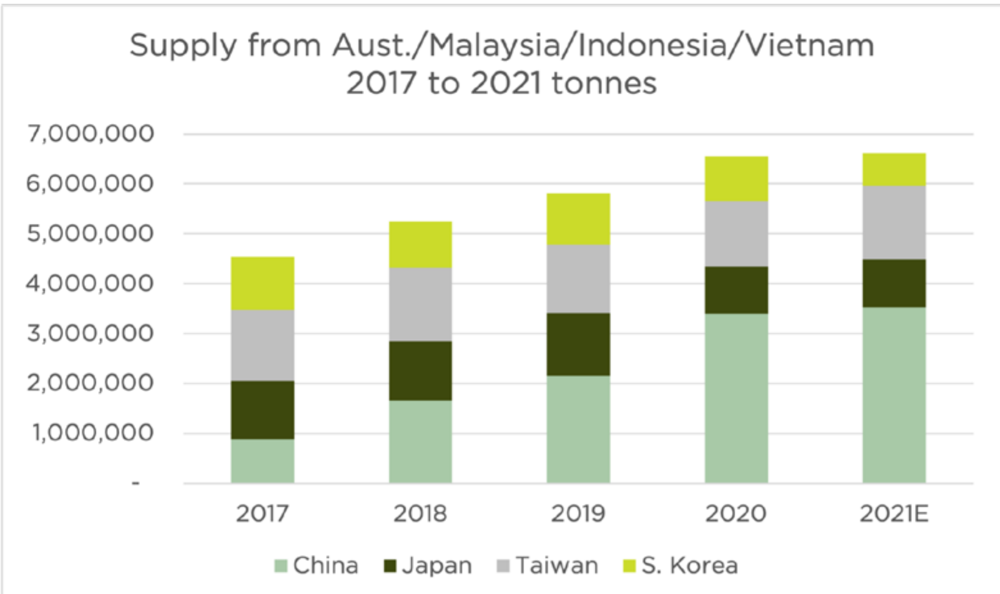


Figure 3.3: Regional import demand of silica sand from key Asia-Pacific suppliers over the period 2017 to 2021 (2021 to October extrapolated out to full year) in tonnes

When matching the supply from Australia, Malaysia, Indonesia and Vietnam against regional demand, it becomes clear that a significant proportion has been met with additional Asian supply, in particular from Malaysia and Indonesia.

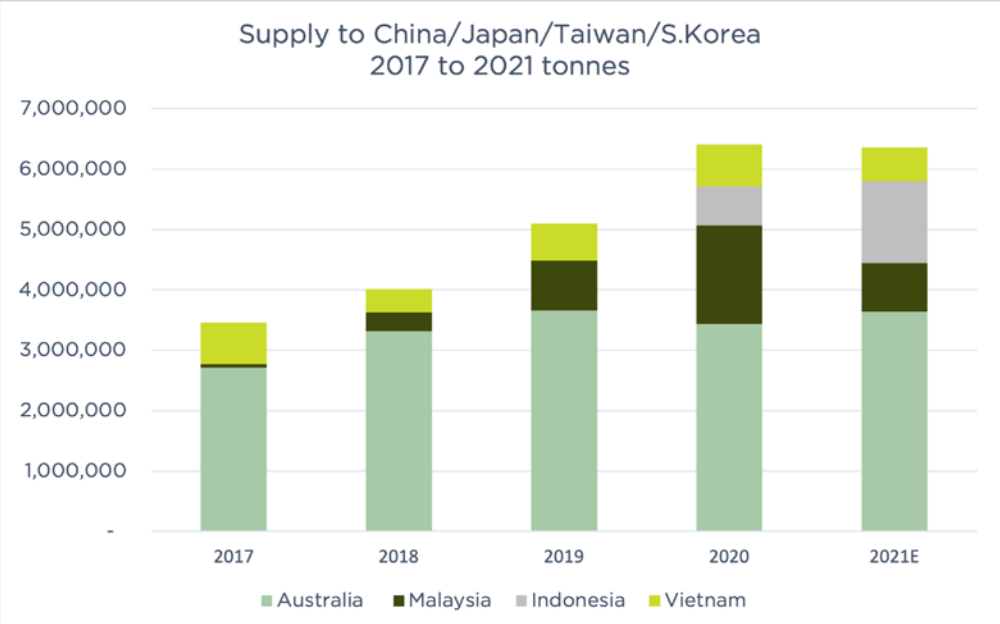


Figure 3.4: Regional export supply of silica sand to major Asian importers over the period 2017 to 2021 (2021 to October extrapolated out to full year) in tonnes

Prime Gain advised that "a high-grade Cape Flattery silica sand product could reasonably achieve FOB pricing of A$55.56 to $A75.00 per tonne, subject to various market conditions and variables."

> **For the purposes of the PFS, CFS has used USD47.50/A$63/t and FOB price for the financial modelling of the Project's economics.**

Table 3.1: Prime Gain pricing analysis — supply of high-grade silica sand FOB and CIF commencing 2023 Q4 from Australia to the China market using forward ocean freight rates

Pricing estimate for a high-grade Cape Flattery product onstream 2024	Low-range estimate	High-range estimate
FOB AUD/t	55.56	75.00
FOB USD/t	40.00	54.00
Ocean Freight USD/t	21.50	21.50
CIF USD/t China	61.50	75.50

CFS has noted that shipping costs are currently high. Prime Gain has consulted with shipping consultants who have estimated a softening in future shipping costs.

4.0 Geology and mineral resources

4.1 Introduction

In mid-2021, Metallica commissioned Ausrocks Pty Ltd (Ausrocks) to complete an Upgraded Mineral Resource Estimation (MRE) on the CFS Project. This work follows a Maiden Mineral Resource Estimate (ASX announcement 30 November 2020), an Upgraded Mineral Resource Estimate (ASX announcement 31 March 2021), and an Upgraded Mineral Resource Estimate (ASX announcement 21 October 2021). All estimations were completed by Ausrocks.

The Project lies within EPM 25734. EPM 25734 is held by Cape Flattery Silica Pty Ltd (CFS), a wholly owned subsidiary of MLM, and comprises 11 contiguous sub-blocks covering the northern end of the extensive Cape Bedford/Cape Flattery dunefield complex. Large northwest-trending transgressive elongate and parabolic sand dunes, stretching kilometres inland from the coast, characterise the dunefield.

4.2 Drilling and sampling

Exploration data, results and interpretation used for the Mineral Resource Estimate are:

- Queensland Globe (Qld Government), World Imagery aerial photos and acquired LiDAR Surface Contours & Image (2021) with sub-meter accuracy.
- Eight (8) shallow (5m) hand-auger holes drilled in 2019 and associated field work. Auger coverage is restricted to the western side of the resource area and spaced approximately 400m apart. Twenty-two (22) vacuum drillholes drilled in December 2020 and associated field work. Holes were drilled along the resource's western side, traversing in the north to the east, then down the eastern side of the resource. Drill spacing is along mainly existing tracks drilled approximately 200m apart. The central and southern part of the potential resource received only limited drill coverage due to lack of access. All holes were drilled vertically to a determined basement or refusal level, with 100% sample recovery received throughout. The drilling has facilitated supplying sufficient silica sand material for the metallurgical bulk testing, which commenced in February 2021.
- Ninety-eight (98) vacuum drillholes were drilled between July and August 2021 which included the clearing of new drill lines and associated field work. The vacuum drilling was more widespread and detailed over the wider Project dunefield area. Vacuum holes were extended at depth until they were terminated at a determined basement or refusal from intersecting water.

L-R: Nathaniel Walker, Naamon Walker, Niall Corbus, Vernon Yoren, Shailand Deeral-Rosendale and Trenton McLea

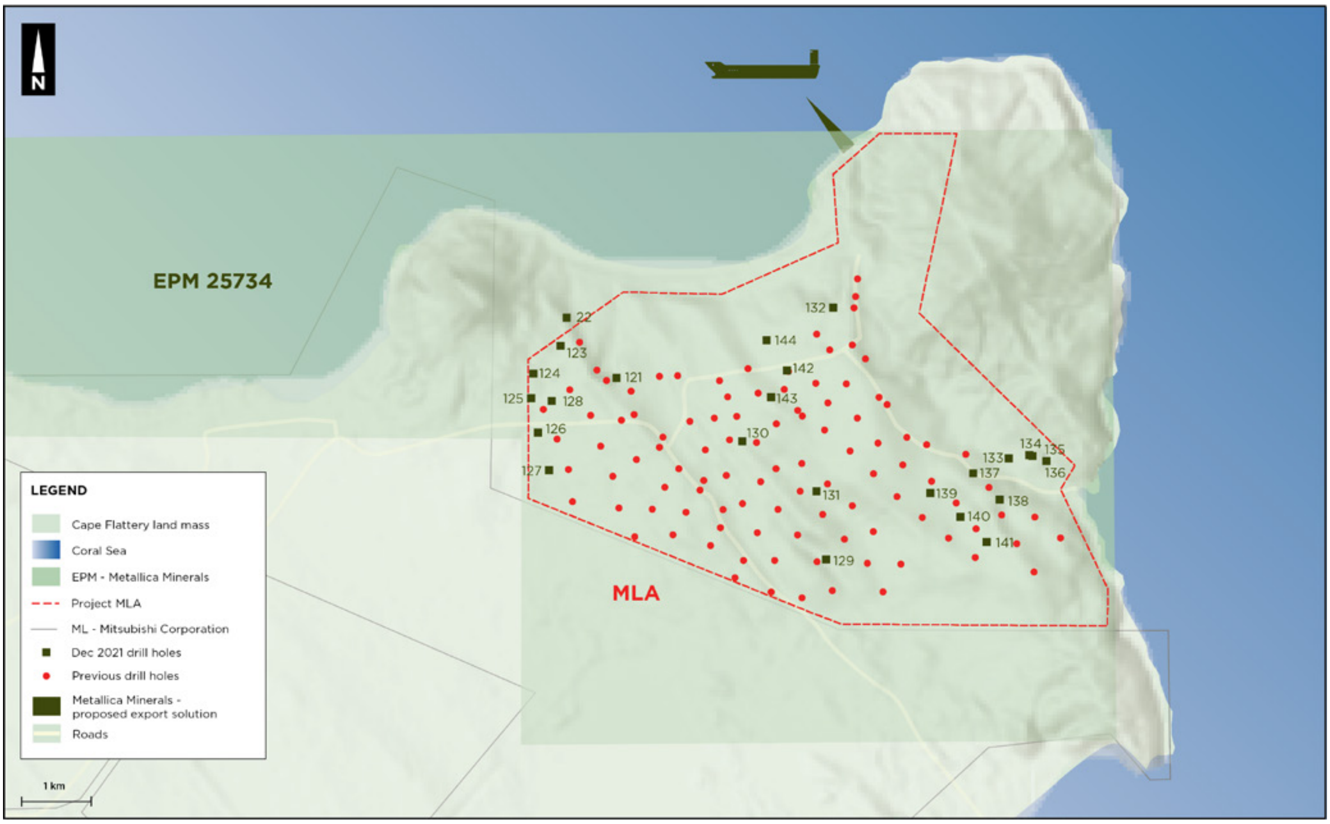


Figure 4.1: Drilling at CFS November 2022 (red labels) and July 2021 (blue labels)

4.2.1 Assays, density and cut-off grade

All assaying has been carried out by ALS Laboratories, Brisbane — a global leader with over 71 laboratories worldwide and ISO/IEC 17025:2017–accredited. ALS is NATA Accredited, Corporate Accreditation No. 825, Corporate Site No. 818.

Assaying was carried out on all (1) metre samples from the drilling and auger holes. Assaying was primarily to determine the SiO_2%.

A final checked assay file for SiO_2, Fe_2O_3, Al_2O_3, LOI and TiO_2, was adopted and incorporated for the modelling and estimation. No correction or adjustment to the assays and assay totals has been made for LOI. A total of 2,229 SiO_2 assays were used in the estimation.

Density measurements were taken on 39 sites throughout the area ranging from 1.50 - 1.66t/m^3 with an average 1.6t/m^3 adopted for the tonnage calculations.

A SiO_2% grade cut-off was used to define the in-situ resource to achieve a marketable high purity silica sand.

A topsoil layer from surface (0.5m) was excluded from the Mineral Resource Estimate.

4.3 Resource summary

The Mineral Resource Estimate was completed in accordance with JORC Code 2012 guidelines with Micromine 2021 used to model and evaluate the resource.

Statistics: A final checked assay file formed the basis for the estimation. Histograms were generated from this file and the block models generated for SiO_2, Fe_2O_3, Al_2O_3, LOI and TiO_2. Silica had a range of values from 91.34% to 100% with a mean of 99.12% and the main contaminant Fe_2O_3 had a range of 0.01% to 3.41% with a mean of 0.138% with approximately 84% of the data falling under 0.2% of the total material volume. For Fe_2O_3, levels there are no values that are below the detectable limit which is (<0.01%).

Model Boundaries: Surface and basement models (base of white sand) were generated. The surface boundary was generated by a combination of the interpreted geological boundaries and mining lease boundaries. A topsoil or humus layer of 0.5m was excluded from the model. A 400m limit was used to guide drillhole continuity where information became sparse or non-existent.

The base of the resource model was determined from selected drillhole depths (silica cut-off), then modelled and adjustments made for intersections with surface topography and other continuity limits. The model was further controlled by cross section checks. A west-to-east cross-section is shown in Figure 4.4 and 4.5.

Modelling: Blocks of 10m (L) × 10m (W) x1m (H) with sub-blocks 5m (L) × 5m (W) × 0.5m (H) were used to generate the block model. The blocks were constrained by the model boundaries and populated by the Ordinary Kriging (OK) estimation method to interpolate assay grades for each of the chosen elements (SiO_2, Fe_2O_3, Al_2O_3, LOI and TiO_2). Inverse Distance Weighting (IDW - 4:1) was used to check the model and yielded similar results.

Estimation checks/validation: The block model was checked to validate the interpolation technique with swath plots and histograms showing the methods are comparable. Micromine 2021 was extensively utilised to validate data and refine the model parameters and assumptions.

Drill spacing and interpreted geological continuity has allowed three resource categories to be defined and are detailed as follows:

- **Measured Mineral Resource:** Area with drillholes completed at semi-gridded spacing <150 × 150m ending in basement/water table;
- **Indicated Mineral Resource:** Area with drillholes at a confirmatory level spacing 150 – 250m ending in basement/water table; and
- **Inferred Mineral Resource:** Areas with drillholes at a scout level spacing 250 – 400m.

The locations of the three resource categories are shown in Figure 4.2. The estimated Mineral Resource covers an area of approximately 315ha with an average thickness of approximately 17m.

The results of the upgraded Mineral Resource Estimate of the Project's eastern resource area provided in Table 4.1.

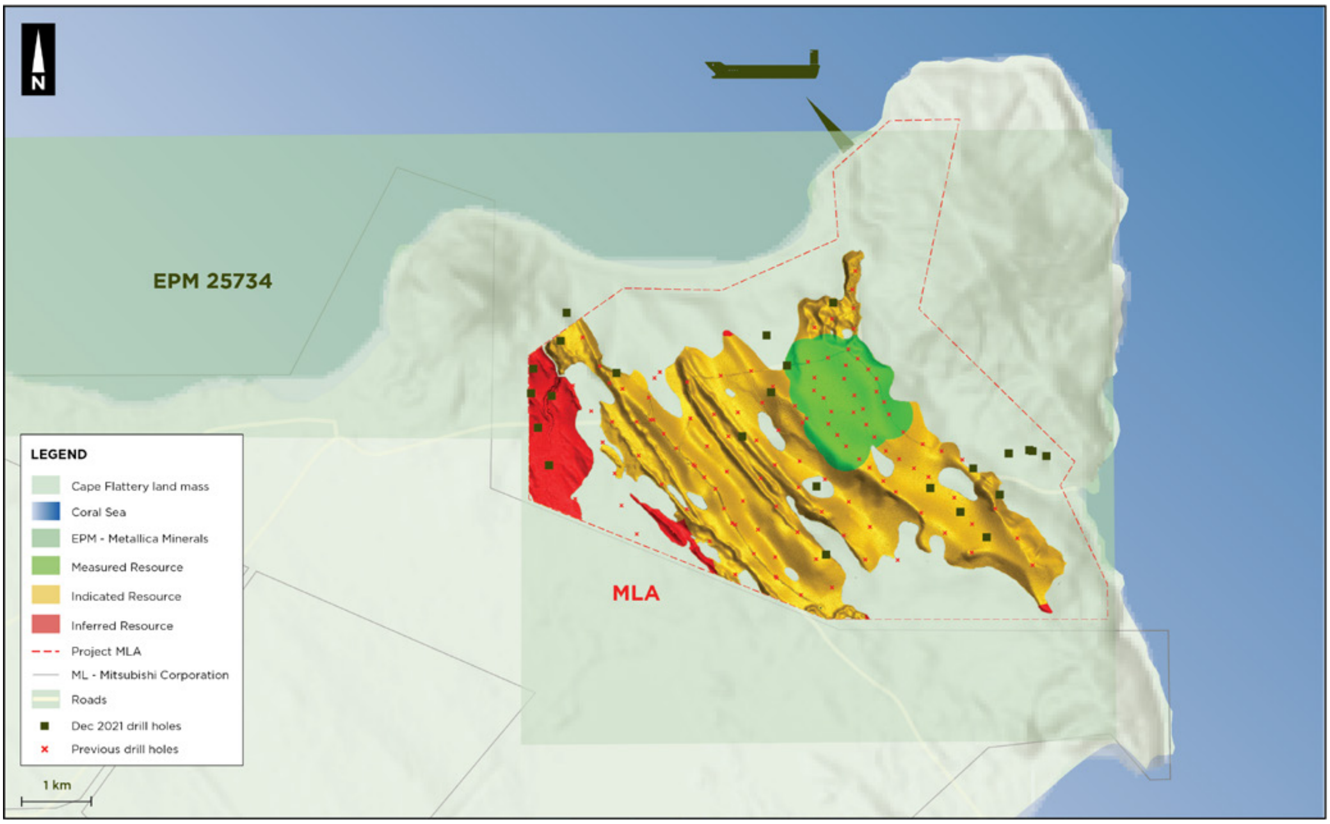
Table 4.1: Resource Area Cape Flattery Silica Project

Resource Category	Silica Sand Mt	SiO_2 %	Fe_2O_3 %	TiO_2 %	LOI %	Al_2O_3 %	Density t/m^3	Silica Sand Mm^3
Measured	9.55	99.29	0.10	0.13	0.18	0.08	1.6	5.97
Indicated	38.25	99.15	0.13	0.14	0.19	0.12	1.6	23.91
Inferred	5.66	99.26	0.11	0.11	0.18	0.16	1.6	3.54
Total	53.46	99.19	0.12	0.14	0.19	0.12	1.6	33.41

For further details, refer to ASX Release: 21 October 2021 'Revised 40% increase of the Cape Flattery Silica Sand Resource to 53.5Mt'.

The Mineral Resource Estimate has been reported in accordance with the JORC Code 2012. A cut-off grade of 98.5% has been defined based on the surrounding data. These results show there is good potential to produce a premium grade silica product using standard processing techniques.

Figure 4.2: Cape Flattery Silica Sand Project – eastern resource area



Signing of the ACHA – Walmbaar Aboriginal Corporation Chairman, Shailand Deeral-Rosendale and Directors, Pauline McLean and Travis Bally with Metallica Executive Chairman Theo Psaros March 2021

Figure 4.3: Schematic cross section (west to east) through block model

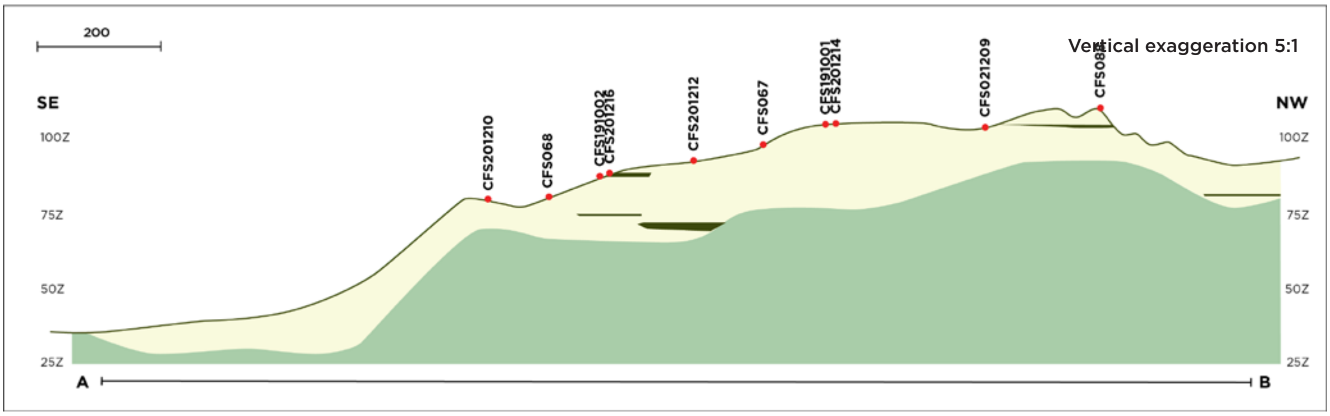
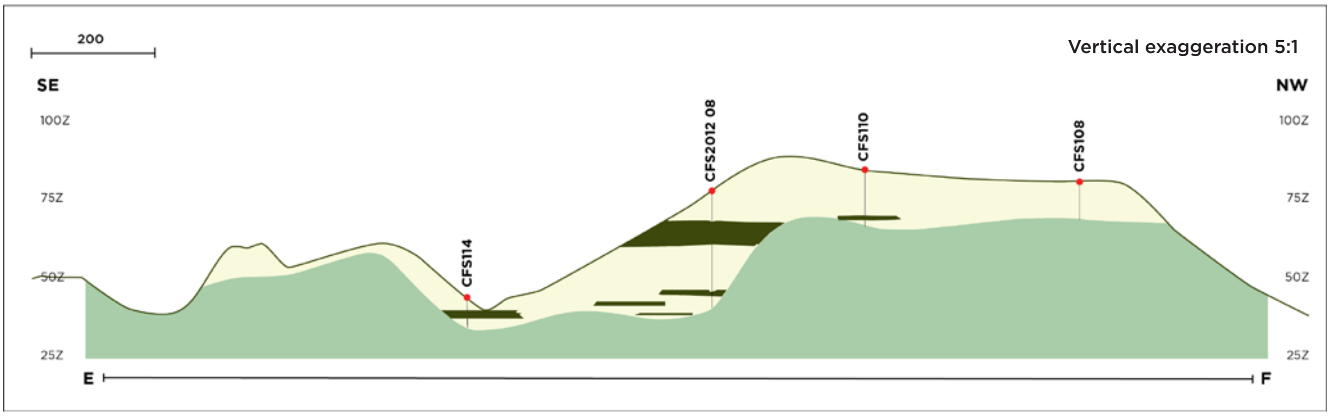
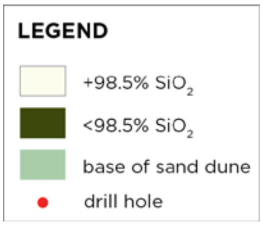


Figure 4.4: Schematic long section (south to north) through block model





Campaigns of vacuum drilling, hand auger and field work have substantiated that high-grade silica sand (SiO_2 >98.5%) with relative low iron (Fe_2O_3 <0.12% or 1200ppm) is present across the wider Project area.

Assaying by XRF method has consistently returned high silica grades throughout the deposit area, including assaying for a range of trace element oxides. Relevant contaminants are Fe_2O_3 and to a lesser degree Al_2O_3 and TiO_2 which have been investigated further and included in the resource estimation. The Fe_2O_3 distribution is not fully understood, and given it is a sensitivity for end products it requires further investigation.

The resource boundary has been defined through geological contact on the eastern side, mining lease boundary along the southern and north-western sides, resource drilling along the western side and a combination of resource drilling and topography on the northern side. The resource floor is defined by drill intercepts to form a 3D grid using Micromine with outer perimeter conservatively daylighted to the topography. The surface is defined by LiDAR topography with an assumed constant thickness of topsoil. The topsoil thickness is subject to variation throughout the site due to topographic and erosional characteristics.

The completion of a confirmatory drilling program has enabled a better understanding of the dune geology and an improved understanding of the geological controls.

The known nature and formation of the dune sands, together with consistent high silica grades achieved in drillholes, places a high degree of confidence in the geological interpretation. Continuity of geology (chip tray photographs) and grade (assays) can be readily identified and traced between all drillholes. Light-coloured (i.e. cream, light brown) iron-oxide-stained sands occur as interburdens, whose distribution and continuity are not fully definable. Their occurrence is sporadic but being the major contaminant, these sands need further investigation and definition. Notwithstanding, the overall interpreted geology of the CFS deposit is robust, and any alternative interpretation of the deposit is considered unlikely to have a significant influence on the total Mineral Resource Estimate undertaken.

The outcome of this Mineral Resource Estimate is summarised as follows:

- Total Measured, Indicated and Inferred Mineral Resource Estimate of 53.46Mt at 99.19% SiO_2, (October 2021) which represents a 39.6% increase on the previous Mineral Resource of 38.3Mt (March 2021).
- Measured Mineral Resource Estimate of 9.55Mt at 99.29% SiO_2, which represents 17.9% of the total (53.46Mt) Mineral Resource that has been identified.
- Indicated Mineral Resource Estimate of 38.25Mt at 99.15% SiO_2, which represents 71.5% of the total (53.46Mt) Mineral Resource that has been identified.
- Inferred Mineral Resource Estimate of 5.66Mt at 99.26% SiO_2, which represents 10.6% of the total (53.46Mt) Mineral Resource that has been identified.

5.0 Ore Reserve

5.1 Introduction

Ausrocks was engaged to carry out an Ore Reserve Estimate for the CFS Project (Project) on behalf of Metallica. The PFS has been compiled concurrently to consider the application and description of all the modifying factors, the outcomes of the PFS have been used to guide the Ore Reserve Estimate. In-house sand extraction expertise was utilised along with the input from a range of specialist consultants who contributed material components to the overall study. These consultants and personnel have consented to the information used in the context in which it appears in this document. The PFS and ore reserve inputs are listed in Table 5.1.

Table 5.1: PFS and ore reserve inputs

Expert person/company	Area of exptertise
Metallica (Pat Smith)	Exploration Data
Ausrocks (Brice Mutton, Chris Ainslie & Carl Morandy)	Mineral Resource Estimates
Mineral Technologies (Fred Woodall)	Metallurgical Test Work and Processing Plant
WAVE International (Steve Bradford)	Civil Design & Processing Infrastructure, Project Execution, Risk & Logistics
Ausrocks (Chris Ainslie & Carl Morandy)	Sand extraction and Ore Reserve
Epic Environmental (Maria Mahon)	Environmental & Social
Metallica (Nicholas Villa)	Project Management
Metallica (Scott Waddell) & WAVE International	Financial Modelling
Metallica (Theo Psaros)	Marketing

5.2 Proposed mine plan

5.2.1 Sand extraction method selection

The deposit is in a remote region, close to the surface with only a limited vegetation and topsoil covering. Based on these characteristics, the deposit is amenable to open-cut sand extraction methods. Underground mining methods are not justified.

Due to the environmental sensitivity of groundwater and relative lack of interaction between the working face and groundwater table, dry sand extraction methods are proposed. Historically, dredging is known to have occurred in similar style deposits but is not considered feasible for this operation. Dry sand extraction can be carried out by a variety of equipment types commonly including bucket wheel excavators, dozers, excavators and wheel loaders. The deposit has an undulating base with waste sand interburden and a requirement for sand extraction selectivity and blending to achieve plant feed grades. Based on these requirements, the wheel loader excavation method has been selected; however, a dozer and excavator are included in the support fleet if required. Wheel loaders are predominantly used for extraction in the neighbouring Mitsubishi operation and represent a good blend of operation flexibility, productivity and scalability.

To transport the material from the mine face to the plant requires a flexible and extendable system as the sand extraction face moves further from the plant during the sand extraction life. Various options were considered, including conveyors, slurry pumping and truck haulage. Each has advantages and disadvantages for CapEx and OpEx but for the purposes of the PFS, slurry pumping has been selected as the preferred method. This option requires a mobile feed unit at the sand extraction face, which includes a grizzly, screen, slurry tank and pump, and poly pipes are then used to pump material to the infrastructure area where it is fed into the processing plant. Slurry pumping provides a good balance between upfront CapEx and long-term efficiency.

5.2.3 Mine survey and reconciliation

A mine survey system will be established to enable regular and accurate reconciliation of mined areas. The mine survey will be regularly updated using site generated survey data from unmanned aerial vehicles (UAVs) or ground surveys. Sand extraction equipment may also be equipped with GPS guidance to enhance the survey control.

Reconciliation with mineral resources and ore reserves will be prepared on a regular basis using inputs from sand extraction plant, processing plant and shipping records. Site management will perform the reconciliation and updates to the mineral resource, and reserve statements will be released to the ASX at regular intervals.

5.2.4 Pit optimisation

Silica sand is a bulk commodity with limited overburden, broadly consistent in SiO_2 grade and variable contaminant grades (Fe_2O_3, Al_2O_3, TiO_2 etc).

Pit shell optimisation was carried out manually using the following parameters:

- Perimeter of the pit where it daylights to the surface based on the geological assumptions, or at a batter angle of 30 degrees where the pit meets the ML boundary
- The base of the pit is predominantly defined by the modelled undulating geological floor profile (>98.5% cut-off), except in the southwestern corner where a buffer is maintained to the estimated water table level.

Pit optimisation has been completed manually using the block model and Surpac Software. Several factors were considered for the sand extraction commencement point, including proximity to the BLF, the highest-confidence resource (Measured) and the lowest-contaminant grade zones. The northeast portion of the resource was selected as the sand extraction commencement point and progressing to the south targeting Fe_2O_3 grades of <1,200ppm for the first five years to enable consistent feed to the plant. Overall the average thickness of sand extraction within the reserve pit shell is 12.03m.

A portion (<5%) of the mineral resources were not converted to ore reserves due to being lower confidence (Inferred), being within the ML boundary buffer, within the TEC buffer, within batter slopes or near the water table. Additionally, several interburden layers with high Fe_2O_3 have been designated as waste, and additional metallurgical testing is required to prove the viability of these materials.

5.2.5 Sand extraction methodology

5.2.5.1 Vegetation clearing

Each stage of the mine schedule will be marked out by site surveyors with appropriate buffers, tree protection zones and offsets. The proposed clearing area will then be assessed for cultural heritage to comply with the conditions of the approval. Vegetation clearing of shrubs and trees will be undertaken by a dozer in a systematic pattern. A fauna spotter catcher will be employed for the duration of the vegetation clearing process. Vegetation will be pushed downslope to the boundaries of the clearing area where it will be stockpiled. In some areas with dense vegetation, mulching may be required to reduce the space required to store the vegetation matter, with mulch used during the rehabilitation process.

5.2.5.2 Topsoil removal

Topsoil stripping will be completed using a dozer or grader with separation of the soil and sub-soil horizon to an average depth of 500mm. Topsoil will be stockpiled in 2m high (maximum) piles at the boundary of the clearing area. In future years topsoil may be carted directly by loader and articulated dump truck to new rehabilitation areas to assist with maintaining viability of the soil for regeneration. Through appropriate topsoil management, the viability of rehabilitation will be increased.

5.2.5.3 Sand extraction

Once the dune sand is exposed, sand extraction can commence with direct loading from the face by a wheel loader. The loader will tram from the face to the mobile feeder unit, with tram distances up to 250m expected with productivity calculations. Several sand extraction faces within a single extraction area may be open at one time, which enables grade control to be carried out during the sand extraction process. If waste blocks are encountered (planned or unplanned) the wheel loader will load articulated dump trucks or direct dump the waste material behind the advancing face. It is anticipated that colour variation will be the main identification process for waste blocks. The extraction floor is anticipated to follow the resource base, which is undulating but predominantly contains slopes <18 degrees.

5.2.5.4 Transport to processing plant

Extracted sand from the face is loaded directly to a mobile feed unit located <250m from the sand extraction face. This unit contains a grizzly and trash screen to process coarse and woody debris. This material is anticipated in low volumes and will be side-cast by the feed unit and direct-dumped by the wheel loader behind the advancing face. Once through the trash screen, sand is fluidised in the sump and pumped via pipelines to the processing plant. Additional pumps will be required once the sand extraction face advances further from the plant. It is anticipated that the feed unit will be relocated on a regular basis to follow the advancing face.

5.2.5.5 Wet concentrator plant

The wet concentrator plant (WCP) is the processing plant designed to refine the sand to reduce heavy minerals, Fe_2O_3 and Al_2O_3 contaminants. It is located to the northeast of the sand extraction area, near to the BLF.

5.2.5.6 Reject transport and placement

The rejects from the WCP contain low-grade silica sand including heavy minerals, Fe_2O_3 and Al_2O_3. These occur naturally in the Cape Flattery region and do not pose a threat to the environment. Rejects will be pumped back to the active rehabilitation faces that trail the active sand extraction face. Rejects will be dewatered using a cyclone and stockpiled rejects will further dewater naturally due to the permeable strata. Once rejects are at a suitable water content, they will be reshaped to suit the final landform using a dozer and grader. The volume of rejects is anticipated to be 20% of the mined product, therefore it is anticipated there will be ample space available to place the rejects within the sand extraction void.

5.2.5.7 Topsoil placement

Topsoil will be dozed or grader-spread over the rejects and mined surface, at a minimum of 150mm thickness subject to viability assessment. Subsoil and topsoil layers will be replaced in order where relevant, and topsoil amelioration may be required to promote stability and regeneration. Topsoil placement will be scheduled at appropriate times during the year to minimise the risk of erosion prior to obtaining a self-sustaining cover.

5.2.5.7 Revegetation

Revegetation will occur naturally from the seed bank in the topsoil. Additional seeding with preferred species will be undertaken to suit the final landform. Seed mixes will be developed through consultation with the Traditional Landowners and through site-specific trials.

5.2.6 Operating parameters

The plant will be designed for continuous operation 24-hours per day, 365-days per year, with approximately 82% utilisation resulting in the nominal operating parameters. Feed rates unless specified otherwise indicate entry to screen feed box.

Table 5.2: Primary operating parameters

Item	Value	Unit
Feed rate - design flow	250*	tph
Annual feed hours	7,200	Hours p.a.

*Process variables provided are steady state design mass balance design data.

5.3 Ore reserve summary

The Maiden Ore Reserve Estimate has been prepared by Ausrocks on behalf of Metallica. In the competent persons opinion, appropriate consideration of sand extraction, processing, metallurgical, infrastructure, economic, marketing, legal, environment, social and government modifying factors have been completed. As a result, a proportion of the previously reported Measured and Indicated Mineral Resources have been upgraded to Ore Reserve status, in accordance with the JORC Code (2012) Guidelines. Areas within the CFS Eastern Resource Area meet the criteria to be classified as a Probable Ore Reserve with grades, volumes and tonnage shown in Table 5.3.

Table 5.3: Ore reserve summary

Ore Reserve Category	Tonnage Mt	SIO_2 %	FE_2O_3 %	TIO_2 %	AL_2O_3 %	LOI %	Waste Mt	Silica Sand Mm^3
Probable Reserve	46	99.18	0.12	0.14	0.11	0.19	2.6	28.76

6.0 Metallurgical test work

6.1 Introduction

6.1.1 Background

Metallica engaged MT to complete bulk sample processing and metallurgical sample characterisation test work for the Project, with the objective of developing a mineral process flowsheet that would produce high-purity silica sand suitable for photovoltaic glass manufacturing. The primary bulk sample provided was a 914kg composite. This was then bulk-screened to remove the oversize and to prepare a sample of -600µm + 106µm, which was used to produce a sample for characterisation.

MT is based at Carrara, Queensland, Australia and has developed substantial expertise in the field of mineral separation technology over a period of more than 80 years. This expertise is provided to the sand extraction industry worldwide and complements MT's equipment range and other services offered by the company. MT's Metallurgical Services test facility uses a comprehensive, documented, in-house quality system that includes standard work procedures for all facets of the operation. All chemical and mineralogical analyses are conducted by NATA-accredited service providers.

Previous work was carried out by IHC Robbins and a summary of this is produced in this report.

6.1.2 PFS test work summary

The following is a summary of the test work completed during the PFS by MT. This indicates the processing steps to produce a low Fe_2O_3 product.

The sample received was 914kg and this was homogenised. This material was screened at 1mm. The test work was then further screened to produce a -600µm +106µm fraction for test work. Test work indicated that this size fraction was able to produce an iron grade of 160ppm following screening, gravity separation, attritioning and magnetic separation.

This product was further processed through a hot acid leach (HAL) process, producing a product grade of 50ppm silica after washing and wet screening (note HAL processing will not be undertaken at the CFS Project site). This will be of significant interest to potential customers in Asia who undertake HAL.

6.2 Historical test work – IHC Robbins

Metallurgical process development test work was completed previously on material from the Project as part of a pre-feasibility level study in 2021. The head feed material for the test work comprised drill samples from within the proposed resource that maintained a depth average SiO_2 grade of >98.5%.

The head feed sample was composed of 1.7% slimes and negligible oversize mass. The -2.0mm+63µm sand fraction represented 98.2% of the as-received sample mass and assayed at 99.7% SiO_2, 800ppm Al_2O_3, 885ppm Fe_2O_3 and 1290ppm TiO_2 and 0.07% organics (LOI 1000).

The material was readily screened and deslimed by a typical Silica Sand feed preparation process to remove +2.0mm particles, -63µm fines and organic content. Flocculent and coagulant was required to achieve an acceptable slime settling rate and supernatant process water clarity.

The heavy mineral was effectively removed by a simple two-stage spiral separation circuit. Particle attritioning showed evidence of improving product grade via the removal of iron-bearing surface coatings on the quartz grains. Magnetic separation successfully removed additional magnetic and paramagnetic particles, further improving product grade. Up-current classification was successful in selectively rejecting undesirable fine particles while maintaining a high mass yield.

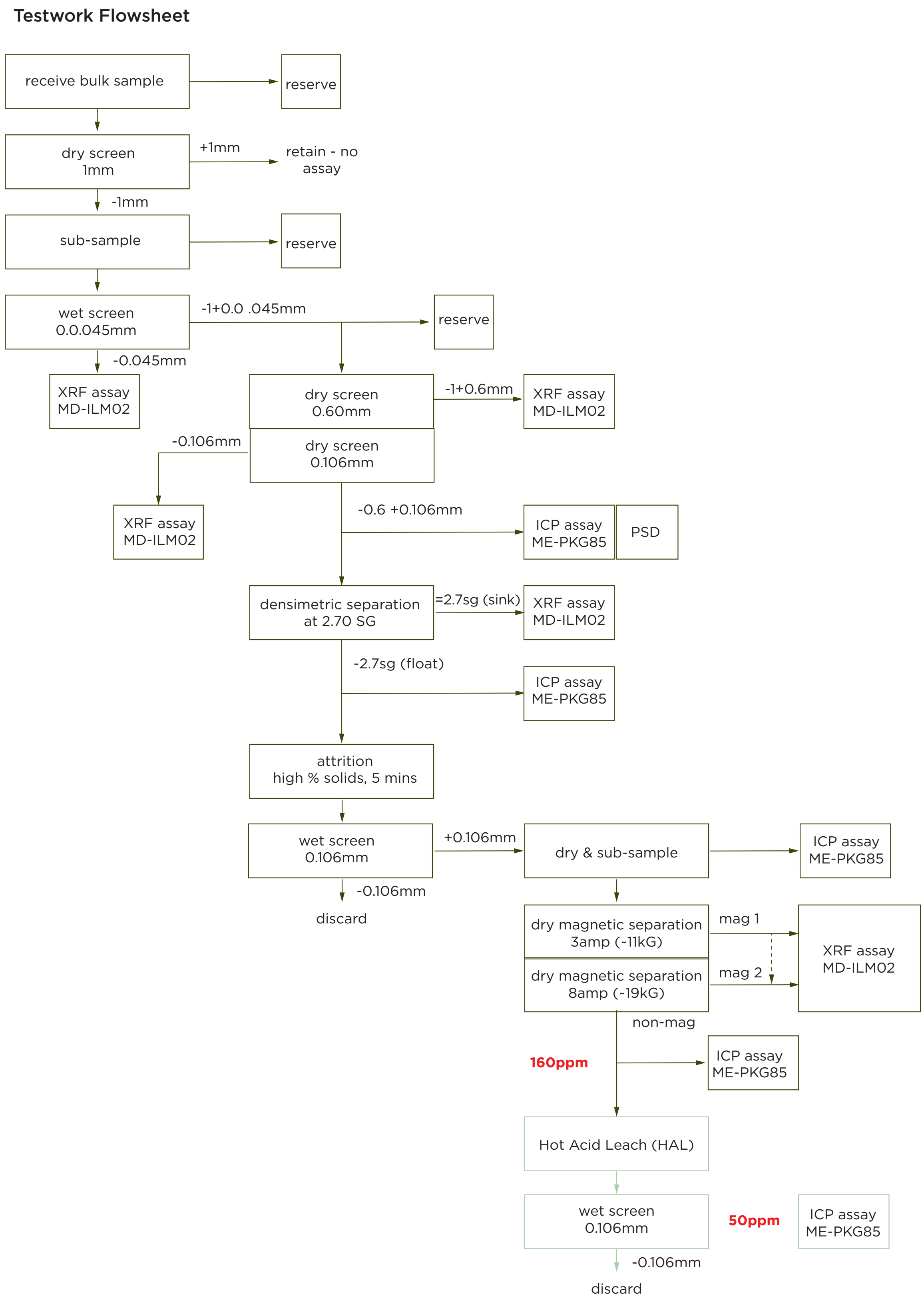


Figure 6.1: PFS metallurgical test work summary

The final product achieved a mass **yield of 77.4%** and assayed as follows:

v %	Al_2O_3 ppm	Fe_2O_3 ppm	TiO_2 ppm	Cr_2O_3 ppm	CaO ppm	K_2O ppm	MgO ppm	MnO ppm	Na_2O ppm	P_2O_5 ppm	V_2O_5 ppm	ZrO_2 ppm	LOI 1000 %
99.8	450	170	210	3	50	30	20	0	20	10	0	30	0.05

Some earlier process streams have also been highlighted in the table below as potential intermediate products, requiring less refining and generating a higher mass yield.

Potential Product Options	MassYield %	Assay			
		SiO_2 %	Al_2O_3 ppm	Fe_2O_3 ppm	TiO_2 ppm
Feed Preparation Sand	97.6	99.7	715	760	1225
Spiral Product	84.0	99.9	500	240	260

The results of this campaign indicated it is likely that, in order to generate a higher-grade product through traditional silica sand refining methods, the process would need to sacrifice product yield and/or require greatly increased capital and operating costs. Notwithstanding the above, further product-grade scoping test work and market investigations were recommended in order to enable the full potential and therefore value of the Cape Flattery material. These recommendations were adopted and further work has been undertaken with MT.

6.3 PFS test work program MT

MT received a 914kg sample from the orebody. This was prepared by MT and the analysis of the prepared fraction of -600µm + 106µm is shown in Table 6.1 below with the non-magnetic and HAL products. The feed sample contained 450ppm (0.045%) Fe_2O_3. The IRMS non mags produce silica sand contained 160ppm (0.016%) Fe_2O_3. This was then processed by HAL and this reduced the Fe_2O_3 levels to 50pm (0.005%), based on this composite sample.

Table 6.1: PFS Feed and product samples

Elements in %	TiO_2	Fe_2O_3	SiO_2	Al_2O_3	Cr_2O_3	MgO	CaO	K_2O	LOI 1000	Cu	Na_2O
Prepared -600µm + 106µm fraction	0.068	0.045	99.7	0.056	0.0002	0.002	0.003	0.003	0.06	<0.001	0.002
IRMS NM	0.021	0.016	99.9	0.033	0.0001	0.001	0.004	0.003	0.03	<0.001	0.002
HAL -600µm + 106µm	0.016	0.005	99.9	0.027	<0.0001	0.001	0.003	0.003	0.04	<0.001	0.002

6.3.1 PFS test work results MT

The sample received was dry-screened at 1mm to remove trash and a photograph of this oversize is shown in Figure 6.2.

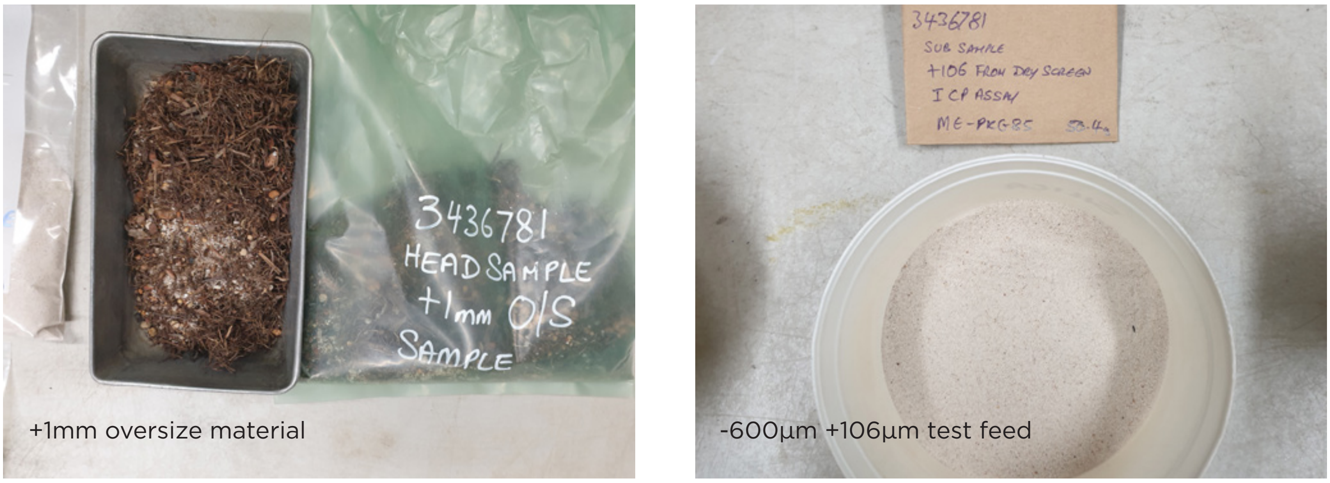


Figure 6.2: Dry-screened sample

From this bulk sample a sample was taken for characterisation. The sample was wet-screened at 45µm to produce a -1mm +45µm fraction. This material was then dry-screened at 600µm and 106µm to produce the sample for magnetic separation and HAL. A photograph of this is in Figure 6.2. A particle-size distribution (PSD) of this characterisation sizing is shown in Table 6.2.

Table 6.2: PSD of characterisation sample

Full PSD	
fraction (total)	**% wt to feed**
+1mm	0.2
-1 +0.6mm	0.8
-0.6 +0.106mm	93.6
-0.106+0.045mm	4.0
-0.045mm	1.4
Total	100.0

As above, 93.6% of the sample is contained in the -600µm + 106µm fraction. All the fractions were analysed above except for the +1mm fraction as it contained mainly root matter. The PSD with their assays is shown in Table 6.3.

Table 6.3 - Assay by size of the -1mm fractions

		Assay								
fraction (total)	**% Wt to feed**	**TiO_2 %**	**Fe_2O_3 %**	**SiO_2 %**	**Al_2O_3 %**	**Cr_2O_3 %**	**MgO %**	**CaO %**	**K_2O %**	**LOI 1000 %**
-1000 +600µm	0.8	0.03	0.05	99.7	0.03	0.0010	0.03	<0.01	<0.01	0.15
-600+106µm	93.6	0.07	0.05	99.7	0.06	0.0002	0.00	0.003	0.003	0.06
-106+45µm	4.0	1.08	0.49	97.5	0.22	0.0050	0.04	0.010	0.010	0.25
-45µm	1.4	1.02	0.74	95.6	0.92	0.0070	0.06	0.110	0.020	1.24
Total	**99.8**	**0.12**	**0.07**	**99.6**	**0.07**	**0.0005**	**0.00**	**0.005**	**0.003**	**0.08**

This table indicates that the lowest iron concentrations and highest silica grades are in the two coarser fractions. Further test work was carried out on the -600µm + 106µm fraction (called 'sand fraction').

The sand fraction was screened. Table 6.4 shows the size distribution within the sand fraction.

Table 6.4: Size distribution of sand fraction

Full PSD		
Fraction (total)	**% wt**	
	to stage	**to feed**
-600 +425µm	**4.4**	4.1
-425 +300µm	**11.1**	10.4
-300 +212µm	**22.5**	21.1
-212 +150µm	**37.0**	34.7
-150 +106µm	**23.4**	21.9
	1.6	**1.5**
Total	**100.0**	**93.6**

Gravity separation of sand fraction

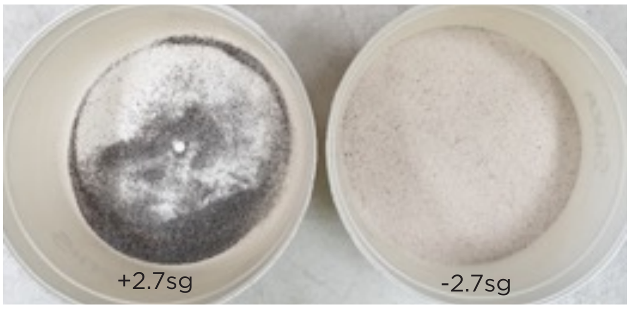
The sand fraction (-600µm+106µm) was processed through heavy liquid separation (at 2.70sg) to simulate gravity separation to remove heavy minerals (HM), where 99.8% of the mass reported to the float fraction (i.e. HM content was 0.2%). A sub-sample from the float fraction (gravity product) was extracted for assay analysis and 1kg of the float sample was used for attritioning and magnetic separation and HAL test work. The assay by density results are presented in Table 6.5 - Assay by density profile of the sand fraction (-600µm+106µm).

Table 6.5: Assay by density profile of the sand fraction (-600µm+106µm)

			Assay													
fraction (total)	% wt		TiO_2 %	Fe_2O_3 %	SiO_2 %	Al_2O_3 %	Cr_2O_3 %	MgO %	MnO %	ZrO_2 %	P_2O_5 %	V_2O_5 %	SO_3 %	CaO %	K_2O %	LOI 1000 %
	to stage	to feed														
-2.7sg float	99.8	93.4	0.02	0.02	99.9	0.04	0.0001	0.001	n/a	n/a	n/a	n/a	n/a	0.003	0.003	0.04
+2.7sg sink	0.2	0.2	23.6	13.9	46.4	9.97	0.0480	0.610	0.790	2.98	0.046	0.07	-0.01	0.100	0.010	1.04
Total	100.0	93.6	0.08	0.05	99.8	0.06	0.0002	0.002	n/a	n/a	n/a	n/a	n/a	0.003	0.003	0.04
Direct assay of -600 +106µm			0.07	0.05	99.70	0.06	0.0002	0.002	n/a	n/a	n/a	n/a	0.00	0.003	0.003	0.06

Gravity removal of the HMs produced a float fraction with reduced levels of TiO_2 (from 0.07% to 0.02%) and Fe_2O_3 (from 0.05 to 0.02%). The HM (+2.7sg) fraction while only representing 0.2% of the mass contained principally TiO_2, Fe_2O_3 and Al_2O_3 with elevated levels of ZrO_2, Cr_2O_3 and MgO.

Figure 6.3: Attritioning of gravity product



A sub-sample of the float fraction was treated in a high-energy attritioning cell to clean the surfaces of the sand particles. The residence time was five minutes with an operating solids density of ~75%w/w. The attritioned sample was wet-screened at 106µm to remove any liberated slimes. The assay for the attritioned and deslimed product is shown in Table 6.4.

Figure 6.4: +106um attritioned product

Table 6.6: Attrition mill product assay

fraction (total)	% wt		Assay								
	to stage	to feed	TiO_2 %	Fe_2O_3 %	SiO_2 %	Al_2O_3 %	Cr_2O_3 %	MgO %	CaO %	K_2O %	LOI $_{1000}$ %
attritioned +106µm	99.1	92.6	0.022	0.017	99.9	0.035	0.0001	0.001	0.004	0.003	0.03
attritioned -106µm	0.9	0.8	Not assayed								
Feed	100.0	93.4	0.024	0.021	99.9	0.037	0.0001	0.001	0.003	.0.003	0.04

The result shows that 0.9% of the mass was removed as slimes generated during the attritioning. Minimal change in the assay of the sample was measured before and after attritioning, except for minor reductions in TiO_2, Fe_2O_3 and Al_2O_3.

Magnetic separation of attritioned gravity product

The attritioned sample was fractioned using a Reading Induced Roll Magnetic separator (IRMS) to remove magnetic impurities from the sample. The IRMS was processed at 3 amps (simulating the maximum field strength that may be achieved in wet magnetic separation) followed by 8 amps (maximum field strength for dry magnetic separation). The result showed 0.2% of the mass was removed as magnetics at the lower intensity with a further 0.8% mass removed at the high intensity. The final non-magnetic fraction was assayed as shown in Table 6.7 below. The two magnetic fractions were combined for assay.

Table 6.7: Analysis of non-magnetic product

fraction (total)	% wt to stage	% wt to feed	TiO_2 %	Fe_2O_3 %	SiO_2 %	Al_2O_3 %	Cr_2O_3 %	MgO %	CaO %	K_2O %	LOI 1000 %
Non-mag (8 amps)	**99.9**	91.7	0.021	0.016	99.9	0.033	0.0001	0.001	0.004	0.003	0.03
Mag 2 (3-8 amps)	**0.8**	0.8	0.070	0.120	99.4	0.150	<0.001	0.040	0.01	<0.01	0.18
Mag 1 (3 amps)	0.2	0.2	0.070	0.120	99.4	0.150	<0.001	0.040	0.01	<0.01	0.18
Feed	100.0	92.6	0.021	0.017	99.9	0.034	0.0001	0.001	0.004	0.003	0.03
Direct assay attritioned +106µm			0.021	0.017	99.9	0.034	0.0001	0.001	0.004	0.003	0.03

In total the magnetic separation removed a small portion (around 1%) of the feed mass. While the assay of the magnetic fraction reported elevated levels of TiO_2, Fe_2O_3 and Al_2O_3, the very low mass of magnetics resulted in little to no improvement in the grade of the non-magnetic product.

HAL of non-magnetic attritioned gravity product

A sub-sample of the non-magnetic attritioned product was processed using the Hepworth method to leach the sample in acid at an elevated temperature. The leached sample was then neutralised and was wet-screened at 106µm to remove any leached slimes. The result showed 1.7% of the mass was removed as slimes. The final HAL product was assayed as shown in Table 6.8.

Table 6.8: Analysis of HAL product

fraction (total)	% wt to stage	% wt to feed	TiO_2 %	Fe_2O_3 %	SiO_2 %	Al_2O_3 %	Cr_2O_3 %	MgO %	CaO %	K_2O %	LOI 1000 %
HAL +106µm	98.3	90.1	0.016	0.005	99.9	0.027	<0.0001	0.001	0.003	0.003	0.04
HAL -106µm	**1.7**	1.6	Not assayed								
feed	100.0	91.7	0.021	0.016	99.9	0.033	0.0001	0.001	0.004	0.003	0.03
Direct assay non-mag			0.021	0.016	99.9	0.033	0.0001	0.001	0.004	0.003	0.03

In total the HAL process removed a small portion (1.6%) of the feed mass. The assay of the HAL product showed a significant reduction in Fe_2O_3 from 0.016% to 0.005%. The levels of TiO_2 and Al_2O_3 were also reduced.

Summary and comparison of final product assays

A summary in table 6.9 shows the mass yield and assay of the prepared feed compared with gravity float, attritioned, non-magnetic and HAL products.

Table 6.9: Summary of the test work assays

	Assay									
fraction (total)	% Wt to feed	TiO_2 %	Fe_2O_3 %	SiO_2 %	Al_2O_3 %	Cr_2O_3 %	MgO %	CaO %	K_2O %	LOI 1000 %
Prepared -600 +106µm	93.6	0.068	0.045	99.7	0.056	0.0002	0.002	0.003	0.003	0.06
Gravity float (-2.7sg)	93.4	0.024	0.021	99.9	0.037	0.0001	0.001	0.003	0.003	0.04
attritioned float	92.6	0.022	0.017	99.9	0.035	0.0001	0.001	0.004	0.003	0.03
Non-mag float	91.7	0.021	0.016	99.9	0.033	0.0001	0.001	0.004	0.003	0.03
HAL non-mag float	90.1	0.016	0.005	99.9	0.027	<0.0001	0.001	0.003	0.003	0.04
Slimes (-45µm)	1.4	1.020	0.740	95.6	0.920	0.007	0.060	0.110	0.020	1.24

The sizing of the received sample showed 93.6% of the total feed are sand particles between 0.6mm and 0.106mm, 5.4% of 0.106mm particles (slime) and 0.2% oversize (+1mm). The SiO_2 content of the sand fraction was 99.7% with levels of TiO_2 (0.068%), Fe_2O_3 (0.045%), and Al_2O_3 (0.056%).

Density separation (at 2.7sg) of the prepared 'sand' (0.6+0.106mm) recovered 93.4% of the initial feed mass as gravity float with the removal of 0.2% of the feed as HM (+2.7sg). The gravity float (silica) had the most significant reduction in Fe_2O_3 content from 0.045% to 0.021%, with a reduction in other impurity levels to 0.024% TiO_2, and 0.037% Al_2O_3. The SiO_2 content of the gravity float (silica) fraction increased to 99.9%.

High-energy attritioning of the gravity float achieved a reduction in Fe_2O_3 from 0.021% to 0.017% and minor reduction in TiO_2 and Al_2O_3. The attritioned sample was then processed through a dry magnetic separator to remove any magnetic minerals.

The non-magnetic product showed minimal reduction in Fe_2O_3 from 0.017% to 0.016%, and Al_2O_3 to 0.033%. The non-magnetic product was then processed through HAL to remove more complex iron particle entrainment.

The HAL product showed a significant reduction in Fe_2O_3 from 0.016% to 0.005% (50ppm), with reductions in TiO_2 to 0.016% and in Al_2O_3 to 0.027%.

The HAL product is an encouraging result, producing a final product with 50ppm Fe_2O_3. It is recommended that additional characterisation test work is conducted to verify this result and if so, bulk test work may be conducted to determine if these results are reproducible using pilot-scale equipment at nominal load conditions.

7.0 Non-process infrastructure

To enable the development of the silica sand extraction operation, the following key infrastructure components are required:

- Overland conveyor from the product stockpile to the JIF
- BLF and associated jetty
- Purpose-built accommodation facility
- Barging and transhipment operations (Section 8 – Transport and Logistics)
- Site access road (jetty to MIA)
- Site-wide services
- MIA facilities
- Product stockpile
- Process plant pad.

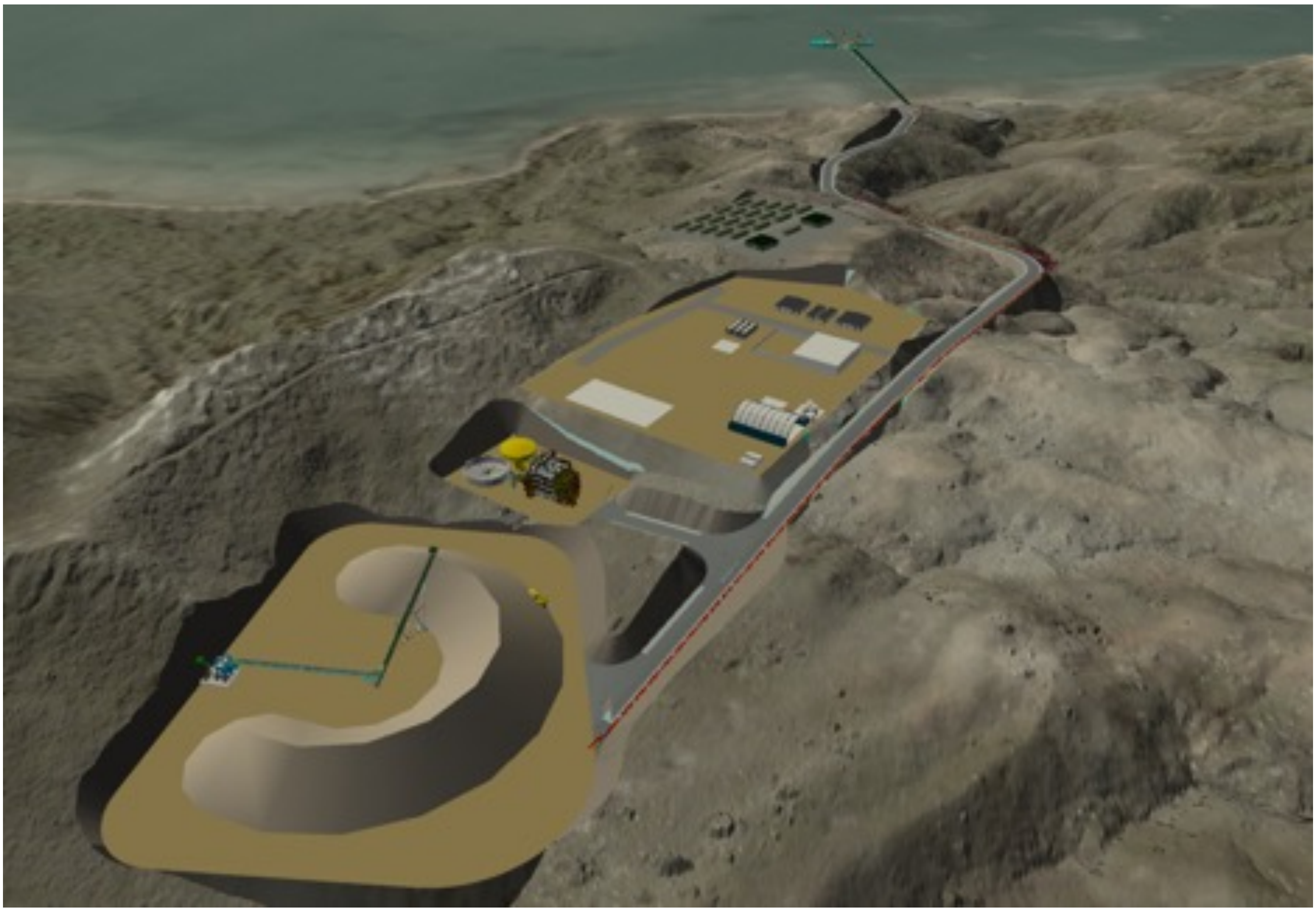
7.1 Site development

7.1.1 Site layout

The mine site has been developed within the MLA. Figure 7.1 provides the proposed site layout illustrating the locations for the process plant, product stockpile, MIA, accommodation facility, overland conveyor, site access road and JIF.

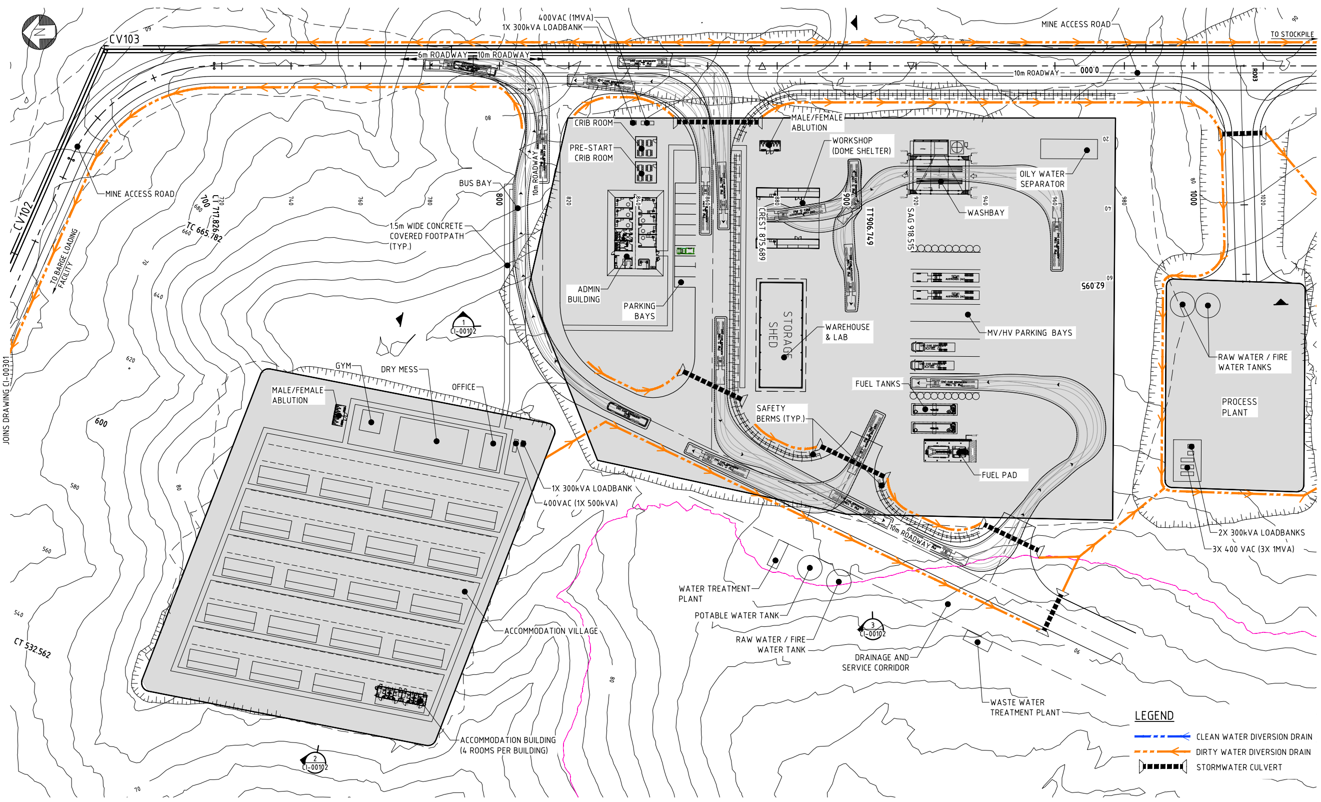
Figure 7.1: Cape Flattery Site General Arrangement

Figure 7.2: Mine infrastructure looking northeast



Drone image of potential jetty location

Figure 7.3: Mine industrial area general arrangement



Key site infrastructure is described in Table 7.1.

Table 7.1: Key site infrastructure

INFRASTRUCTURE ITEM	DESCRIPTION
Process plant pad	2,400m² prepared earthworks pad to accommodate the process plant.
Product stockpile	16,200m² prepared earthworks pad to accommodate the dewatering plant, radial stacker and 75,000t product stockpile.
Mine infrastructure area	24,000m² prepared earthworks pad to accommodate facilities including: » Offices » Equipment workshop, storage area » Go-line, vehicle wash, fuel storage and filling pad, power plant (generators).
Accommodation facility	80-bed camp comprising demountable ensuite rooms.
Overland conveyor	1,200tph overland conveyor full length 1.2km long located between the product stockpile and jetty. This overland conveyor includes CV001, CV002 and CV003.
Site access road	1.2km unsealed access road between JIF and the product stockpile. The roadway comprises 6m unsealed pavement with widening for overtaking. The road formation has provision for the overland conveyor along part of its length.
Jetty infrastructure facility	3,300m² paved earthworks pad to accommodate jetty infrastructure.
Jetty	350m-long elevated jetty piled with berthing with mooring dolphins.
Barge ramp	10m-wide reinforced concrete barge ramp.
Barge loading	Tele-stacker rail mounted on a crescent shaped headstock supported on piles filling a 3600dwt barge.
Site access / internal roads	4WD access to sand extraction, perimeter access track around MLA.
Hardstand pads and basins	Stockpile pad (150 x120m) process plant (60 x 40) MIA (160 x 120) JIF (65 x 85)
Non-process buildings and facilities	Admin and operations buildings / MV workshop / lube bay / 15,000 water oil storage tank / tyre-bay / stores area / training room / crib room / safety and induction / toilet bock M/F / fuel.
Water supply facility	2 x 300KL raw water tanks with ring beams raw water (process to WCP) & fire water 1 x 150KL domestic water supply tank (accom supply) 1 x 150KL domestic water supply tank (MIA supply)
Power supply	4 x 1,000kVA & 5 x 500kVA gensets with 6 x 300 kVA load banks
Communications	4G reception with repeater stations and mine site digital radios with repeater stations.
Process plant facilities	Mineral technologies plant — slurry lines/process water pipelines.

7.3 Jetty infrastructure facility

7.3.1 Summary

The navigable water depths off the coast of Cape Flattery are too shallow to allow direct access to the mine port facility by an ocean-going vessel without significant capital cost. The proposed method of product export is to transfer the ore from the mine to ocean-going vessels using transhipment barges.

It is proposed to provide an out-loading berth to facilitate the loading of product onto the transhipment barges.

A logistics barge facility will be needed to support the logistics of the mine construction and the operational logistics during the operational phase of the mine. This will consist of a barge ramp to facilitate berthing of landing craft barges (LCTs) for roll-on/roll-off (RoRo) cargo operations.

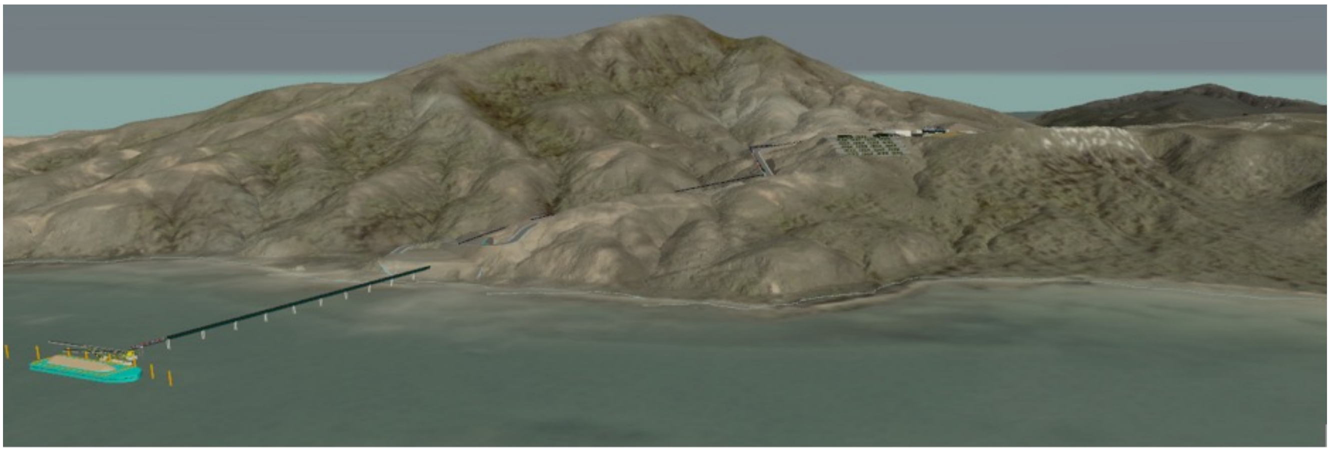
Facilities at the JIF include:

» Jetty
» Barge ramp
» Hardstand area
» Product conveyors
» Bunker
» Amenities.

7.3.2 Jetty

A 350m-long piled jetty will be constructed to support conveyor CV04.

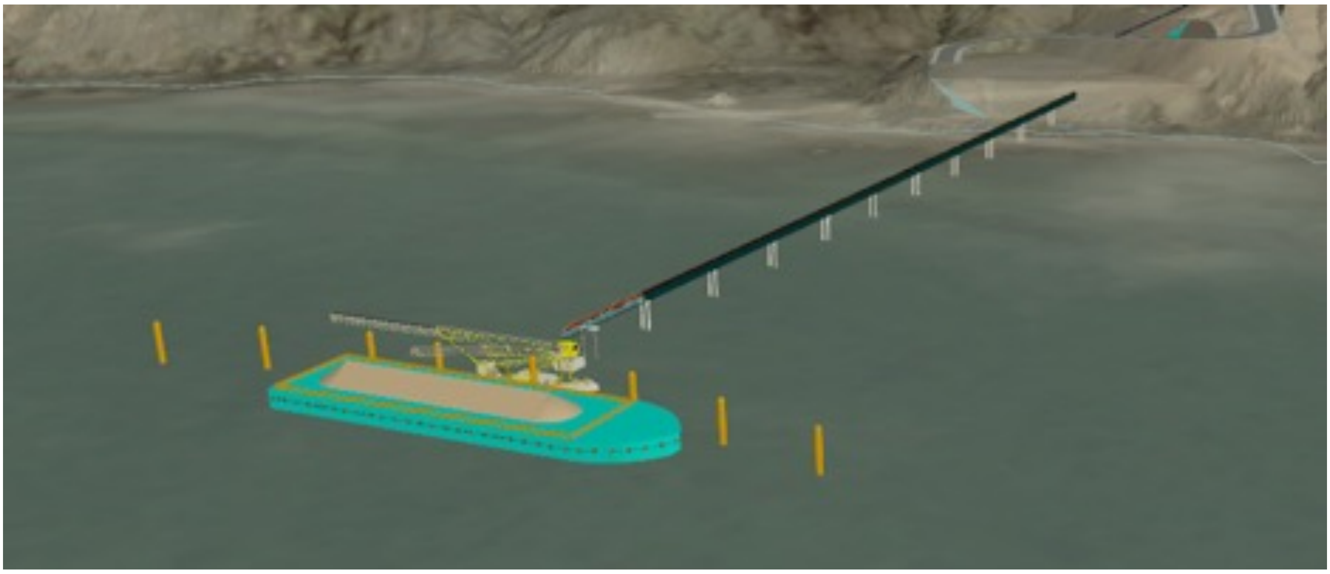
Figure 7.4: Looking southwest towards Cape Flattery with jetty structure foreground



7.4 Barge loading facility

A tele-stacker rail mounted on a crescent shaped headstock supported on piles filling a 3600dwt barge as in Figure 7.5.

Figure 7.5: Stacker arrangement looking west



The stacker will be a vendor package like the one shown in Figure 7.5 with its own MCC to operate the equipment and barge load head-end conveyor motor.

7.5 Water supply

The source of raw water is anticipated to be from a bore located inside the MLA and allocated for:

- potable water services
- fire and process water services.

Based on an average daily consumption rate of 250L/person/day and an equivalent person (EP) population of 80, the MIA requires a total average daily demand of 19kL of potable water or approximately 7ML/year.

Raw water will be pumped from the borefield from the south to the potable water treatment plant (PWTP) via a pipeline running along the existing access track in a north easterly direction in front of the mine advancement. Pipelines generally consist of 100mm diameter polyethylene mains and are run along the ground to allow inspection and repair as required.

Potable water will be treated to ensure water quality for human consumption complies with the National Health and Medical Research Council (NHMRC) Australian Drinking Water Guidelines.

After water treatment it is proposed that the potable water is stored in a proprietary steel or poly tank reservoir to provide seven days' storage in the event of source failure. The reservoir would be located approximately 100m southwest of the MIA office. The final location will be determined during detailed design.

Two 300,000L water storage facilities for process and MIA use should sufficiently enable capacity for use in the fire system. This will be assessed and progressed in further studies. Due to the limited process requirement it is anticipated the water will require minimal treatment to be used in the process or MIA areas. The water from the plant is anticipated as being suitable for re-use in the MIA and process plant, hence will be diverted to the stormwater retention basin for re-use.

Fire and raw water services will be provided along the overland conveyors at key points including:

- conveyor transfer points
- conveyor drive stations
- conveyor tail ends
- conveyor take-ups.

Runoff water from the MIA and product stockpile (PS) will be stored within stormwater retention basin and be transferred to the water storage facilities for the water to be re-used on site. Run-off from the network of internal roads will be captured in sediment catch drains pumped back to the main sedimentation basin to vegetated areas.

7.6 Power supply

The Project team has not completed a detailed electrical assessment at this level of study for the process plant. Capital costs have been factored from library projects and the following commentary reflects those levels of inclusions. Future studies will require the following inclusions and exclusions to be assessed and refined.

The process plant (PP) is supported by a local switchroom connected to a diesel generator system. The generator system is proposed for set-up in the process plant area and distributed to the main switchboards in the PP. The electrical design has included N+1 installation whereby an additional unit is installed in a standby capacity to enable continuous process plant operation in the event of maintenance requirement or failure of a generator.

There are localised generation for the site is in the following areas:

- Mine operations (ROM)
- WCP/product
- Product stockpile
- Barge load-out facility
- MIA and accommodation village.

The site does not have existing grid infrastructure. Due to the location and weather conditions it is proposed to have localised leased power to the BLF on the conveyor system on cable ladder and to the accommodation camp.

At the ROM area local diesel generating is expected to have an aggregate rating of at least 500kVA (400kW generation equivalent).

The WCP local diesel generating set(s) are expected to have an aggregate rating of at least 2000kVA (1600kW generation equivalent).

All generating sets operate at low voltage.

ROM power will be supplied from the local diesel generator set to the local switchboard. From here power is distributed to all loads in the Dry Mining Unit (DMU) area. The electrical battery limits for the DMU design are the incoming Low Voltage (LV) terminals of the Main LV Switchboards. As the mine develops, the DMU generator set will move with the DMU and associated equipment.

WCP power will be supplied from the local diesel generator set(s) to the local motor control centre. From here, power is distributed to most of the plant and motor loads in the WCP and to several distribution boards. Distribution boards supply final sub-circuit and building loads. It is recommended that consideration is given to selecting N+1 diesel generation sets to provide back-up redundancy. This arrangement also allows for a single generation set to be taken out of service for maintenance while the plant remains fully operational.

At the product stockpile area power will be supplied from a localised generator to a local switchboard.

8.0 Transport and logistics

8.1 Introduction

8.1.1 General

The Cape Flattery site is in a remote location accessed by secondary roads and beach, barge or aircraft. The secondary road/beach access is limited to normal 4WD road vehicles due to the requirement to pass through the neighbouring Mitsubishi mine site. The only available crossing of the product loadout conveyor is a single underpass constructed of precast concrete culverts. Road-registered 4WD vehicles can pass through this underpass, but there is negligible clearance between the vehicles' standard door mirrors.

While remote, the site is near routes used by barging service providers servicing the wider Cape York Peninsula area. These services include general cargo, project or charter, and fuel, and generally depart twice a week. The extensive fleets that service the north-eastern coast include a large range by size and capacity of landing craft (LCT).

8.1.2 Operations requirements

The operational requirements for the mine will essentially comprise fuel, food, operational consumables, and periodic replacement parts or components.

In addition to the 'heavy' requirement, personnel transport is also required to enable shift change and rotation of personnel. It is expected that personnel will commute from Cooktown Monday and Friday for those designated five days on/two days off. Crews on seven days on/seven days off will change shift and commute on Wednesday. For general freight requirements, service providers are well established in the Cairns and Cooktown areas.

8.2 Materials inbound to site

Materials and equipment inbound to the site will require transport by LCT. The JIF area includes an access ramp for these vessels and has been configured to accommodate the required draft. From the unloading point, general cargo will traverse a one-way access road to the area adjacent to the accommodation. Direct access continues past the accommodation and down to the MIA and WCP area.

8.3 Materials outbound from site

8.3.1 Cape Flattery Port

The Project's proposed jetty and BLF are located within the Cape Flattery Port area operated by Ports North. CFS has entered discussions with Ports North regarding a DA to approve establishment of a new jetty and BLF within the Cape Flattery Port boundary.

Discussions with Ports North have also been initiated for the establishment of a 'roll-on/roll-off' ramp that will allow equipment and supplies to be delivered to the Project.

The existing jetty operated by Mitsubishi was established solely for the export of their silica sand. Mitsubishi's mine is the largest exporter of silica sand in the world, with 2.8Mt for the year ended November 2021. Mitsubishi's jetty is a single berth serviced by a travelling ship loader for the exporting of sand. Before establishing its existing jetty and ship loader, Mitsubishi exported sand via a tug-and-barge operation.

8.3.2 Proposed transhipment approach

A WAVE International marine consultant undertook a desktop review exploring the options for exporting silica sand. The review indicated that the export of silica sand is planned to occur by barging operations located approximately two to three nautical miles offshore. It is here where a bulk carrier could be moored during transfer operations.

This proposed transhipment approach is intended to use conventional tug-and-barge operations.

The study assumes that transhipment can occur all-year-round; however, the application of lower ship loading productivity rates were made during the months of the year when higher wave movements are most likely to occur. Transhipment has historically been used to load silica sand onto bulk carriers at the Cape Flattery Port by Mitsubishi.

8.3.3 Proposed maritime Project area

CFS has identified a point on the Cape Flattery headland (Latitude 145.337405, Longitude -14.94949) suitable for constructing a jetty and BLF for the Project.

The proposed BLF location is within three nautical miles of suitable swing basins, affording efficient turnaround of barges and tug in the loading operations.

Water depths within the identified anchorage area are approximately 20m. Further work is required to better understand the seafloor characteristics and determine the best method of securing bulk carriers. A survey of the port area water depths was undertaken in July 2021. A geotechnical survey has also been undertaken in December 2021/January 2022, but the results have not been received at the time of publication of this PFS.

8.3 Marine

CFS is planning to export about 1.35Mtpa of silica sand. The sand will be transhipped, via tug and barge operations, to exports ships averaging 55,000dwt. The BLF will be on the North Shore of Cape Flattery and the ships will be anchored in deep water within the port of Cape Flattery about three nautical miles from the BLF.

8.3.1 Ships type and gear

For this project, it is considered that geared and grab (4 cranes and 12m^3 grabs) fitted vessels will be used of the Supramax (50-60k) sizes. This adequately meets intended 55kt shipments.

It is proposed in the DFS to evaluate other barge options which may include self-unloading barges.

8.3.2 Ship loading rates

The simulations have shown that, at a ship crane rate of 250tph per crane, the ship loading rates are between 18,000 and 21,000tpd. It would be reasonable for the Project to be confident (after the commissioning period) of declaring commercial loading rates to be >16,000tpd.

8.3.3 Sizing of suitable barges and tugs

Barge sizes vary depending on the amount of cargo to be carried. As a rule, the standard barges used are: 230ft — 3,500 to 3,600t; 270ft — 5,500t; and 300ft — 8,000t.

Barges of 230ft (70m) 3,500 — 3,600dwt are considered suitable for this Project and are the basis of the transhipment preliminary desktop simulation. Tugs to suit these barges would be twin screw 1 x 1,200 to 1,500HP and 1 x 800 — 1,000HP or 2 x 1,200 — 1,500HP tugs.

Benefits of smaller barges:

» Lower capital cost of the barge.

» Smaller tug requirement savings in capital and operational costs, i.e. fuel consumption etc.

» Shallow draft (i.e. 230ft barge has a draft of about 3.3 — 3.6m; a 300ft barge has a draft of 4.3 — 4.5m). The draft has a direct impact on the water depth at the BLF and jetty length.

» Jetty design and construction requirements may be reduced to accommodate a small barge versus a larger barge.

» Smaller barges allow better flexibility and efficiency at the ship during transhipment operations.

» Normally 2 x 230ft barges can be placed alongside on each side of the ship. With larger barges only one barge can be placed along each side of the ship at a time. This causes delays in the loading while one empty barge is removed, and the loaded barge can be placed alongside.

8.3.4 BLF loading rate

The system desktop simulation has indicated a load-out rate of 1,500tph A load-out rate between 1,000 and 1,500tph is adequately supported by the two tug/three barge model. The product transfer conveyor barge loading system has been configured for 1250tph and will be developed further during the DFS.

8.3.5 Water depth at the BLF loading berth and the jetty length

From the studies, a depth of 3.5m at LAT is ideal; however, a reduction to 3.0m at LAT is feasible with little or no impact on barge loading or ship loading rates. From the jetty drawing to date, 3.5 water depth is about 100m off the jetty length, and 3.0 is about 175m off the jetty length. Therefore, 3.0m water depth is worthy of consideration.

8.3.6 Transhipment operations

Transhipment operations are feasible for this Project. Refer to the transhipment study below.

8.3.7 Commercial ship loading rates

When chartering ships for export, the Project will have decided on a contractual ship loading rate. This rate will impact the freight rate so it is best to set an achievable rate as high as the Project is comfortable with. It is best to set the rate below the Project's peak achievable rate allowing some room for unforeseen delays on shipper's side. This strategy enhances the reputation of the port and loading operations.

Our study has outlined the potential loading rates for the ship size studied 55,000dwt.

If actual loading rates are kept above the declared commercial rate then a 'no demurrage' situation and an efficient and reliable port will be achieved. See the transhipment study below.

8.3.8 Weather parameters

The non-cyclonic weather parameters for the port area at Cape Flattery have been confirmed by WAVE to be mainly waves about a maximum 1m in height and period four seconds, and that there are no long period swells.

From wind rose data for the area, the prevailing wind is south-easterly at about 90%, the wind over 20 knots is about 5%, wind above 15 knots is about 10%, and the rest is 85%. These figures tie in with the reported 1m sea state.

Tug and barge operations are workable in sea state waves of up to about 2 to 2.5m height and periods of four to five seconds. The transhipment operations, based on this information, will be able to operate on a 24-hour basis during non-cyclonic conditions. Cyclones will shut the port operations.

An allowance of 300 operating days and 65-day allowance for cyclonic weather has been assumed.

8.3.9 Transhipment study

The required outcome of all transhipment operations is to ensure ships are loaded efficiently, safely and at loading rates commercially beneficial to the Project.

The following assumptions are required in reading the results.

Ships crane working rate as 200, 250 and 300tph per crane for comparison. These three rates have been considered , and although peak rates may be above these, it is feasible to achieve these rates given Supramax 12m^3 grabs.

It is normal practice for **ships to load on a 24-hour**, 2 x 12-hour shifts for the stevedores and this has been assumed this for the study. Potential crane hours available are shown on the basis four ships cranes are available for 24 hours unless the ship completes within a 12-hour shift. Similarly with the BLF loading facilities, tugs are counted on full 24-hour availability.

Ship crane utilisation is based on available crane hours, calculated on the number of crane hours for full 12-hour shifts available (i.e. four x 12-crane-hours per shift). The lost hours are a product of total hours available minus hours used and includes time at the end of loading where a full shift is available, but the ship has finished loading. Therefore, the best evaluation of utilisation is time used as a percentage of time available.

BLF loading — for this study the following allowance has been made: for 1,000tph, four hours barge loading; for 1,500tph, three hours barge loading; for 2,000tph, two hours barge loading.

Barge standby (SB) at ship waiting discharge indicates the time a full barge was alongside waiting to discharge due to barges already there having not finished discharging.

Barge SB at ship waiting tugs indicates that an empty barge, at the ship, is waiting for the tugs to take it to the BLF, basically indicating that the tugs are busy, usually in transit with a full or empty barge from or to the BLF. In fact, although technically 'waiting for tugs', it is similar to waiting to load at the jetty (i.e. it is an issue where the ship is running ahead of the BLF loading cycles).

Barge SB at jetty waiting to load indicates a barge is alongside and loading.

SB hour two tugs — the hours that the tugs are on standby, although shown as two tugs, being they always work together moving barges it is enumerated as single tug hours (i.e. the hours for each tug).

Ship loading rates, commercially at a rate of >16,000tpd is a desired result. To have confidence in the declared ships loading rate it is best through experience to build up and declare a rate less than the achievable rate (i.e. for the above maybe 18,000-plus for a 16,000-plus commercial rate).

8.3.9.3 Transhipment conclusions

A crane load rate throughout of 250tph per crane would be the average considering the product and density. There may be some additional handling considerations onboard the barge (dozer tracks etc.) with 250tph as the expected average.

The study confirmed three barges and two tugs were sufficient for operation given the short distance to the ship anchorage. A four-barge may increase the ship loading rate marginally, but the study shows ships crane use rates are above 70% and in most cases above 80% and it is unlikely that any increase would be beneficial. The extra barge would cause increased, unreasonable barge waiting time delays at the BLF. The added cost would not give any benefits.

Considering the BLF load-out rates, any of the three tph rates studied would be sufficient with the higher being better, subject to project budget constraints. However, a load-out rate of 1.5kt is recommended as a good compromise with a minimum load-out rate between 1.0 and 1.5kt (e.g. 1.2kt), ensuring a solid load-out rate of 1,000t.

Ship loading rates are the result of the whole transhipment process and have a direct commercial financial impact upon the Project, as well as reputation as a supplier. Buyers only know two aspects of the supplier:

- the quality of the product
- the efficiency of the ship loading.

For the Project to have a ship loading rate set commercially at >16,000tpd is considered desirable. This transhipment study shows these rates are achievable.

L-R: John Deeral, Nicholas Villa and Ned Yoren

9.0 Workforce and operations management

9.1 Introduction

Operation of the Project will be managed from on-site facilities, supported through the local townships of Hope Vale and Cooktown. The CFS Brisbane office will provide technical and commercial support. The key components of the site operation include:

- a mine with an annual production of up to 1.35Mt of silica, delivered over a 25-year life
- mine infrastructure includes processing facilities, stockpile, office, workshop, conveying and access roads
- the JIF
- a transfer anchorage (TA) located in deep water offshore.

Barges loaded at the JIF will transfer the processed product to the export ship (or Ocean-Going Vessel/ OGV), which will take the product to overseas markets for processing.

Early engagement in operations will optimise the Project ramp-up and overall plant performance. Sustained production from the Project, after commissioning, requires a capable operations team to take over the facilities and improve and optimise production, maximising the return on investment. The operations team will need to be developed and prepared in parallel to facility design, construction and commissioning. The average operational manning estimate is approximately 65 people, including management, sand extraction and processing teams, maintenance, laboratory, logistics and administrative personnel, and accommodation operations personnel.

CFS will develop the Project with a blended style of operations, using specialist contractors for key activities and support services, while managing an in-house workforce for process plant operations and overall project management and supervision. The Project will operate within the guidelines of the Project design, with operational areas being managed to capacity to maintain all aspects of plant operation.

CFS will owner-manage sand extraction operations and maintenance activities, outlined in Section 5 - Ore Reserve. To complement this, mine management, planning, technical and geological activities will be the responsibility of CFS employees and consultants. The operation will run 24-hours per day, every day of the year as required by the mine schedule (excluding planned and unplanned downtime allowances), but sand extraction will be on day and night shift but vegetation clearing will only be undertaken on day shift, with sand extraction, processing and barge loading (as required) 24/7. Maintenance of mobile equipment will be scheduled to not impact operations.

The PFS design operating time of the DMU and WCP is planned for 7,200 hours per year (82%). The operating time and plant capacity have been optimised to minimise the cost of the core processing facilities and the initial supporting facilities.

CFS will conduct the core maintenance functions supported by contractors for the specialised functions and the large shutdowns. The major process plant equipment vendors will be engaged to provide technical support on an as-required basis. The initial philosophy is to provide workshop support for emergency-type repairs to continue operations. Major rebuild requirements will be undertaken on service exchange basis by arrangement with the Original Equipment Manufacturer.

9.1.1 Performance objectives

The Project has the following key operational performance objectives.

9.1.1.1 Safety

As part of the planning process, the HSEC strategy will connect to the CFS business strategic objectives. The leadership team must operate by example and demonstrate visible leadership as an ongoing commitment.

To enable the following objectives, CFS will install an integrated HSEC system to deliver performance monitoring which in turn delivers progressive improvement to the health safety management systems, standards, plans and procedures at the Project site.

Five priorities are planned to be achieved in operations through a supporting plan and program of work:

- Establishing standards and assessing performance
- Integrated HSE/maintenance database and monitoring systems
- Risk management (HAZOP/risk assessments and registers)
- Active contractor/personnel engagement and mentoring
- QA/QC assessment and improvement.

9.1.1.2 Environmental

- Impacts to the terrestrial environment including surface and ground water from the Project are identified, avoided, minimised, and mitigated such that the resultant residual impacts from the activity represent an acceptable risk level.
- Impacts to the marine environment from the Project are identified, avoided, minimised, and mitigated such that the resultant residual impacts from the activity represent an acceptable risk level and no aspects of the Project result in a significant residual impact to the Outstanding Universal Values of the Great Barrier Reef World Heritage Area.
- If residual risks to environmental values are deemed significant under relevant legislation and cannot be further reduced, it is considered likely that an appropriate offset could be developed and approved to compensate the residual impact in accordance with relevant Commonwealth and State legislation.
- Mined areas are to be rehabilitated progressively after sand extraction panel advance to meet a range of environmental, scenic, cultural, social, and engineering KPIs.

9.1.1.3 Socio-economic

- Impacts from the Project are identified, avoided, minimised and mitigated such that the resultant residual impacts from the activity represent an acceptable risk and it is considered likely that appropriate mitigation measures can be developed via management plans.
- Social impacts from the Project are identified, avoided, minimised and mitigated such that the resultant residual impacts from the activity represent an acceptable risk level and it is considered likely that appropriate mitigation measures can be developed and approved under the Social Impact Management Plan (SIMP).
- Cultural and historic heritage impacts from the Project are identified, avoided, minimised and mitigated such that the resultant residual impacts from the activity represent an acceptable risk level and it is considered likely that appropriate mitigation measures can be developed and approved under a CHMP or equivalent Native Title/Cultural Heritage agreement.
- Provide employment opportunities to Hope Vale and Cooktown residents in a range of skilled and unskilled jobs.

9.1.4 Safety systems

A Safety and Health Management Plan will be developed and submitted prior to the start of construction and upgraded for operations in accordance with Queensland's mining safety and health legislation *Mining and Quarrying Safety and Health Act 1999*.

9.1.5 Operational preparedness

A personnel and contractor management platform will be implemented which will encompass the full lifecycle of personnel-contractor management, including prequalification, onboarding selection and engagement and the management of contractors. Contractor selection and early engagement will be undertaken during the DFS.

General procedural systems and site administration will be developed as the Project transitions through operational preparedness.

9.1.6 Operating methodology

As owner/operator, CFS will develop the Project to process ore using a specialist and trained owner/operator team. The operation will conform to design criteria and the sand extraction schedule will be predetermined to match financial modelling.

The Project is intending to have specific targets and provisions aimed at maximising local employment and training. A small number of CFS non-resident staff and contractors are likely to access the site periodically and are expected to stay at the site accommodation facility.

CFS Manning	Equivalent Full-Time Manning		
	Crew A	Crew B	Day Shift
Production processing	19	19	1
Maintenance & electrical	10	10	0
Export operations	17	17	0
Camp facilities	4	4	1
Management & administration	3	3	2
Total	**53**	**53**	**4**

10.0 Project implementation

10.1 Introduction

The Project implementation strategy outlines the preliminary overall plan for implementation of the Project through further studies and delivery to operations. The PFS has been based around an Procurement and Construction Management (EPCM) execution framework.

An Integrated Management Team (IMT) will support the execution of the Project. The IMT approach provides CFS with the opportunity to incorporate key operations staff into the Project management structure for risk management and continuity through operations readiness. Through this approach, IMT package managers will oversee a range of EPCM and EPC work package contracts structured to best suit the scope and associated risk and cost profiles.

10.2 Key objectives

The key objectives of the execution phase are to:

- Achieve 'zero harm' to people and minimise impact on the environment in delivering the Project.
- Minimise overall project cost, maximise value and deliver the Project within budget.
- Complete the works within an approved schedule.
- Meet the Project's identified KPIs.
- Conform to statutory requirements and CFS corporate requirements.
- Develop and maintain good relationships with relevant government agencies and local communities.
- Seek to actively engage the local workforce and contractors wherever feasible to do so.
- Undertake the Project with no industrial disputes and with no adverse industrial legacies for the ongoing operations.

10.4 Project implementation schedule

10.4.1 Schedule summary

Project approvals through the regulatory process is critical to CFS achieving execution schedule and cost targets. A detailed program will be developed during DFS.

Table 10.1: Conceptual project milestones

Milestone	Target Date
PFS	Qtr 1 2022
EA approval	Qtr 4 2022
ML and DA approvals complete	Qtr 4 2022
DFS	Qtr 1 2023
Construction and Commissioning Completion	Qtr 2 2024
Production start	Qtr 2 2024
First export	Qtr 3 2024

* Note the above table assumes a Site Specific EA approval with no need to undertake a full EIS.

11.0 Permits and approvals, health, safety, environment and community

11.1 Introduction

This section of the PFS outlines the permits, approvals and health, safety, environment, and community (HSEC) engagement undertaken by CFS in the development of the CFS Project, along with the indicative timeframes required for implementation.

11.2 Permits and approvals

11.2.1 Regulatory framework

11.2.1.1 Purpose of Pre-Feasibility Study

The purpose of this PFS is to assess the known and potential, direct and indirect, adverse, and beneficial impacts (environmental, economic, and social) of the Project as well as to propose measures to avoid, minimise or manage these impacts, and provide relevant information to decision-makers. As such, this PFS addresses the requirements of the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) and the Queensland Environmental Protection Act 1994 (EP Act).

This PFS supports the CFS application for the grant of an EA and ML for the mine and processing area and a DA for the jetty and BLF. For this reason, the scope of information provided includes the requirements of technical guidelines for DA and EA applications and Section 125 of the EP Act. As per section 125 of the EP Act, the EA and DA:

- Describe all environmentally relevant activities (ERAs) and land on which each activity will be carried out
- Include an assessment of the likely impact of each activity on the environmental values including:
  - A description of the environmental values likely to be affected by each relevant activity
  - Details of any emissions or releases likely to be generated by each relevant activity
  - A description of the risk and likely magnitude of impacts on the environmental values
  - Details of the management practices proposed to be implemented to prevent or minimise adverse impacts
  - Details of how the land which is the subject of the application will be rehabilitated after each relevant activity ceases.
- Includes a description of the proposed measures for minimising and managing waste generated by each relevant activity.

11.2.2 Land use

Cape Flattery and its surrounds are in mostly undeveloped landscapes, with access tracks forming the primary infrastructure within MLA100284 where the Project (sand extraction and processing plant) will be situated. The Project does not overlap with any other mineral tenements, except for their own exploration permit EPM25734, and it is adjacent to the existing silica sand mine owned and operated by Mitsubishi’s Cape Flattery Silica Mines Pty Ltd (CFSM). Cape Flattery is surrounded by the Pacific Ocean to the north and east. Land to the south and west of the footprint encompasses ML2965 and ML2806 owned and operated by CFSM.

There are multiple tenures within MLA100284. The mine and associated infrastructure comprise:

- Active sand extraction area
- Processing plant and stockpile area.

The jetty and BLF will remain outside of the designated mine lease boundary.

11.2.3 Primary approvals

This section summarises the key Commonwealth, Queensland and local government legislation, planning requirements, guidelines, and policy framework.

- *Environment Protection and Biodiversity Conservation Act 1999 (Federal Government)*
- *Environmental Protection Act 1994 (Queensland Government)*
- *Mineral Resources Act 1989 (Queensland Government)*

11.2.4 Approval timeframes

The EA process under the EP Act and DA process under the Planning Act have several stages and decision milestones. The key steps involved in obtaining approval for the Project are summarised in Table 11.1.

Table 11.1: Conceptual stages in the EA and DA processes

Relevant Approval	Estimated Completion Date
EPBC referral submission	Q2 2022
Community and Government consultation	Ongoing
Submission of EA Application	Q2 2022
Submission of DA	Q2 2022
Decision on EPBC referral	Q3 2022
EA and DA notification phase, response to submissions and response to information requests	Q3 2022
DA and EA decision phase	Q3 2022
Approval granted for EA and PRCP	Q4 2022
Decision notice issued for DA	Q4 2022

* Note the above table assumes a Site Specific EA approval with no need to undertake a full EIS.

12.0 Stakeholder relations

12.1 Community and stakeholder engagement strategy

12.1.1 Objectives

The objectives of the community and stakeholder engagement process are to ensure transparent and inclusive community and stakeholder engagement that informs the EA and DA processes and the ongoing management of any community questions or concerns during the construction and operational phases of the Project.

Community and stakeholder engagement is informed by the Indigenous and Community Relations Policy. Community and stakeholder engagement strategies will endeavour to form mutually beneficial relationships with both Indigenous and community groups to ensure sustainable economic, environmental, and social value both for the company, Traditional Landowners, and broader Indigenous communities.

Community and stakeholder engagement will include the following elements:

» **Project:** All Project-level stakeholder engagement, including overall Project communications, negotiations, public relations, and complaints management

» **EA:** The statutory stakeholder notification and consultation required for the EA process and Progressive Rehabilitation and Closure Plan (PRCP)

» **DA**: The statutory stakeholder notification and consultation required for the DA process, as well as potential lease arrangements for the jetty and BLF

» **Post-EA and DA**: Community and stakeholder engagement to inform the ongoing monitoring, review and update of management measures

» **Ongoing**: consultation with Traditional Landowners, including native title matters.

12.2 Stakeholder relations

12.2.1 Stakeholder relations assessment

To date the feedback from all consultation sessions has been analysed by CFS. Across all stakeholder groups, initial discussions focused on:

» Initial consultation about the Project

» Initial site visits

» Social and economic opportunities for Dingaal and Nguurruumungu Peoples and the local communities of Hope Vale and Cooktown

» Opportunities for participation in preliminary activities such as groundwater and surface water monitoring for the Project.

Consultation with all stakeholder groups will be ongoing as the Project progresses.

12.2.1.1 Landholders

The registered owner of Lot 35 SP232620 in which the Project area is located is Hopevale Congress. There are various landholders within Lot 35 SP232620 that lease land from Hopevale Congress. These landholders will be identified and consulted with as part of the detailed feasibility phase.

12.2.1.2 Commonwealth, state and local government

The Project team held a series of consultation and meetings with State and Local Government representatives to introduce the Project and to enable all levels of government to provide any initial feedback. The main discussion points were:

State government

» Department of Environment and Science

» Department of Resources

» Department of Regional Development, Manufacturing and Water

» Ports North

Federal government

» Department of Agriculture, Water and the Environment

» Great Barrier Reef Marine Park Authority

Local government

» Hope Vale Aboriginal Shire Council

» Cook Shire Council.

12.2.1.3 Indigenous groups

Consultation has been undertaken with Indigenous stakeholders to ensure mutually beneficial relationships are developed and to confirm the availability and capability of Indigenous groups and their involvement in the Project as it progresses.

The two Indigenous groups engaged in discussion to date include the Dingaal and Nguurruumungu peoples. Consultation with these groups commenced in late 2020, and CFS is committed to ensuring ongoing collaboration with these stakeholders throughout the Project.

Consultation to date has focused on:

- Project progress
- Infrastructure placement
- Sand extraction, processing and exporting process
- Opportunities for Dingaal and Nguurruumungu Peoples
- Methods for receiving community feedback, concerns, and queries.

CFS has policies in place to ensure their duty of care will be met. These policies include the Indigenous and Community Relations Policy and the Site Code of Conduct, and aim to ensure that:

- Respectful and transparent consultation is maintained with Indigenous stakeholder groups
- Harm to, or disturbance of Aboriginal Sites or cultural objects is mitigated
- To the extent that harm cannot be reasonably avoided, to minimise harm to Aboriginal cultural heritage.

A Cultural Heritage Management Plan (CHMP) will also be developed.

12.2.1.4 Local community

Initial consultation with the Hope Vale community occurred in early October 2020 to introduce the Project to the community. Consultation with this stakeholder group is in the beginning stages and will increase significantly as the Project progresses to ensure there are adequate channels for community feedback and Project involvement.

Consultation thus far has focused on the following:

- Project progress
- Sand extracton, processing, and exporting process
- Opportunities for local community members to arise from the Project
- Initial Community opinions, concerns, and queries.

12.3 Environment, Social and Governance

12.3.1 Current perspective

Environment, Social and Governance (ESG) has gained prominence due to heightened consumer and stakeholder expectations, capital investment pressures and maturing global regulatory requirements. More than just addressing Climate Change, ESG incorporates a range of environmental and social considerations into organisational business strategy, to deliver a commercial benefit while achieving positive social and environmental outcomes.

Silica sand is the world's most-consumed raw material after water. It is an essential ingredient for many products and a critical mineral for the new low-carbon economy. The global focus on emissions reductions and the NetZero 2050 target has resulted in a significant demand for greener technologies such as solar, where silica sand is a major production component. High-purity silica sand is used in the production of not only solar panels, but also flat glass, container glass, fiberoptics, LCD panels, LED lights and even medical vials used to store vaccines.

Research shows just one kilogram of polysilicon — a refined material made from silica — saves more than 7,000kg of CO_2 emissions during the lifetime of a solar panel and increasing the development of solar panels could reduce CO_2 emissions by 21% by 2050. Solar power technologies could cover a quarter of the global electricity needs by mid-century becoming the second-largest generation source after wind.

12.3.2 ESG maturity

As a critical mineral producer for the new economy, CFS recognises the opportunity to make a positive global contribution as the world pivots towards a low-carbon future. CFS believes that embedding ESG into the business operations and decision-making process will enable the company to enhance financial and non-financial returns over the short, medium and long term.

Existing ESG objectives include the adoption of a comprehensive Environmental Management System and an expressed intention to minimise the company's footprint by rehabilitating disturbed areas after exploration and or sand extraction operations to natural bushland or other agreed alternative land uses.

On the social front, CFS has already established close relationships with Indigenous communities and Traditional Landowners in the Cape York Peninsula of North Queensland Australia, with signed Cultural Heritage Agreements in place and strong positive relationships with the two Native Title holders, Hope

Vale Congress Aboriginal Corporation RNTBC Trustee, on behalf of the Nguurruumungu Clan, and Walmbaar Aboriginal Corporation, on behalf of the Dingaal Clan. CFS is committed to working closely to develop partnerships within and beyond the local community.

CFS seeks to continually enhance its contribution and commitment to sustainable development and is committed to reviewing and maturing its ESG strategy as appropriate, including objectives, metrics, framework alignment and reporting obligations, post-completion of the PFS.

In recognition of CFS' current ESG maturity, when mapped against the United Nations Sustainable Development Goals (SDG), the resultant framework alignment is demonstrated in Table 12.1.

Table 12.1: Consultation techniques for stakeholder groups

ESG Framework SDG Alignment		SUSTAINABLE DEVELOPMENT GOALS
Environment	We are committed to minimising land disturbance, preserving wet season flora and fauna and embracing resource efficiency in our operations. Using optimal extraction methods and efficient water use we aim to minimise our impacts on the environment and ensure progressive rehabilitation and restoration of mined landscape with minimal impact on the local water table.	
Social	We are committed to working with the communities in which we operate to develop partnerships, including the two Native Title-holding Traditional Landowners. We undertake to maintaining a safe and healthy work environment, actively promote workforce diversity and inclusion, and empower local communities through employment creation and sourcing of materials locally where possible.	
Governance	We are committed to working with integrity in line with our ethical business practices and governance standards maintaining transparency, accountability and responsibility in all that we do.	

The purpose statement of CFS focuses on successfully delivering high-purity silica sand to customers, and the company is positioning itself as a producer of a critical mineral commodity that will positively contribute to the transition to a lower-carbon economy.

12.3.3 Stakeholder sentiment

As a part of its early ESG strategy development, CFS engaged ESG specialists JukesTodd — advisors to and project managers for the Resource, Infrastructure and Energy Sectors — to undertake a stakeholder sentiment survey and data analysis, to determine the ESG themes most material to its business.

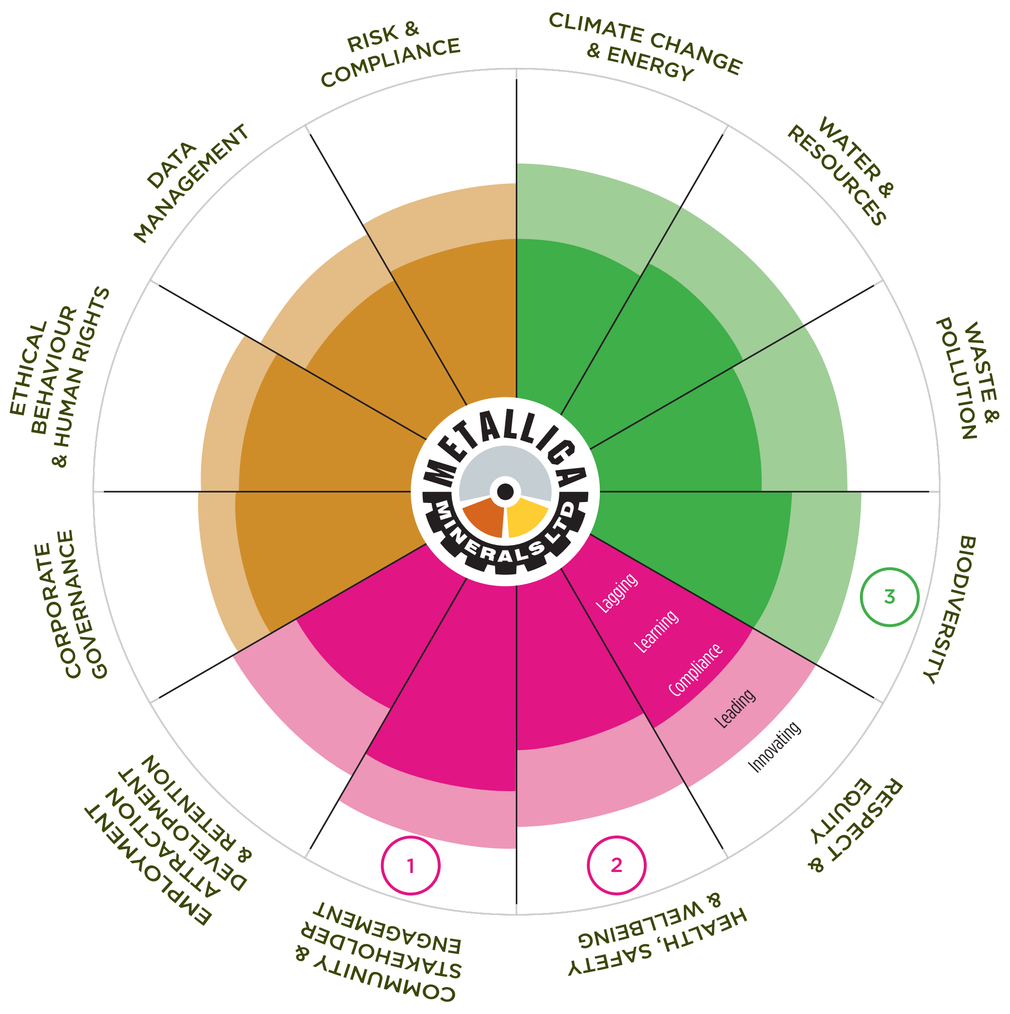
An ESG Stakeholder Sentiment Survey was disseminated to 38 CFS stakeholders, with 25 respondents. The survey consisted of 55 questions with participants taking an average time of 25 minutes to complete. Survey questions were broken into 12 themes aligning to the Environmental, Social, and Governance pillars. The purpose of the survey was to gather sentiment and insights on which ESG themes stakeholders felt are of material importance to CFS.

Survey respondents were a mix of internal and external stakeholders including representation from the senior CFS leadership team, local community members, financial service providers and insurers, relevant industry and Government bodies.

Stakeholders were asked to rate whether the organisation was perceived to be leading or lagging across each of the 12 ESG themes. They were asked to do this for both the current state of the business, as well as for where they felt the organisation should be positioned/aiming to be.

Feedback and shared perception across the CFS internal and external stakeholders surveyed was highly complimentary regarding CFS's consultative approach to addressing environmental and social aspects of the proposed project.

Figure 12.1: Organisational ESG performance chart



Current

Aspiration

Materiality 1 2 3

Lagging - Organisation is not investing in this category
Learning - Seeking to improve and learn beyond compliance
Compliance - Meets compliance obligation by nothing additional
Leading - Substantial investment in this category
Innovating - Pioneering change and advanced development

12.3.4 Material ESG themes

Sentiment survey results indicate that although in the early stage of its organisational development, CFS demonstrates a genuine and open approach to engagement with its different stakeholder groups. Results and commentary reflect CFS's positive ESG foundations that will continue to mature as the organisation develops. The themes with the highest materiality across the stakeholder groups are summarised as:

- The organisation's engagement with the local communities and key stakeholders (social)
- Employee and contractor health, safety and wellbeing (social)
- Workplace respect and equality (social)
- Impacts on biodiversity and protection of natural habitats (environmental)
- Water efficiency and management (environmental).

Responsible water usage and the importance of protecting biodiversity and restoring the environment to its original state featured strongly in stakeholder feedback, indicating a need for continued focus on a robust environmental management system. Additional commentary praised the extensive collaborative engagement with the two Traditional Owner groups of the region, the importance of continuing to strengthen relationships and the imperative for respecting traditional lore customs and the cultural significance of the region.

Many stakeholders expressed sentiments around the opportunity for CFS to strengthen the social aspect of its ESG strategy by continuing to focus on developing corporate social policies and inclusive corporate culture with the implementation of various socially focused programs. Across the stakeholders surveyed, the majority indicated they would like to see ongoing governance around the company's ESG strategy and program, with a tangible implementation plan and a commitment to regular auditing and reporting in line with national/international frameworks and standards.

12.3.5 Strategic direction

Embedding an ESG focus into project development and early operations affords CFS with significant opportunities to maximise positive environmental and social impacts both now and into the future.

The CFS leadership team is committed to operating safely, reliably, and efficiently. Business activities will continue to be planned and conducted with due consideration to community, Traditional Landowners and environmental values, and to minimise and where possible avoid negative impacts on the environment. CFS is committed to understanding how its activities, products and operations align with global efforts to move towards a more sustainable use of resources.

Insight into current stakeholder priorities and suggestions supports the positive work already undertaken by CFS and will be used to shape and refine the future direction of the CFS ESG program, with a particular focus on further developing a robust ESG framework that delivers environmental and social benefit with a positive and sustainable commercial return.

13.0 Capital cost estimate

13.1 Estimate summary

The capital cost estimate has been prepared based on the Project scope of work. The indicative capital costs for the construction of the CFS Project, prepared in accordance with Class 4 (as defined in AusIMM) are summarised as follows:

CapEx Summary	Total (A$M)
Process Plant	23.3
BLF	21.6
Conveyor & slurry pipeline	5.9
Camp & other surface infrastructure	9.3
Civils, roads & clearing	3.7
EPCM costs	4.0
Construction barging logistics	2.0
Contingency (15%)	9.6
Total CapEx	**79.4**
Total CapEx excluding contingency	**69.8**

Table 13.1: Capital cost summary

Sand extraction and other heavy fleet capital costs are included in Operating Costs as a lease arrangement and thus for the purpose of the PFS were not capitalised.

All buildings and service structures are costed from recent historic projects and will be modular packages built off site then relocated, with services connected on site. Additional installation works such as concrete, walkways, cover, lighting and services have been estimated from proposed layouts on an 'order of magnitude' basis.

Conveying system estimates are built from studies by WAVE and cost estimates obtained from previous recent WAVE project estimates.

The following have been excluded from the capital cost estimate:

- Mine/plant closure and rehabilitation costs
- Offsite costs including power, water, access
- Escalation.

No allowance has been included in the CFS Project capital cost estimate for owner's costs, however these have been included in the financial model as appropriate; typically these include:

- Taxes
- Royalties
- Insurance costs
- Working capital
- Environmental and jetty bonds
- Permits and licensing
- Training of operations personnel.

13.2 Basis of estimate

The capital cost estimate prepared is based on first principles built up using library and some project-specific vendor pricing. Cost estimates have been developed assuming Australian suppliers and fabricators and are expressed in Australian Dollars.

13.2.1 Mechanical equipment pricing

This study includes a capital cost inclusive of design, supply, manufacture, delivery to site, construction and commissioning. Related administration and procurement have been incorporated to provide a client-executed capital cost basis.

The engineering design-supplied modular units and installation of the DMU, WCP, and product stacking have been provided by Mineral Technologies.

All remaining equipment, fabrications, logistics, procurement, site construction and commissioning has been derived from recently estimated or undertaken projects in Queensland.

13.2.2 Direct field costs

13.2.2.1 Run of Mine Area (ROM) costs

Capital costs have been included for the processing equipment used at the ROM area covering the grizzly inlet at the dump hopper through to WCP feed piping where it connects into the WCP. The low-grade cyclone stacker unit and return water infrastructure has been incorporated into the ROM area capital costs as this equipment moves with the ROM as the working faces are mined.

The open pipe disposal system for thickener underflow discharge has been included in the WCP capital cost.

A diesel generator at the DMU/ROM will be provided on a lease basis.

13.2.2.2 Processing plant costs

A capital cost estimate has been developed for the processing plant using industry-acceptable engineering estimation methods to a level of accuracy of ±25%.

The processing facilities cover the plant input screen through to the final product discharge pumps through to the product area and the final product stacker.

Low-grade silica waste is pumped from WCP-based pumping and field piping systems for connection to the ROM-based cyclone stacker unit.

The open pipe disposal system for thickener underflow discharge has also been included within the WCP as it does not connect to any ROM equipment despite trailing the low-grade cyclone stacker system. Return/reclaimed water will be integrated into the DRU/ROM system.

Return water from the WCP thickener reports to the WCP water tank. Flocculant and Coagulant dosing systems have been allowed to support thickener operations.

A dedicated WCP switchroom has been included at the WCP inclusive of power, control and instrumentation cabling and distribution. The WCP holds the control room.

Diesel generators at the ROM area as a client cost, inclusive of bunded skids and ongoing fuel supply.

13.2.3 Non-process infrastructure

13.2.3.1 Earthworks

Quantities were developed from preliminary site layouts for the MIA, WCP and stockpile, outbound product conveyor, and JIF to camp access road. The quantities developed from 3-D modelling were considered for assumed geotechnical conditions observed during the site visit of October 2021. The complexity of execution, anticipated contractor execution methodology, requirement for blasting, and subsequent working requirements were considered.

Generally, rock to be removed will be crushed and returned to the working area for final pavement surfaces. Quantities have been adjusted to make provision for a portion of blasted rock to be dozer pushed direct to fill, with balance crushed and prepared for final capping.

Contractor rates from previous projects were assessed for applicability considering site specific requirements.

13.2.3.2 Offices and operations support facilities

Requirements for offices, crib, ablution, laboratory, and workshop have been determined following preliminary staff and workforce requirements determinations, and with reference to similar-scale operations in Queensland. Pricing has been drawn from the WAVE estimate library data, with spot checks in the market to understand where unusual escalation may be occurring in the industry at this time.

13.2.3.3 Accommodation facility

A conventional-style mine accommodation facility has been provided that includes 80 beds for personnel. The final workforce/operator requirements will be developed in detail in DFS, but it is expected that a steady state workforce of approximately 60 will be on site at any time, with provisions incorporated for DFS for periodic consultants, maintenance contractors, customers, and statutory visitation occasions.
The estimate has been benchmarked with recent quotes for similar projects consistent with workforce expectations (aligned with personnel retention and industrial stability).

14.0 Operating expenditure

Operating costs for CFS were developed based on work undertaken by WAVE including a 'bottom-up' estimate for some components of the Project. All significant and measurable items are listed. However, smaller items are factored as per industry practice for PFS–level assessment.

The level of effort for each of the line items meets the Class 4 estimate as defined by the AusIMM, and the extent of work performed allows for a ±20% to 25% accuracy (related to capital cost basis).

14.1 OpEx assumptions

The operating costs for the site are based upon the following:

- The Project will operate 365 days p.a., less designated non-working days and annual maintenance (major) shutdowns
- Extraction operations in advance of the sand extraction face, i.e., clearing, grubbing, and topsoil removal, will be undertaken on day shift only
- Mine face loading operations to be undertaken on 24-hour basis
- Processing plant will operate to 7,200 hours per annum (feed on to plant)
- Ship loading operations will occur aligned with shipping schedule averaging a ship every two weeks.

14.2 Basis of estimates

The following criteria have informed the determination of the operating cost estimate:

- ROM feed – 1,800,000tpa
- Product shipped – 1,350,000tpa
- Personnel basis ex-Cooktown – Staff – 5/2 roster Monday to Friday
- Operator/maintainers – 7/7 roster with shift change Wednesday
- Operations labour costs have been based on estimated salary allowances and will need to be reassessed to account for local labour markets during the DFS. The costs included in this estimate include provision to account for typical on-costs, including superannuation, sick leave, annual leave, training, worker's compensation, payroll tax entitlements and similar.
- Personnel movements to and from site per site rosters will be by contracted (boat) service ex-Cooktown.
- Regular supply and delivery services to site shall be contracted services for site consumables, food, fuel delivery, and miscellaneous aligned to regular LCT (marine) services operated from Cairns and servicing the Cape York Peninsula.
- Operator site vehicles, buses, mobile equipment (loaders, dozers etc.) are included on a lease basis, with estimated fuel consumptions calculated on estimated operating hours of each unit.
- Annual fuel consumption is based on Caterpillar published fuel consumptions, applying the average of the mid-range consumptions published.
- Site power has been included as leased generators located locally to the load requirements, and calculation of fuel consumption based on operating hours, and maintenance costs included within the lease provision. Fuel consumptions as provided by FW Power UK for the 500kva and 1,000kVA generating applications.
- Allowance for offsite logistics to supply labour, parts and materials to site, has been incorporated into the estimate. These services are considered on 'by water' only basis to the site. The specific frequency of service is anticipated to align with current regularly scheduled services available to the area.
- Fuel cost A$0.99 per litre, including Federal fuel rebate.
- Make up water shall be drawn from onsite bores.
- Thickener dosing of flocculant and coagulant is based on 0.22kg / ROM t at $5/kg.
- Fixed plant maintenance will be outsourced to local contractors at a commercial labour rate.
- Accommodation camp supply and installation is included in the capital expenditure, but operation and maintenance will be on a contract basis with an experienced service provider, including management, cook, and cleaning personnel.
- Transhipment services to be contracted (package) services.
- Product ship size 50,000 to 60,000dwt, average of 55,000dwt for 25 ships per year.
- Minimum ship loading rate 16,000t per day, therefore average 3.44 days to load ship.

» Marine fleet comprising 2 x tugs and 3 x 3,600t barges.

» Commercial royalty for Traditional Landowners included in forecast expenditure.

14.3 OpEx summary

Steady state operating costs are summarised below. Marketing and ramp-up costs are sourced from the financial model and added to the operating cost summary to show the total C1 costs.

Figure 14.1: Operating cost breakdown

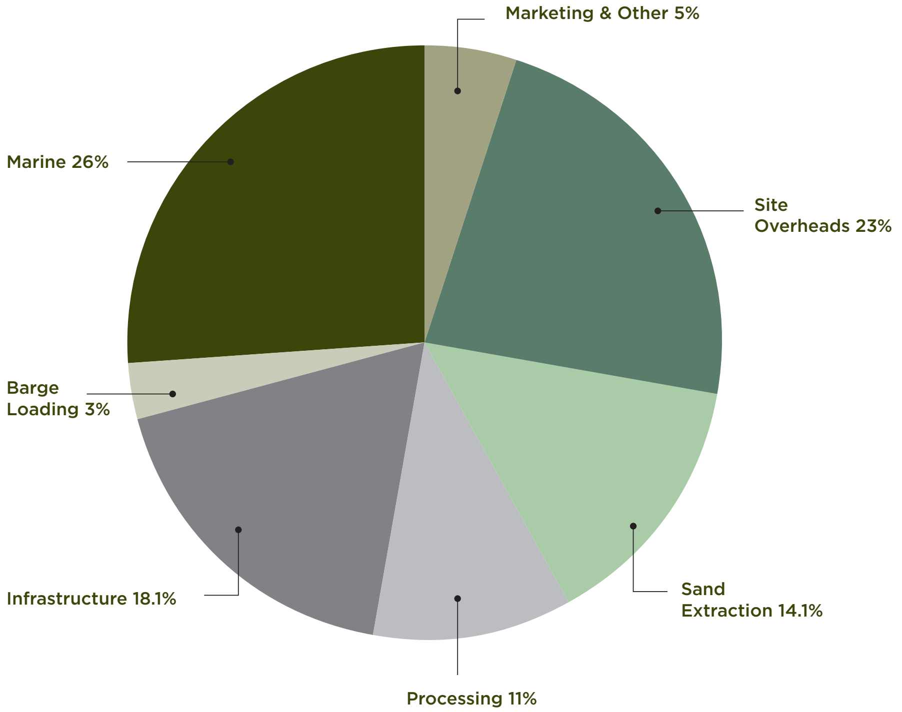


Table 14.1 Operating Cost Summary

Total OpEx Summary	AUD/t Product
Site overheads*	7.85
Sand extraction	4.80
Processing	3.73
Infrastructure	5.97
Barge loading	0.95
Marine	8.94
Marketing & other	1.53
C1 Cost Total	**33.77**

*Site Overheads expenditure includes Royalties, Workforce transportation, Camp Facilities and year-round equipment and supplies barging

15.0 Financial evaluation

The combination of the technical and financial analysis undertaken by the PFS, delivers a very strong financial result and justifies the CFS Project progressing to a DFS. The financial model prepared by WAVE used a discounted cashflow methodology to assess the financial viability of the Project. Sensitivity and scenario analysis demonstrate the Project is financially robust and can maintain a positive NPV through stress-testing of the various scenarios.

The key financial highlights of the Project are shown in Table 15.1.

Table 15.1: Summary of the Net Present Value

Item	Units	PFS Result
Pre-tax NPV[8]	A$M	290.1
Pre-tax IRR	%	34.9
LOM EBITDA	A$M	952
LOM Revenue	A$M	2,127
Payback (from 1st production)	Years	3.9

The financial evaluation of the Project has made several assumptions:

» Inferred Resources have been excluded on the basis that they are considered too speculative to have economic considerations applied to them to enable categorisation as mineral reserves

» The Probable Ore Reserve and Measured and Indicated Mineral Resource underpinning the above production assumption targets has been prepared by a Competent Person in accordance with the requirements of the JORC Code 2012 (refer Table 2 – Ore Reserves; and Table 3 – Mineral Resources).

» All physical tonnage is assumed to be wet

» Future cashflow has been discounted using a weighted average cost of capital (WACC) of 8% to generate the NPV calculations. Inflation or escalation have not been considered

» An allocation for head office costs (Brisbane) has not been made to the Project, although it is considered that support services that can be based on site and in North Queensland have been included

» Mine and Marine Bonds have been included in the Financial Model however not included as a project capital item

» The PFS Financial Model assumes 100% equity funding with no gearing. Financing the Project will be further explored in the DFS process.

» Working capital is included within the financial model, which includes first fills, critical spares and construction insurance for the late stages of construction. These items are unique to the financial model as they are not in the scope of the CapEx or part of steady state operations; but are material factors that are commonly applied to early stages of similar projects.

» All figures are presented in Australian dollars unless otherwise specified.

» Corporate tax rate of 30%

» USD/AUD exchange rate of approximately US$0.75

» Straight-line depreciation over 25 years (LOM)

» Queensland Government royalty of A$0.90/t product shipped

» Silica sand recovery of 75%

» The plant is designed to process 1.8Mtpa.

» Silica sand flat price of US$47.50/t (A$63.63/t)

» Start-up CapEx of A$79.4M

» The CapEx estimate includes a contingency of $9.6M (15%).

» Production commences after 13 months of first drawdown.

The product market and price forecasts used in the financial evaluation of the PFS are based on a photovoltaic-grade silica sand with an iron (Fe) content less than or equal to 120ppm. Forward-looking FOB prices are disclosed in the Marketing section.

The table below lists the key metrics considered most defining to the viability of the Project and their corresponding totals calculated from the financial model. C1 costs include the cash costs of the Project. All-In-Sustaining-Costs (AISC) include the C1 Cash costs, royalties and sustaining capital costs. Queensland Government Royalties and sustaining capital account for A$0.90/t and A$1.00/t respectively.

TLO royalties have been incorporated into the general expenses category using an average of the industry expected royalty rate.

Table 15.2: Project key metrics

Key metric	Unit	Total
NPV[8] – pre-tax	A$M	290.1
IRR – pre-tax	%	34.9
NPV[8] – post tax*	A$M	189.3
IRR – post tax	%	27.1
Payback (start of production)	Years	3.9
Initial CapEx	A$M	79.4
LOM CapEx	A$M	113.9
Average annual revenue	A$M	85.1
LOM revenue	A$M	2,127
Average annual OpEx	A$M	46.4
LOM OpEx	A$M	1,159
Average annual EBITDA	A$M	38.1
LOM EBITDA	A$M	952
C1 costs	A$/t product	33.77
AISC	A$/t product	35.70
Average silica sand price	US$/t (FOB)	47.50
LOM	Years	25
LOM sand mined & processed	Tonnes M	45
LOM silica sand production	Tonnes M	33.4

* Note: Metallica had deferred tax assets not recognised totalling $6.7M as disclosed in Note 7 of the Annual Financial Report to 30 June 2021 (see ASX release dated 14 October 2021 titled 'Annual Report to Shareholders'). These tax assets have not been included in the PFS post-tax financial results shown in this report or in Table 15.2 above; however, it is expected that a large portion of these tax assets will be included in a DFS report.

The forward-looking silica sand price is based on a forecast provided by Metallica/CFS. The AUD:USD exchange rate of $0.75 is a two-year forward rate obtained from an independent third party. The average yearly gross revenue is approximately A$85M. The Project's strong gross revenue, post-tax and cumulative cashflows can be viewed in Figure 15.1 and Figure 15.2.

Figure 15.1: Cashflow forecast (first 10 years of production)

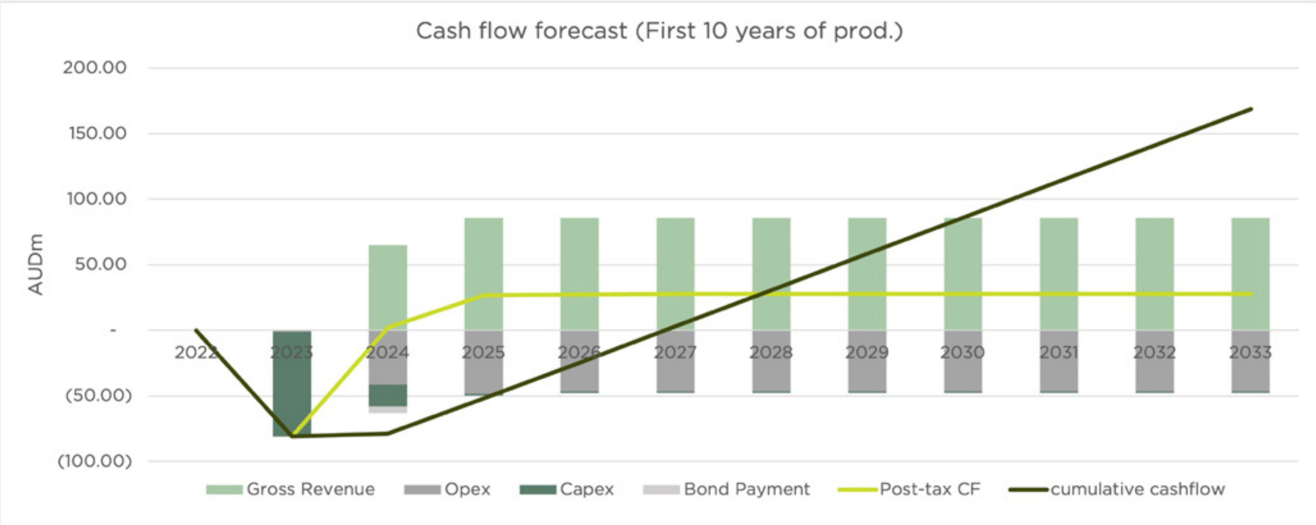
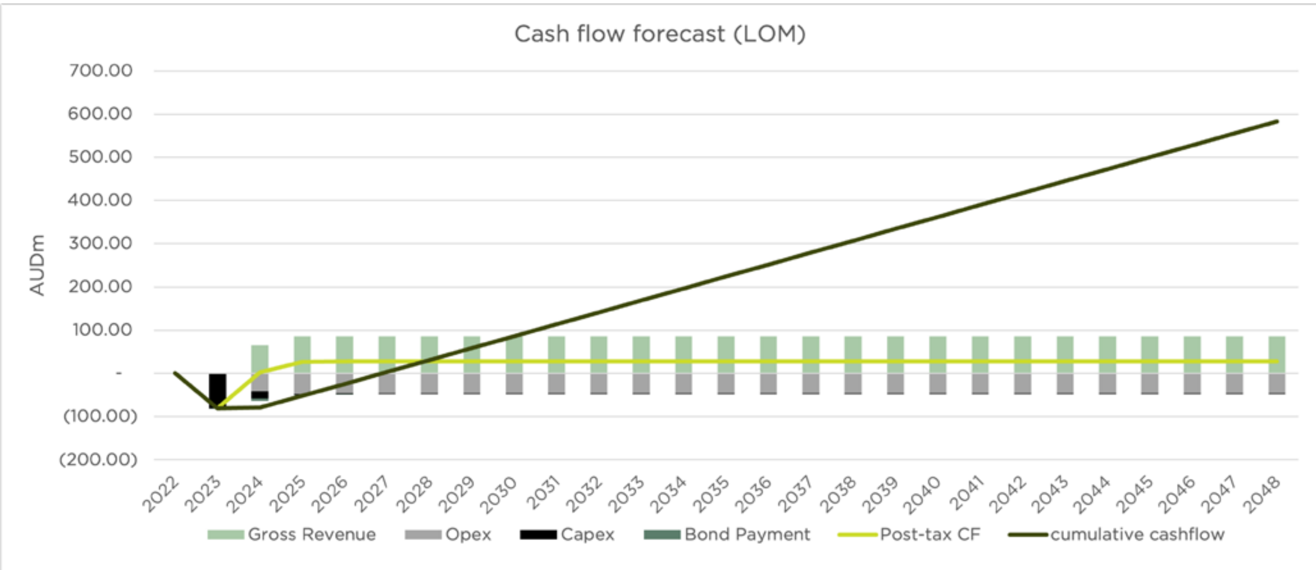


Figure 15.2: Cashflow forecast LOM



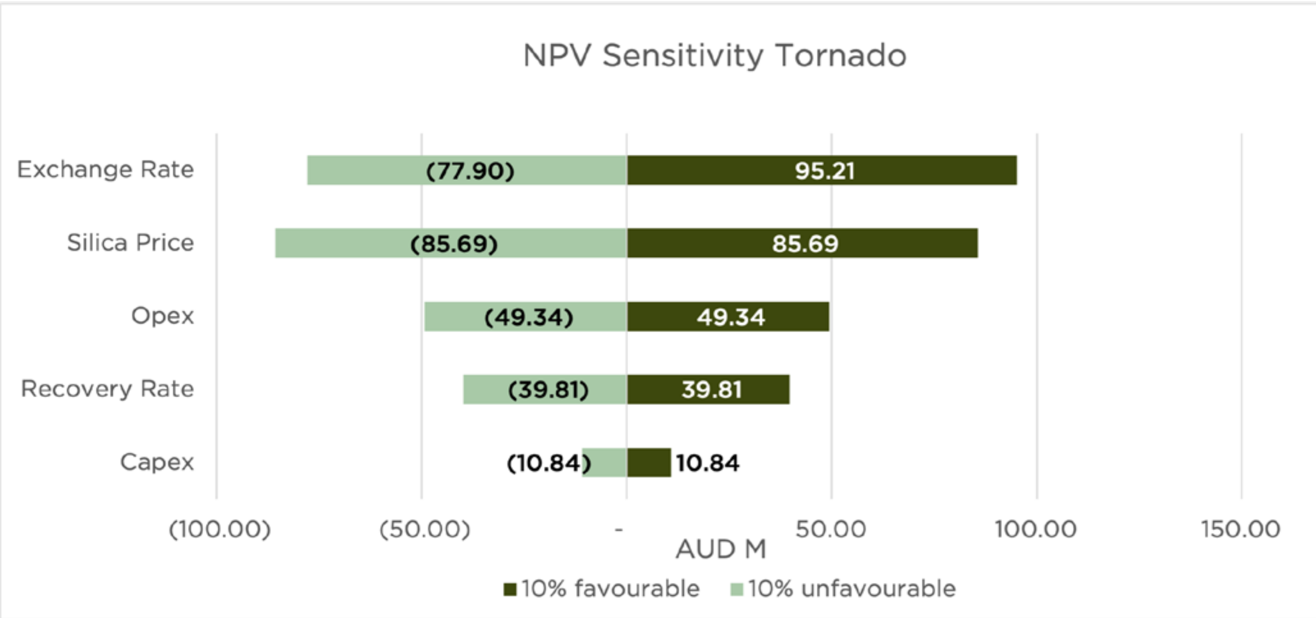
15.1 Sensitivity analysis

The following charts detail the project's financial sensitivity, on an individual basis, to the five key drivers and assumptions, which are:

1. Silica sand Price
2. OpEx
3. CapEx
4. Exchange rate
5. Recovery rate.

The below figures show the project can withstand strong changes in the economic environment. The project is most sensitive to (from most to least sensitive): exchange rate; silica sand price; OpEx; recovery rate; CapEx.

Figure 15.3: NPV sensitivity tornado



16.0 Project risk and opportunities

16.1 Risk summary

The PFS established a set of assumptions to develop a broad understanding of the CFS Project. This was followed by a risk review to identify, assess and manage ongoing project risk. Additional risks identified since the risk register workshop are noted.

This Section summarises the identified risks and discusses any impacts to the Project that may occur.

16.1.1 Risks by discipline

The risk register includes a nominated discipline that operates as the risk owner. The risk owner is the lead function responsible for overall management and includes monitoring of any additional controls by others in the team.

The distribution of risks across the disciplines is shown in Figure 16.1. The chart represents the cumulative total of each of the risks scores and the maximum individual risk rank within each of these grouped discipline totals. The cumulative ranking and the maximum risk rank helps to highlight disciplines with a proportionately high-risk profile.

The following information is based on the complete risk register, including the medium and low ranked risks.

Figure 16.1: Risk chart by topic

16.2 Detail of project risks

The following sub-sections provide summary risk information referring to specific sections of this report along with data from the risk register that was used to inform the following discussion of risks. Some items in this section were identified after the workshop and are noted here for inclusiveness.

- Strategic
- Sales and marketing
- Ownership, legal and contractual
- Sand extracction, geotechnical and hydrological investigation
- Metallurgical testwork
- Process
- Non-process infrastructure
- Health, safety, environment and community.

16.2.1 Schedule

Risks to the schedule and possible mitigations include:

- Delay in engineering design and issue for construction information – Managed through early start of a front-end engineering phase.
- Logistic delays such as shipping, clearing and transport – Managed through appointment of logistics agents familiar with the process of international shipping to negotiate agreements between owners and vendors to meet tight delivery requirements.

- Construction delays – potentially managed through modular structural construction.
- Weather delays – The Project will occur during the wet season in far North Queensland. There is an inherent risk of delay caused by the weather, but the mitigations to engineering, logistics and construction listed above could potentially limit the extent.
- Delay in vendor data on long-lead items to support engineering design and issue for construction information – managed through early confirmation of vendor data for items with long-lead times is received prior to final Project funding being achieved.
- Delays in project approvals – managed through a well-defined approval pathway going forward.

16.2.1 Financial

16.2.1.1 Capital and operating cost risk

The following CapEx and OpEx risks exist:

- Foreign currency exchange rates
- Labour rate increases or poor availability of key personnel
- Scope creep from PFS to DFS.

16.2.1.2 Market risk

The following market risks may affect the Project:

- Increased output from existing and new producers and projects currently progressing through project development and approvals programs.

Appendix X | JORC Table 1

JORC Code, 2012 Edition – Table 1 Report

Cape Flattery Silica Project - Eastern Resource Area
Ore Reserve Estimate – Probable, March 2022

Section 1 Sampling Techniques and Data

(Criteria in this section apply to all succeeding sections.)

Criteria	JORC Code explanation	Commentary
Sampling techniques	» Nature and quality of sampling (eg cut channels, random chips, or specific specialised industry standard measurement tools appropriate to the minerals under investigation, such as down hole gamma sondes, or handheld XRF instruments, etc). These examples should not be taken as limiting the broad meaning of sampling. » Include reference to measures taken to ensure sample representivity and the appropriate calibration of any measurement tools or systems used. » Aspects of the determination of mineralisation that are Material to the Public Report. » In cases where 'industry standard' work has been done this would be relatively simple (eg 'reverse circulation drilling was used to obtain 1 m samples from which 3kg was pulverised to produce a 30g charge for fire assay'). In other cases more explanation may be required, such as where there is coarse gold that has inherent sampling problems. Unusual commodities or mineralisation types (eg submarine nodules) may warrant disclosure of detailed information.	» Drilling was completed using a tractor mounted vacuum rig, with samples predominantly collected every one meter. Occasionally samples of less than one meter were collected (usually at the top of the hole), The drilled sand was collected from a cyclone and 100% of the sample was collected and placed into a pre-numbered sample bag, with each sample having a mass of between 2.5 to 4kg. » Seven hand auger samples from a 2020 programme were used in the resource estimate, The hand auger holes were samples were between 1-2kg in weight (~50% of drill material returned via the auger) and collected and bagged. Care was taken to remove possible contamination from the Shell Auger. » In the case of the drill samples the entire 1m sample was collected on site and dispatched to the laboratory for splitting and analysis (2021 programme), In the 2020 programme a spear sample of the 1m was taken and submitted for assay. » Samples were submitted to ALS Laboratories in Brisbane for drying, splitting and pulverization in a tungsten carbide bowl, prior to being analysed by an XRF analysis. » Sampling techniques are mineral sands "industry standard" for dry aeolian sands with low levels of induration and slime. » As the targeted mineralization is silica sand, geological logging of the drill material is a primary method for identifying mineralisation. » Samples from this drilling programme have been selected for Metallurgical testwork. These samples will be composited to form a bulk sample. Initially all the samples (above the COG) for each hole within the Measured Resource area will be composited to form a bulk sample for metallurgical testwork. Selected samples with high clay content are also being tested to determine if the purity of the SiO_2 in the sample can be upgrade by scrubbing out any clay.

Criteria	JORC Code explanation	Commentary
Drilling techniques	» Drill type (eg core, reverse circulation, open-hole hammer, rotary air blast, auger, Bangka, sonic, etc) and details (eg core diameter, triple or standard tube, depth of diamond tails, face-sampling bit or other type, whether core is oriented and if so, by what method, etc).	» Two (2) drilling techniques were used to collect samples for the resource estimate, namely hand-auger and vacuum drilling operated by Yearlong Drilling Contractors. All holes were drilled vertically. » Vacuum drilling was by a 4x4 tractor mounted drill rig with a blade drill bit diameter of 60mm equivalent to NQ sample size, using 1.8m rods. » Holes were terminated in a basement layer (clay/ coloured sands) or when the very damp sand or water was intersected.
Drill sample recovery	» Method of recording and assessing core and chip sample recoveries and results assessed. » Measures taken to maximise sample recovery and ensure representative nature of the samples. » Whether a relationship exists between sample recovery and grade and whether sample bias may have occurred due to preferential loss/gain of fine/ coarse material.	» Visual assessment and logging of sample recovery and sample quality. » Vacuum drilling is low disturbance and low impact, minimising drill hole wall impact and contamination. » Samples are collected in a cyclone which has a clear Perspex casing allowing visual inspection of sample as they are being collected. » Regular cleaning of cyclone and drill rods was utilised to prevent sample contamination. » No sample bias occurred between sample recovery and grade. » The consistent weight of the samples indicates that recovery of between 90 to 100% was achieved, lower recoveries (less than 80%) were recorded in the top 1m of each hole due to the presence of organic matter and topsoil.
Logging	» Whether core and chip samples have been geologically and geotechnically logged to a level of detail to support appropriate Mineral Resource estimation, mining studies and metallurgical studies. » Whether logging is qualitative or quantitative in nature. Core (or costean, channel, etc) photography. » The total length and percentage of the relevant intersections logged.	» Geological logging of the total hole by field geologist, with retention of sample in chip trays to allow subsequent re-interpretation of data if required. » The total hole was logged at 1m intervals; logging includes qualitative descriptions of colour, grain size, sorting, induration and estimates of HM, slimes and oversize utilising panning. » Photographs of each chip tray were taken so a digital visual record of each of the drill holes was obtained. » Logging has been captured through field drill log sheets and transferred through to an excel spreadsheet which is then transferred to a central database and storage prior to being provided to a third-party consultant (Ausrocks) for resource estimation.

Criteria	JORC Code explanation	Commentary
Sub-sampling techniques and sample preparation	If core, whether cut or sawn and whether quarter, half or all core taken. If non-core, whether riffled, tube sampled, rotary split, etc and whether sampled wet or dry. For all sample types, the nature, quality and appropriateness of the sample preparation technique. Quality control procedures adopted for all sub-sampling stages to maximise representivity of samples. Measures taken to ensure that the sampling is representative of the in situ material collected, including for instance results for field duplicate/ second-half sampling. Whether sample sizes are appropriate to the grain size of the material being sampled.	» Hand-auger holes were sampled in 1m intervals with 1-2kg (~50% of drill material returned via the auger) collected and bagged. » For the August vacuum drilling programme sample for the entire 1m interval was collected from the cyclone. » The entire one meter (1) samples were placed in a numbered calico bag (August 2021), or subsamples of approximately 500g were speared and separately numbered, bagged and sealed ready for assaying (December 2020 programme) prior to being placed in a poly-weave sack for dispatch to the laboratory. » Each one meter sample weighed between 2.5 to 4.0Kg. » At ALS the samples were split to 100gram samples for analysis in the laboratory under laboratory-controlled methods. » The sample size is considered appropriate for the grain size of material, average grain size (87% material by weight) between 0.125mm and 0.5mm. » The Competent Person considers the sample preparation to be appropriate for drilling of this nature. » The Competent Person considers the sample sizes to be appropriate for the type of material being sampled. Appropriate sample sizes and pulverisation of the entire sample support good representivity.

Criteria	JORC Code explanation	Commentary
Quality of assay data and laboratory tests	» The nature, quality and appropriateness of the assaying and laboratory procedures used and whether the technique is considered partial or total. » For geophysical tools, spectrometers, handheld XRF instruments, etc, the parameters used in determining the analysis including instrument make and model, reading times, calibrations factors applied and their derivation, etc. » Nature of quality control procedures adopted (eg standards, blanks, duplicates, external laboratory checks) and whether acceptable levels of accuracy (ie lack of bias) and precision have been established.	» All assaying has been carried out by ALS Mineral Laboratories, Brisbane. ALS is a global leader with over 71 laboratories worldwide providing laboratory testing, inspection certification and verification solutions. ALS Quality Assurance and all ALS geochemical hub laboratories are accredited to ISO/IEC 17025:2017 for specific analyses, which includes their Townsville and Brisbane laboratories. ALS is NATA Accredited, Corporate Accreditation No. 825, Corporate Site No. 818. » XRF was chosen as the most cost-effective assaying method for silica and minor elements for all exploration samples. » Analysis was undertaken by ALS Brisbane utilising a Tungsten Carbide pulverization, ME-XRF26 (whole rock by Fusion/XRF) and OA-GRA05 (H2O/LOI by TGA furnace). » 2,229% SiO_2 assays were completed on 1m downhole intervals over various drilling programs. » Assaying was primarily to determine the silica (SiO_2%) percentage, but as part of the method results were obtained for a range of minor elements, namely Al_2O_3, BaO, CaO, Cr_2O_2, Fe_2O_3, K_2O, MgO, MnO, Na_2O, P_2O_5, SO_3, SrO, TiO_2. » Analysis undertaken determined by a sample code which correlates to drill logs to ensure no sample bias. » There is an alternative ICP method which has lower detection limits for the other oxides such as Fe_2O_3 and Al_2O_3, but the SiO_2 assay is determined by calculation and not a measured quantum. » Internal laboratory QAQC checks include the analyses of standards, blanks and duplicates. » Acceptable levels of precision and accuracy were established. » QC procedures - No duplicate samples were collected in the field for the August 2021 programme as the entire sample was submitted to the laboratory. However selected duplicate samples have been selected from the coarse rejects at the laboratory, for duplication, Inter-laboratory checks will also be undertaken by Intertek in Perth.

Criteria	JORC Code explanation	Commentary
Verification of sampling and assaying	» The verification of significant intersections by either independent or alternative company personnel. » The use of twinned holes. » Documentation of primary data, data entry procedures, data verification, data storage (physical and electronic) protocols. » Discuss any adjustment to assay data.	» Significant intersections validated against geological logging and local geology/ geological model. » No holes have been twinned, as the grade continuity in the holes is consistent. » All data captured and stored in both hard copy and electronic format. Assay data had to be adjusted in some locations for the 0-1m interval due to minor topsoil contamination. » All digital data is verified by the Competent Person. » No adjustments were made to assay data. » Significant intersections were independently validated by Ausrocks against geological logging and the geological model. » Four (4) holes have been twinned with vacuum and hand-auger to check repeatability of drill results. To date, there is a strong correlation between results from different type holes and different assay batches. Downhole variability is matched in different drill programs and different assay batches. » The infill drilling in 2021 validated the 2020 programme as the intercepts and grade of the silica were consistent along the various sections.
Location of data points	» Accuracy and quality of surveys used to locate drill holes (collar and down-hole surveys), trenches, mine workings and other locations used in Mineral Resource estimation. » Specification of the grid system used. » Quality and adequacy of topographic control.	» All holes initially located using handheld GPS with an accuracy of 5m for X, Y. » UTM coordinates, Zone 55L, GDA94 datum. » LiDAR topography and imagery with a vertical accuracy of <10cm was used as the topographic surface. Collar RL's draped against this surface verifies the accuracy of the hole locations. The Lidar imagery which was produced by Aerometrex.

Criteria	JORC Code explanation	Commentary
Data spacing and distribution	» Data spacing for reporting of Exploration Results. » Whether the data spacing and distribution is sufficient to establish the degree of geological and grade continuity appropriate for the Mineral Resource and Ore Reserve estimation procedure(s) and classifications applied. » Whether sample compositing has been applied.	» Drilling was completed on existing tracks and newly cleared lines which are 100m to 200m apart, the lines are orientated approximately NW – SE » The holes were spaced approximately 200m apart and in some areas were infilled to 100m and 50m centres. » Drill spacing and distribution is sufficient to allow valid interpretation of geological and grade continuity for a Measured Mineral Resource, Indicated Mineral Resource and Inferred Mineral Resource where determined. Drilling has been completed at varying spacings across the Resource Area. » Drill spacing and interpreted geological continuity has allowed three resource categories to be defined which have been estimated in accordance with the JORC Code (2012) and are defined as follows: - **Measured Mineral Resource:** Area with drillholes completed at semi-gridded spacing <150m x 150m ending in basement/water table. - **Indicated Mineral Resource:** Area with drillholes at a confirmatory level spacing (150m x 250m) ending in basement/water table. - **Inferred Mineral Resource:** Areas with drillholes at a scout level spacing (250m-400m). » No sample compositing was undertaken.
Orientation of data in relation to geological structure	» Whether the orientation of sampling achieves unbiased sampling of possible structures and the extent to which this is known, considering the deposit type. » If the relationship between the drilling orientation and the orientation of key mineralised structures is considered to have introduced a sampling bias, this should be assessed and reported if material.	» The dune field has ridges dominantly trending 320º - 330°. » The drill access tracks typically run along or sub-parallel to dune ridges which suggest unbiased sampling, some cross-dune tracks linking the ridges were also drilled. » Silica deposition occurs as windblown with angle of rest approximately 35º. Drilling orientation is appropriate for the nature of deposition. » The orientation of the drilling undertaken is assessed to provide representative intersections and unbiased data for the deposit. All drilling is vertical, intersecting the dune field geology essentially normal or at 90 degrees to the dune sand formation. Drilling was undertaken along or sub-parallel to dune ridges. Some cross-dune tracks linking the ridges were also drilled.

Criteria	JORC Code explanation	Commentary
Sample security	» The measures taken to ensure sample security.	» Sample collection and transport from the field was undertaken by company Personnel following company procedures. » Samples were aggregated into larger polyweave bags and sealed with plastic zip ties, Bags were labelled and put into palette-crates and sealed prior to being shipped to ALS Townsville. » Samples were delivered direct to ALS in Townsville, where they were transhipped to ALS Brisbane for sample preparation and analysis.
Audits or reviews	» The results of any audits or reviews of sampling techniques and data.	» A review was conducted internally by Metallica Minerals Ltd and a third-party consultant, Ausrocks Pty Ltd, who also reviewed the data prior to undertaking a resource estimate.

Section 2 Reporting of Exploration Results

(Criteria listed in the preceding section also apply to this section.)

Criteria	JORC Code explanation	Commentary
Mineral tenement and land tenure status	» Type, reference name/number, location and ownership including agreements or material issues with third parties such as joint ventures, partnerships, overriding royalties, native title interests, historical sites, wilderness or national park and environmental settings. » The security of the tenure held at the time of reporting along with any known impediments to obtaining a licence to operate in the area.	» The Cape Flattery Silica Sand Project is located within EPM 25734 in Queensland and is held by Metallica Minerals Ltd through subsidiary company Cape Flattery Silica Pty Ltd. » The project is located in Far North Queensland, approximately 220km north of Cairns or about 50km north of Cooktown and lies within EPM 25734. EPM 25734 is held by Cape Flattery Silica Pty Ltd, a wholly owned subsidiary of Metallica Minerals Pty Ltd and comprises 11 contiguous subblocks covering the very northern end of the extensive Cape Bedford/Cape Flattery dunefield complex. The dunefield complex is characterised by large northwest trending transgressive elongate and parabolic sand dunes, stretching inland from the coastline for kilometres. » A compensation and conduct agreement is in place with the landholder (Hopevale Congress) and native title party. » The tenement is in good standing and there are no impediments to conduct exploration programs on the tenements.
Exploration done by other parties	» Acknowledgment and appraisal of exploration by other parties.	» Previous exploration has been carried out in the area during the 1970s and 80s by Cape Flattery Silica Mines (CFSM). CFSM reported seven (7) holes drilled for 84 meters. These holes intersected sand dunes between 10 and 20m in thickness. » The historical exploration data is of limited use since but never assayed for SiO_2 and there is poor survey control to determine exact locations of historical holes. » All current exploration programs are managed by Metallica Minerals.

Geology	» Deposit type, geological setting and style of mineralisation.	» The CFS Project is a large surface deposit of overlying sand dunes that lies in the northern most part of the Quaternary age Cape Flattery-Cape Bedford dunefield complex. » The geology comprises variably re-worked aeolian sand (silica) dune deposits associated with Quaternary age sand-dune complex. The mineralisation is high grade quartz (silica) and it occurs as sand deposits within an aeolian dune complex. » CFSM, which also lies at the northern end of the dune field, has been in operation since 1967 and is Queensland's largest producer of world class silica and the highest production of silica sand of any mine in the world. » The linear sand dunes developed predominantly during the dry Pleistocene glacial and interglacial periods when the sea-level receded and fluctuated approx. 100m below present. Prior to sea level rises in the Holocene (10,000 years before present) sand was blown inland by the prevailing south-easterly winds to form linear dunes and is now interspersed with numerous lakes and swamps. The land sand masses form mainly as elongate parabolic and longitudinal dunes. Multiple episodes of dune building are evident. Most dunes are stabilised by vegetation, but some active dune fronts occur. Periods of water level table fluctuations, erosion and depositional phases have occurred. » Silica sand Mineralisation occurs within aeolian dune sands.
Drill hole Information	» A summary of all information material to the understanding of the exploration results including a tabulation of the following information for all Material drill holes: » easting and northing of the drill hole collar » elevation or RL (Reduced Level – elevation above sea level in metres) of the drill hole collar » dip and azimuth of the hole » down hole length and interception depth » hole length. » If the exclusion of this information is justified on the basis that the information is not Material and this exclusion does not detract from the understanding of the report, the Competent Person should clearly explain why this is the case.	» A tabulation of the material drill holes used in the Mineral Resource Estimation is attached to the relevant ASX release. » Relative to the previous Mineral Resource Estimate (March 2021), an additional 98 drillholes have been added.

Data aggregation methods	» In reporting Exploration Results, weighting averaging techniques, maximum and/or minimum grade truncations (eg cutting of high grades) and cut-off grades are usually Material and should be stated. » Where aggregate intercepts incorporate short lengths of high grade results and longer lengths of low grade results, the procedure used for such aggregation should be stated and some typical examples of such aggregations should be shown in detail. » The assumptions used for any reporting of metal equivalent values should be clearly stated.	» The significant intercepts for each drill hole are calculated using a cut off grade of 98.5% SiO_2, only intercepts of greater than 3m are considered as significant. » Internal dilution of up to 3m is included in the reported intercepts » A cut-off grade of 98.5% silica has been used for the Mineral Resource Estimation. » The grade is highly consistent, and the aggregate intercepts use a simple arithmetic average. » No top cuts were applied to the data. » No metal equivalents reported.
Relationship between mineralisation widths and intercept lengths	» These relationships are particularly important in the reporting of Exploration Results. » If the geometry of the mineralisation with respect to the drill hole angle is known, its nature should be reported. » If it is not known and only the down hole lengths are reported, there should be a clear statement to this effect (eg 'down hole length, true width not known').	» All drilling was vertical (-90°) intersecting undulating flat-lying aeolian dune sands. » Down hole length correlates with true width. » As the mineralisation is associated with aeolian dune sands the majority sub-horizontal, some variability will be apparent on dune edges and faces.
Diagrams	» Appropriate maps and sections (with scales) and tabulations of intercepts should be included for any significant discovery being reported. These should include, but not be limited to a plan view of drill hole collar locations and appropriate sectional views.	» A map of the drill collar locations is incorporated with the main body of the report.
Balanced reporting	» Where comprehensive reporting of all Exploration Results is not practicable, representative reporting of both low and high grades and/or widths should be practiced to avoid misleading reporting of Exploration Results.	» All exploration results are reported in a balanced manner. All results are supported by clear and extensive diagrams and descriptions. No assays or other relevant information for interpreting the results have been omitted.

Other substantive exploration data	» Other exploration data, if meaningful and material, should be reported including (but not limited to): geological observations; geophysical survey results; geochemical survey results; bulk samples – size and method of treatment; metallurgical test results; bulk density, groundwater, geotechnical and rock characteristics; potential deleterious or contaminating substances.	» Geological observations are consistent with aeolian dune mineralisation. » Groundwater was intersected during drilling at the base of holes, as expected given the dune complex is an aquifer and drilling was undertaken to a maximum depth of 35m. » The relationship of the groundwater to the regional groundwater table is unknown. It is likely that the true groundwater table is well below the termination depth of the current drillholes. » A bulk sample will be composited from the individual samples for metallurgical testwork, this work will commence in Q4. » Iron (Fe_2O_3) in various forms may potentially act as a contaminant for very high-quality "processed" end products. » IHC Robbins completed preliminary bulk laboratory sample in early 2021. Testing confirmed a product: - between 99.8% and 99.9% SiO_2 - 450ppm Al_2O_3 - 170ppm Fe_2O_3 - 210ppm TiO_2 - 2.6% <125µm particles. - Mass yield of 77.4%
		» Mineral Technologies completed laboratory testing in early 2022 to determine the processing requirements and assist in understanding the marketability of a premium sand product. Testing confirmed a product: - 99.9% SiO_2 - 330ppm Al_2O_3 - 160ppm Fe_2O_3 - 210ppm TiO_2 - 2.6% <125µm particles. - Mass yield of 91.7% » All exploration results detailed in relevant ASX Release.
Further work	» The nature and scale of planned further work (eg tests for lateral extensions or depth extensions or large-scale step-out drilling). » Diagrams clearly highlighting the areas of possible extensions, including the main geological interpretations and future drilling areas, provided this information is not commercially sensitive.	» Further metallurgical testing. » A limited amount of infill drilling may be required to increase the confidence levels in the resource prior to a PFS and FS. » The next stage of exploration on the EPM will be to assess the western targets on the EPM utilising Auger sampling, but this work has yet to be planned.

Section 3 Estimation and Reporting of Mineral Resources

(Criteria listed in section 1, and where relevant in section 2, also apply to this section.)

Criteria	JORC Code explanation	Commentary
Database integrity	» Measures taken to ensure that data has not been corrupted by, for example, transcription or keying errors, between its initial collection and its use for Mineral Resource estimation purposes. » Data validation procedures used.	» The database was originally constructed, validated and electronically provided by Metallica to Ausrocks. » Ausrocks reformatted the database into appropriate file formats checking the veracity of the assay results. The data was further validated and cross checked against the geological logs and the chip tray photographs. » Micromine 2021 validated the files which were used for the Mineral Resource Estimate.
Site visits	» Comment on any site visits undertaken by the Competent Person and the outcome of those visits. » If no site visits have been undertaken indicate why this is the case.	» A site visit was completed by the Competent Person (B Mutton) from 13th – 18th Dec 2021 during the previous drilling program. The visit enabled an appraisal of the dune geology and setting.
Geological interpretation	» Confidence in (or conversely, the uncertainty of) the geological interpretation of the mineral deposit. » Nature of the data used and of any assumptions made. » The effect, if any, of alternative interpretations on Mineral Resource estimation. » The use of geology in guiding and controlling Mineral Resource estimation. » The factors affecting continuity both of grade and geology.	» The CFS Project is dominated by several elongate dunes rising in elevation to the northwest. The deposit is by far dominated by high-grade silica (quartz) sand. The sands are mainly very fine-grained and pure white in colour and in places a slight creamy colour. Based on current exploration, the depth of clean white high-grade sand ranges up to a maximum thickness of 35m. The high-grade silica sand overly to varying depths, yellow-orange-brown (coloured) high Silica Sand mainly representing the podsolised B2 horizon and/or in part, the flatter heavily weathered parts of the basement Devonian and Jurassic age formations. Some drilling intersected coloured sands only and in places several holes intersected coloured interburden. Sand colouration is from surface coating on sand grains of Iron (Fe) rich clay material including Fe_2O_3. It only takes a trace percentage of Fe_2O_3 to colour the sand, with cream and orange-coloured sands being in excess of 98.5% SiO_2, several intervals below the 98.5% grade are being investigated further to determine viability. In several places these coloured sands are exposed on surface. One hole intersected from surface, a continuous thickness of 38m of coloured silica sand. » The Cape Flattery Silica Sand Deposit (CFSSD) has been well defined by drilling and the geological controls are reasonably well understood.

		» The known nature and formation of the dune sands, together with consistent high silica grades achieved in drillholes, places a high degree of confidence in the geological interpretation. Continuity of geology (chip tray photographs) and grade (assays) can be readily identified and traced between all drillholes. » The interpreted geology of the CFSSD is robust, and any alternative interpretation of the deposit is considered unlikely to have a significant influence on the total Mineral Resource Estimate undertaken. » No major factors affect continuity both of grade and geology. » Geological controls were applied to multiple cross and long sections to constrain the final resource wireframe. » Prior to interpolating and assigning assay values to each block, a solid was generated to model the overall deposit shape and volume by applying the following parameters: - Top surface - defined as the base of topsoil which is 0.5m below surface topography. Bottom surface – a gridded surface based on drillhole depths and geological interpreted boundary points. - Boundary – the resource boundary was defined by the following considerations: • Surface dune extents based on imagery and interpretation. • Geological interpretation of drillholes. • The area where the top and bottom surfaces intersected. • Area of influence around drillholes determined by confidence level. » Several iterations were run to cross check boundary sensitivities.
Dimensions	» The extent and variability of the Mineral Resource expressed as length (along strike or otherwise), plan width, and depth below surface to the upper and lower limits of the Mineral Resource.	» The extent and variability of the Mineral Resource is expressed in terms of the full Resource Area » **Max Length (along strike)**: 2.4 km » **Max Width:** 2.2km » **Area:** The Mineral Resource covers an area of approximately 315ha. » **Average Depth:** The average thickness of the total resource within the Resource Area is 17m. » **Top of Resource:** The top of the resource corresponds to the topography ranging from 10mRL to 106mRL. » **Bottom of Resource:** The base of the resource corresponds to basement/water table ranging from 6mRL to 85mRL.

Estimation and modelling techniques	» The nature and appropriateness of the estimation technique(s) applied and key assumptions, including treatment of extreme grade values, domaining, interpolation parameters and maximum distance of extrapolation from data points. If a computer assisted estimation method was chosen include a description of computer software and parameters used. » The availability of check estimates, previous estimates and/or mine production records and whether the Mineral Resource estimate takes appropriate account of such data. » The assumptions made regarding recovery of by-products. » Estimation of deleterious elements or other non-grade variables of economic significance (eg sulphur for acid mine drainage characterisation). » In the case of block model interpolation, the block size in relation to the average sample spacing and the search employed. » Any assumptions behind modelling of selective sand extraction units. » Any assumptions about correlation between variables. » Description of how the geological interpretation was used to control the resource estimates. » Discussion of basis for using or not using grade cutting or capping. » The process of validation, the checking process used, the comparison of model data to drill hole data, and use of reconciliation data if available.	» The Mineral Resource Estimate was completed in accordance with JORC 2012 guidelines with Micromine 2021 used to model and evaluate the resource. » Using Micromine 2021, Statistical and Geostatistical analyses was undertaken on silica (SiO_2) and the key impurities (Fe_2O_3, TiO_2, LOI, and Al_2O_3) of the dataset. Assay methods also returned results for Al_2O_3, BaO, CaO, Cr_2O_3, Fe_2O_3, K_2O, MgO, MnO, Na_2O, P_2O_5, SO_3, SrO, TiO_2 but they were not examined due to their very low grades (at or near detection range). » All sample intervals underwent basic statistical analysis (minimum, maximum, mean etc.). All variables showed that there were no requirements for top or bottom cutting. » The raw data distribution for silica and the key impurities (Fe_2O_3, TiO_2, LOI, and Al_2O_3) were analysed in detail and used in the block modelling. » The surface boundary was generated by a combination of the interpreted geological boundaries and Mining Lease boundaries. A topsoil or humus layer of 0.5m was excluded from the model. A 400m limit was used to guide drillhole continuity where information became sparse or non-existent. Multiple cross section iterations were used to further define and constrain the model where data was minimal. » The base of the resource model was determined from selected drillhole depths (silica cut-off), then modelled and adjustments made for intersections with surface topography and other continuity limits. The model was further controlled by cross section checks. » Parent blocks of 10mE (X direction) by 10mN (Y direction) by 1mRL (Z direction) were used with sub-blocking splitting these blocks by 5m in the X direction, 5m in the Y direction and 0.5m in the Z direction. All sub-blocks have the same interpolated values as their parent blocks. » The blocks were constrained by the model boundaries and populated by the Ordinary Kriging (OK) estimation method to interpolate assay grades for each of the chosen elements (SiO_2, Fe_2O_3, Al_2O_3, LOI and TiO_2). Inverse Distance Weighting (IDW - 4:1) was used to check the model and yielded similar results.

		» The block model was validated by comparing basic statistics and histograms of modeled data (block model) against the input data (drilling data) which showed similar means, range of data and data distribution. Additionally, cross-section throughout the block model were compared with the same sections through the drillhole data showing that the modeling completed was indicative of the input data and the mineralisation. » Grade cutting or capping was not applicable as no SiO_2 values exceeded 100%. » Parent blocks of 10mE (X direction) by 10mN (Y direction) by 1mRL (Z direction) were used with sub-blocking splitting these blocks by 5m in the X direction, 5m in the Y direction and 0.5m in the Z direction. All sub-blocks have the same interpolated values as their parent blocks. » The blocks were constrained by the model boundaries and populated by the Ordinary Kriging (OK) estimation method to interpolate assay grades for each of the chosen elements (SiO_2, Fe_2O_3, Al_2O_3, LOI and TiO_2). Inverse Distance Weighting (IDW - 4:1) was used to check the model and yielded similar results. » The block model was validated by comparing basic statistics and histograms of modeled data (block model) against the input data (drilling data) which showed similar means, range of data and data. » Grade cutting or capping was not applicable as no SiO_2 values exceeded 100%.
Moisture	» Whether the tonnages are estimated on a dry basis or with natural moisture, and the method of determination of the moisture content.	» All samples were placed into bags and sealed so samples would be received with slightly less than in-situ moisture. » Estimations assume a moisture content of 2.5%

Cut-off parameters	» The basis of the adopted cut-off grade(s) or quality parameters applied.	» An SiO_2 % grade cut-off was used to define the in-situ resource to achieve a marketable high purity silica sand. Geological logging and returned assay grades and intersections showed an obvious grade demarcation of ore versus waste at 98.5% SiO_2. This was further supported by statistical analysis and representation. Lengthy continuous vertical intervals of >98.5% SiO_2 was the norm, and these intervals were used for the modelling and Mineral Resource Estimate. The clear in-situ grade demarcation of >98.5% SiO_2 persisted through successive exploration programs, and across the whole of the Resource Area. » The surface to one (1) metre interval, where assayed, returned a <98.5% silica assay and a higher than normal LOI. This logged interval included topsoil and organic material which caused minor contamination. This one (1) metre interval was adjusted by adopting the succeeding one metre assay (1-2m interval) grade. A topsoil layer from surface (0.0m to 0.5m) was excluded from the Mineral Resource Estimate. » A silica grade cut-off of 98.5% SiO_2 is robust and was applied as the cut-off grade for the resource modelling and Mineral Resource Estimate, for all reporting levels.
Sand extraction factors or assumptions	» Assumptions made regarding possible sand extraction methods, minimum sand extraction dimensions and internal (or, if applicable, external) sand extraction dilution. It is always necessary as part of the process of determining sand extraction reasonable prospects for eventual economic extraction to consider potential sand extraction methods, but the assumptions made regarding sand extraction methods and parameters when estimating Mineral Resources may not always be rigorous. Where this is the case, this should be reported with an explanation of the basis of the sand extraction assumptions made.	» It is expected that sand extraction will be conducted with dozer and wheel loader from the face, which will load a grizzly & feed bin. Material will then be conveyed to the processing plant. This sand extraction method is flexible and is considered suitable for the deposit and is not likely to unnecessarily constrain the Mineral Resources. » Dilution was not considered in the Mineral Resource Estimate. In some holes there was minor additional resource below the >98.5% silica floor which is slightly lower grade material and would only marginally dilute the product. » Based on the sample assays and geological logs, the top 0.5m of the deposit has been excluded from the Mineral Resource Estimate as it is assumed that this would be a soil and vegetation layer and would be scalped when extracting the deposit and re-used for rehabilitation.

Metallurgical factors or assumptions	» The basis for assumptions or predictions regarding metallurgical amenability. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider potential metallurgical methods, but the assumptions regarding metallurgical treatment processes and parameters made when reporting Mineral Resources may not always be rigorous. Where this is the case, this should be reported with an explanation of the basis of the metallurgical assumptions made.	» Initial Metallurgical testing has been completed, returning results consistent with assumptions. Further metallurgical testing is underway to refine the processing method and to determine specifications for end-products. » No metallurgical factors were deemed required for this Resource Estimate.
Environmental factors or assumptions	» Assumptions made regarding possible waste and process residue disposal options. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider the potential environmental impacts of the extracting and processing operation. While at this stage the determination of potential environmental impacts, particularly for a greenfields project, may not always be well advanced, the status of early consideration of these potential environmental impacts should be reported. Where these aspects have not been considered this should be reported with an explanation of the environmental assumptions made.	» Environmental considerations were made by referencing overlays as provided by the Queensland Government including Category A, B & C Environmentally sensitive areas as well as wetland areas. » Small zones of potential environmentally sensitive ecology have been identified within the resource area however these have yet to be excluded from any resource figures until these areas have been accurately categorized. » Due to the high-grade nature of the deposit, it is expected that there will be a small portion of rejects produced through processing and thus minimal disposal in the voids.
Bulk density	» Whether assumed or determined. If assumed, the basis for the assumptions. If determined, the method used, whether wet or dry, the frequency of the measurements, the nature, size and representativeness of the samples. » The bulk density for bulk material must have been measured by methods that adequately account for void spaces (vugs, porosity, etc), moisture and differences between rock and alteration zones within the deposit. » Discuss assumptions for bulk density estimates used in the evaluation process of the different materials.	» Thirty nine density measures have been completed over the wider resource area in February 2021 and December 2021 returning an average density of 1.6 t/m^3 which has been used to convert all volumes to tonnes.

Classification	» The basis for the classification of the Mineral Resources into varying confidence categories. » Whether appropriate account has been taken of all relevant factors (ie relative confidence in tonnage/ grade estimations, reliability of input data, confidence in continuity of geology and metal values, quality, quantity and distribution of the data). » Whether the result appropriately reflects the Competent Person's view of the deposit.	» Drill spacing and interpreted geological continuity has allowed three resource categories to be defined and are defined as follows: » Measured Mineral Resource: Area with drillholes completed at semi-gridded spacing <150m x 150m ending in basement/water table. » Indicated Mineral Resource: Area with drillholes at a confirmatory level spacing (150m - 250m) ending in basement/water table. » Inferred Mineral Resource: Areas with drillholes at a scout level spacing (250m - 400m). » The result appropriately reflects the Competent Persons view of the deposit.
Audits or reviews	» The results of any audits or reviews of Mineral Resource estimates	» Previous Mineral Resource Estimates have been completed and reviewed internally by Ausrocks.
Discussion of relative accuracy/ confidence	» Where appropriate a statement of the relative accuracy and confidence level in the Mineral Resource estimate using an approach or procedure deemed appropriate by the Competent Person. For example, the application of statistical or geostatistical procedures to quantify the relative accuracy of the resource within stated confidence limits, or, if such an approach is not deemed appropriate, a qualitative discussion of the factors that could affect the relative accuracy and confidence of the estimate. » The statement should specify whether it relates to global or local estimates, and, if local, state the relevant tonnages, which should be relevant to technical and economic evaluation. Documentation should include assumptions made and the procedures used. » These statements of relative accuracy and confidence of the estimate should be compared with production data, where available.	» It is the opinion of the Competent Person that the relative accuracy and confidence level across the reported geological intervals is adequate, given the drill density and continuity of geochemical samples. » The Resource boundary and the reported geological confidence intervals is relatively tightly constrained based on the drill density, although some further drill definition should be undertaken to better constrain dune sides/perimeters. » No production data is available at present as this is a Greenfields project. However, CFSM lies in the same adjoining coastal dunes immediately to the North, suggesting potential viability.

Section 4 Estimation and Reporting of Ore Reserves

(Criteria listed in section 1, and where relevant in section 2, also apply to this section.)

Criteria	JORC Code explanation	Commentary
Mineral Resource estimate for conversion to Ore Reserves	» Description of the Mineral Resource estimate used as a basis for the conversion to an Ore Reserve. » Clear statement as to whether the Mineral Resources are reported additional to, or inclusive of, the Ore Reserves.	» The Mineral Resource Estimate used as a basis for the conversion to an Ore Reserve was developed by Chris Ainslie & Brice Mutton of Ausrocks as part of the 'Cape Flattery Silica Sand Project – Upgraded Mineral Resource Estimate - Measured, Indicated and Inferred– 30 November 2021. The block model was developed in Micromine 2021 and titled 'CFSSP_BM PFS_11_2021'. » Approximately 96% of the Measured and Indicated Mineral Resources were converted to Ore Reserves. Approximately 86% of the Total Mineral Resources were converted to Ore Reserves. » Factors affecting the conversion of Resources to Reserves include ecological constraints, groundwater table, zones of elevated Fe_2O_3 as well as proximity to the ML Boundary. » The Ore Reserve is sufficient to satisfy the planned PFS 25 year mine life. The viability to mine remainder of the Ore Reserve is subject to future operating conditions. » The Mineral Resources reported above are inclusive of the Ore Reserves.
Site visits	» Comment on any site visits undertaken by the Competent Person and the outcome of those visits. » If no site visits have been undertaken indicate why this is the case.	» The Competent Persons for Exploration Results, Mineral Resources & Ore Reserves; Pat Smith, Brice Mutton, Chris Ainslie & Carl Morandy have completed site visits to the Cape Flattery Silica Sand Project. » Pat Smith and Brice Mutton have spent a number of days working on site during drilling campaigns, this provides a detailed understanding of the topography, vegetation, groundwater and other Mineral Resource assumptions. » Chris Ainslie and Carl Morandy have completed a site visit on 20th October 2021 as part of the PFS project team. This visit provided a detailed understanding of the topography, vegetation, groundwater and other sand extraction assumptions used in the Ore Reserve assumptions.

Study status	» The type and level of study undertaken to enable Mineral Resources to be converted to Ore Reserves. » The Code requires that a study to at least Pre-Feasibility Study level has been undertaken to convert Mineral Resources to Ore Reserves. Such studies will have been carried out and will have determined a mine plan that is technically achievable and economically viable, and that material Modifying Factors have been considered.	» Metallica Minerals Limited has completed a PFS for the Cape Flattery Silica Sand Project. This Ore Reserve was completed in conjunction with the PFS and is therefore reported concurrently.
Cut-off parameters	» The basis of the cut-off grade(s) or quality parameters applied.	» A 98.5% SiO_2 grade cut-off was used to define the in-situ Resource which was converted to Reserve. Geological logging and returned assay grades and intersections showed an obvious grade demarcation of ore versus waste at the 98.5% SiO_2 cutoff. This was further supported by statistical analysis and metallurgical testing. » Intermediate sub-marginal silica grades we encountered rarely in drillholes, but these intervals were restricted to several vertical meters or less. Here the grades were still >95% SiO_2 and may be considered as an alternative product, but for the purposes of the Reserve these materials are classified as 'waste'. The total volume of waste within the Pit Shell is 2.6Mt, which represents approximately 5.3% of the mined volume (46Mt Reserve + 2.6Mt Waste). » Consideration was given to the XRF test method, liaising with ALS Laboratories it was concluded this method very marginally under-reports silica grade and possibly slightly overestimates iron (Fe_2O_3) grade, however no adjustments were made. » The surface to one (1) metre interval consistently returned a <98.5% silica assay and retuned higher than normal LOI. This logged interval included an average 0.5m topsoil which includes organic material and is considered minor contamination. This one (1) metre interval was adjusted by adopting the succeeding one metre assay grade. A topsoil layer from surface (0.0m to 0.5m) was excluded from the Mineral Resource Estimate. It is assumed the topsoil material will be utilised for rehabilitation.
Sand extraction factors or assumptions	» The method and assumptions used as reported in the Pre-Feasibility or Feasibility Study to convert the Mineral Resource to an Ore Reserve (i.e. either by application of appropriate factors by optimisation or by preliminary or detailed design).	

	» The choice, nature and appropriateness of the selected sand extraction method(s) and other sand extraction parameters including associated design issues such as pre-strip, access, etc.	» The deposit is in a remote region, close to the surface with only a limited vegetation and topsoil covering. Based on these characteristics, the deposit is amenable to open-cut sand extraction methods. Underground mining methods are not justified.
	» The assumptions made regarding geotechnical parameters (eg pit slopes, stope sizes, etc), grade control and pre-production drilling.	» The extraction floor is anticipated to follow the resource base, which is undulating but predominantly contains slopes <18°. Therefore the open pit highwalls are considered low risk and geotechnical parameters are selected based on experience in similar mining environments. Highwalls are relatively low and excavation depths are relatively limited. A 30° batter angle has been selected which is more conservative than the angle of repose (for sand). » No benches have been stipulated due to the 30° batter angle and relatively low depth of excavation. » Grade control at a 50 x 50m grid has been assumed pre-mining to assist with pit optimisation.
	» The major assumptions made and Mineral Resource model used for pit and stope optimisation (if appropriate).	» The lack of overburden and relatively limited waste blocks (5.3% of total pit void) resulted in a limited overall gain from detailed pit optimization. Therefore the pit design was primarily based on the maximum allowable extents of the orebody based on environmental and other constraints rather than strip ratio.
	» The sand extraction dilution factors used.	» A sand extraction dilution factor of 0% has been used. The removal of topsoil is a simple process and is expected to be efficient and well managed. The surrounding material for the pit is generally high silica sand, which results in minimal risk of dilution.
	» The sand extraction recovery factors used	» 100% sand extraction recovery is assumed, regular survey and quality control in-pit will enable high levels of recovery.
	» Any minimum sand extraction widths used.	» No minimum sand extraction width is used, the sand extraction method allows variable sand extraction widths down to approx 3x machine width (~<20m). The pit design includes limited regions which approach this width and the average sand extraction face width is expected to be >250m.
	» The manner in which Inferred Mineral Resources are utilised in sand extraction studies and the sensitivity of the outcome to their inclusion.	» No Inferred Resources are utilised to support the Reserve Estimate, whilst small quantities of Inferred Resources are located around the periphery of Indicated Resources, these have not been factored into the current studies but may be considered for future assessments.

	» The infrastructure requirements of the selected sand extraction methods.	» No fixed infrastructure is required to support the sand extraction method. The equipment is designed to be mobile with the flexibility to be moved around site frequently to minimise haul and tram distances. » The processing plant infrastructure includes the processing plant, jetty, barge ramp, product conveyors, bunker and amenities. » Non-processing buildings include administration buildings, heavy vehicle workshops, fuel & lube facility, potable water treatment plant, services reticulation, sewerage treatment plant, car & bus parking, generator compound and accommodation.
Metallurgical factors or assumptions	» The metallurgical process proposed and the appropriateness of that process to the style of mineralisation. » Whether the metallurgical process is well-tested technology or novel in nature. » The nature, amount and representativeness of metallurgical test work undertaken, the nature of the metallurgical domaining applied and the corresponding metallurgical recovery factors applied. » Any assumptions or allowances made for deleterious elements. » The existence of any bulk sample or pilot scale test work and the degree to which such samples are considered representative of the orebody as a whole. » For minerals that are defined by a specification, has the ore reserve estimation been based on the appropriate mineralogy to meet the specifications?	» Mineral Technologies (MT) were engaged to prepare laboratory scale characterisation testing for the purposes of the PFS. This study included operating and technical requirements to achieve a suitable silica sand processing facility for the CFSSP in early 2022. The proposed metallurgical process is well developed in the silica sand industry and uses mainly off-the-shelf plant and components that are tried and tested at sites with similar operating parameters. » The selected plan includes a DMU, WCP and product stockpile. The WCP includes a Lyons feed control unit surge bin, spiral separation, attritioner, up current classifier, low intensity & wet high intensity magnetic separators, thickener and product dewatering. The plant is capable of 250t/h. » Metallurgical testing conducted to date is sufficient to support the PFS study. Further detailed metallurgical test work will be undertaken in the DFS with the target to reduce the Fe_2O_3 levels to ≤120ppm. » Bulk samples representative of the Measured Resources were used in the latest metallurgical testing. Additional samples from other locations have also been used for variability testing. » A mass yield of 91.7% was achieved as non-magnetic product of 99.9% SiO_2, 160ppm Fe_2O_3, 210ppm TiO_2 & 2.6% -125 micron particles. Recovery rates of 75% have been conservatively used for the Ore Reserve to achieve the target Fe_2O_3 grade of ≤120ppm. » The main contaminant Fe_2O_3 has been assessed with a focus on processing representative samples from the first 5 years of the mine schedule. Higher Fe_2O_3 occurs (up to 1600ppm) occurs in year 6 onwards and it is anticipated that further optimising of the processing method likely to resolve these variances.

Environ-mental	» The status of studies of potential environmental impacts of the sand extraction and processing operation. Details of waste rock characterisation and the consideration of potential sites, status of design options considered and, where applicable, the status of approvals for process residue storage and waste dumps should be reported.	» An assessment of the Environmental and Social Impacts have been undertaken for the CFSSP, these have been progressed to a satisfactory level for the status of the project. » Whilst the project is located in close proximity to sensitive areas, suitable buffers, the presence of the neighboring mine, lack of chemical use for treatment and benign nature of the material result in the operation maintaining a low risk to the natural environment.
Infrastructure	» The existence of appropriate infrastructure: availability of land for plant development, power, water, transportation (particularly for bulk commodities), labour, accommodation; or the ease with which the infrastructure can be provided, or accessed.	» WAVE have carried out studies to determine the feasibility of the jetty and barge infrastructure which is critical for the transport process. » Labour, accommodation and other services have been assessed and appropriate services have been allowed in the PFS.
Costs	» The derivation of, or assumptions made, regarding projected capital costs in the study. » The methodology used to estimate operating costs. » Allowances made for the content of deleterious elements. » The source of exchange rates used in the study. » Derivation of transportation charges. » The basis for forecasting or source of treatment and refining charges, penalties for failure to meet specification, etc. » The allowances made for royalties payable, both Government and private.	» Capital and operating cost items have been estimated using a mixture of fee proposals from suppliers, benchmarking similar operations and industry knowledge. » Capital cost estimates are ±25% » A 15% capital cost contingency has been factored. » Operating cost estimates are -15% to +25% » A 0% operating cost contingency has been factored. » AUD:USD exchange rate of ~US$0.75 » Inflation or escalation have not been considered. » Shipping costs have been derived from shipping consultants who estimate a softening in future shipping costs. » All likely royalties including Government and TLOs have been considered
Revenue factors	» The derivation of, or assumptions made regarding revenue factors including head grade, metal or commodity price(s) exchange rates, transportation and treatment charges, penalties, net smelter returns, etc. » The derivation of assumptions made of metal or commodity price(s), for the principal metals, minerals and co-products.	» Head grade has been determined by mine scheduling averaged annually. » No actively traded spot markets are available for silica sand. » Prices are estimated FOB and include barge loading and marine costs calculated by 'bottom-up' estimates with smaller items as per industry practice for PFS level assessment.

Market assessment	» The demand, supply and stock situation for the particular commodity, consumption trends and factors likely to affect supply and demand into the future. » A customer and competitor analysis along with the identification of likely market windows for the product. » Price and volume forecasts and the basis for these forecasts. » For industrial minerals the customer specification, testing and acceptance requirements prior to a supply contract.	» A marketing study by Metallica has assessed the likely sale price, consumption and competition with other suppliers in the industry. » Reputable market bodies have indicated the demand for silica sand is increasing and that the sand produced at the CFS Project will be readily accepted by the market. » Silica sand product pricing has been based on market consultant assessment, with prices between \$55.56 and \$75.00 sighted in the PFS, an average of \$63.63/t. » Production of 1.8Mt/a results in 1.35Mt/a product sales (75% recovery). This volume forecast is conservative compared to the global market for silica sand across the glass industry, foundry, hydraulic fracturing, filtration, abrasives and others. » Silica sand specifications anticipated to be marketed by Metallica incl 99.9% SiO_2, 160ppm Fe_2O_3, 330ppm Al_2O_3 & 210ppm TiO_2 & 2.6% -125 micron particles.
Economic	» The inputs to the economic analysis to produce the net present value (NPV) in the study, the source and confidence of these economic inputs including estimated inflation, discount rate, etc. » NPV ranges and sensitivity to variations in the significant assumptions and inputs.	» Metallica have completed a comprehensive economic analysis including inputs from the various project team members with the following key outcomes; - NPV[8] – pre-tax \$290.1M - IRR – pre-tax 34.9%, - NPV[8] – post-tax \$189.3M - IRR – post-tax 27.1%, - Payback period 3.89 years - Initial CapEx \$79.4M - LOM CapEx \$113.9M - Average annual revenue \$85.1M - LOM revenue \$2,126.8M - Average annual OpEx \$46.4M - LOM OpEx \$1,159M - Average annual EBITDA \$38.1M - LOM EBITDA \$951.8M - C1 OpEx (FOB) \$33.77/t - Average silica sand price \$63.63/t - Mineral Resources 53.5Mt - Ore Reserve (Maiden) 46Mt - LOM 25 years - LOM sand mined & processed 45Mt - LOM silica sand production 33.4Mt - Plant operating capacity 1.8Mtpa - Yield 75% - Silica product 1.35Mtpa

Social	» The status of agreements with key stakeholders and matters leading to social licence to operate.	» Appropriate social and government processes have been followed and CFS have engaged with Cook Shire Council, Hopevale Nguurruumungu Clan, and Dingaal Clan to establish a suitable social framework. » It is anticipated that Metallica will be able to progress these agreements to final completion in a reasonable timeframe.
Other	» To the extent relevant, the impact of the following on the project and/or on the estimation and classification of the Ore Reserves: » Any identified material naturally occurring risks. » The status of material legal agreements and marketing arrangements. » The status of governmental agreements and approvals critical to the viability of the project, such as mineral tenement status, and government and statutory approvals. There must be reasonable grounds to expect that all necessary Government approvals will be received within the timeframes anticipated in the Pre-Feasibility or Feasibility study. Highlight and discuss the materiality of any unresolved matter that is dependent on a third party on which extraction of the reserve is contingent.	» Risk assessments have been completed for various key areas of the project. » Mining Lease Applications have been submitted in favour of the proposed operations. Metallica has reasonable grounds that approval for these Mining Leases will be granted within the timeframes nominated in the PFS.
Classification	» The basis for the classification of the Ore Reserves into varying confidence categories. » Whether the result appropriately reflects the Competent Person's view of the deposit. » The proportion of Probable Ore Reserves that have been derived from Measured Mineral Resources (if any).	» The Ore Reserve has been classified 100% as Probable Ore Reserves. » The first 6 years of mine life are derived from ~82% Measured Resources and ~18% Indicated Mineral Resources. Overall Ore Reserves were derived from ~21% Measured Resources and ~79% Indicated Mineral Resources.
Audits or reviews	» The results of any audits or reviews of Ore Reserve estimates.	» Ore Reserve estimates have been reviewed internally by Metallica. » No external audits of Ore Reserve estimates have been conducted at this stage.

Discussion of relative accuracy/ confidence	» Where appropriate a statement of the relative accuracy and confidence level in the Ore Reserve estimate using an approach or procedure deemed appropriate by the Competent Person. For example, the application of statistical or geostatistical procedures to quantify the relative accuracy of the reserve within stated confidence limits, or, if such an approach is not deemed appropriate, a qualitative discussion of the factors which could affect the relative accuracy and confidence of the estimate. » The statement should specify whether it relates to global or local estimates, and, if local, state the relevant tonnages, which should be relevant to technical and economic evaluation. Documentation should include assumptions made and the procedures used. » Accuracy and confidence discussions should extend to specific discussions of any applied Modifying Factors that may have a material impact on Ore Reserve viability, or for which there are remaining areas of uncertainty at the current study stage. » It is recognised that this may not be possible or appropriate in all circumstances. These statements of relative accuracy and confidence of the estimate should be compared with production data, where available.	» The Ore Reserve is based on a PFS which has been completed to a level of detail expected for the project at its current stage. A global accuracy for the Ore Reserve cannot be stated, however CapEx estimates were completed to ±25% and OpEx were completed to -15% to +25% accuracy. » Further work is required to evaluate Fe_2O_3 distribution throughout the orebody, which could be used for estimation of relevant confidence intervals for the Ore Reserve. » Key risks to the Ore Reserve are the metallurgical recoveries, product price and shipping costs. The competent person believes that appropriate level of detail has been provided for these factors and that the assumptions made are of a conservative nature.

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