Report for Pensana plc

Competent Person's Statement for Longonjo Ore Reserves

Project Number DA206943

September 2022

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Reviewed by:	Tarrant Elkington *PhD BEng(Hons) BComm MAusIMM* General Manager

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Table of Contents

Figures

Tables

1 BACKGROUND

Pensana plc (Pensana) is a UK London Stock Exchange (LSE) listed mining company focused on the supply of rare earth metal oxides for the catalyst, laser, glass, polishing and magnetic materials industries for the growth in the wind turbine and electric vehicle sectors. The Longonjo Ore Reserve estimate was prepared by Snowden Optiro in August 2022 as part of the Longonjo Project Feasibility Study, using the guidelines of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (JORC Code, 2012 Edition).

2 DEPOSIT LOCATION

The Longonjo rare earths deposit is located within the Longonjo municipality of Huambo Province, approximately 60 km west of the provincial capital of Huambo in central Angola. Access to the project is from both sealed national road (EN110) and Benguela railway line (Caminho de Ferro de Benguela) and both pass within approximately 5 km of the project area.

Figure 2.1 Location of the Longonjo rare earths deposit

3 ORE RESERVE ESTIMATE

The Ore Reserve estimate is provided in Table 3.1. The Ore Reserve is reported in accordance with the JORC Code (2012). The individual oxide grades split by resource category are provided in Table 3.2 and the concentrate yield is also estimated. Details of the completed mine planning process are available in the Feasibility Study document titled “PENSANA RARE EARTH PROJECT: FEASIBILITY STUDY”.

Table 3.1 Longonjo Proved and Probable Ore Reserve September 2022 reported using a 0.3% NdPrO (approx.) cut-off

Classification	NdPrO cut-off (%)	Tonnes (Mdt)	NdPrO (%)	TREO (%)	NdPrO (t)	TREO (t)
Proved	0.3–0.4	13.3	0.67	3.19	89,300	424,000
Probable	0.3–0.4	16.8	0.46	2.05	77,000	323,000
Total	**0.3–0.4**	**30.1**	**0.55**	**2.55**	**166,000**	**767,000**

Notes:

- *Million tonnes are dry and rounded to one decimal place. Grades are rounded to three significant figures.*
- *No fixed cut-off is applied to the rare earths NdPrO, the cut-off varies between 0.3% NdPrO and 0.4% NdPrO.*
- *The variable NdPrO cut-off reflects the block cash flow positive method used to determine the economically viable portion of the resource.*
- *NdPrO tonnes and grade is inclusive of the TREO and not additional to it.*

Table 3.2 Longonjo Proved and Probable Ore Reserve oxide grades split by Mineral Resource category

Item	Measured	Indicated	Total
Ore (Mwt)	18.4	23.3	**41.8**
Ore (Mdt)	13.3	16.8	**30.1**
NdPrO[1] (%)	0.67	0.46	**0.55**
TREO (%)	3.19	2.05	**2.55**
LREO (%)	2.99	1.88	**2.37**
HREO (%)	0.20	0.17	**0.18**
La_2O_3 (ppm)	8,094	4,802	**6,257**
CeO_2 (ppm)	15,124	9,365	**11,909**
Pr_6O_{11} (ppm)	1,561	1,019	**1,258**
Nd_2O_3 (ppm)	5,162	3,571	**4,274**
Sm_2O_3 (ppm)	649	515	**574**
Eu_2O_3 (ppm)	141	118	**128**
Gd_2O_3 (ppm)	303	256	**277**
Tb_4O_7 (ppm)	32	28	**30**
Dy_2O_3 (ppm)	140	126	**132**
Ho_2O_3 (ppm)	21	19	**20**
Er_2O_3 (ppm)	46	43	**44**
Tm_2O_3 (ppm)	5	5	**5**
Yb_2O_3 (ppm)	24	23	**24**
Lu_2O_3 (ppm)	3	3	**3**
Y_2O_3 (ppm)	602	563	**580**

4 COMPETENT PERSONS

The information in this report that relates to the Longonjo Ore Reserve is based on information reviewed or work undertaken by Mr Frank Blanchfield, FAusIMM, an employee of Snowden Optiro. He has relied on Pensana for separated oxide marketing, environmental, social impacts and permitting aspects, and financial modelling and any costs not relating to mining. The mine design and mining costs for the project were assessed and completed by Snowden Optiro under his direction and economic viability of the project was prepared by Pensana and reviewed by Mr Blanchfield. Mr Blanchfield has sufficient experience 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 by the JORC Code 2012.

The scientific and technical information in this report that relates to process metallurgy is based on information reviewed and work directed or completed by Greg Henderson, FAusIMM (concentrator area), who is a metallurgical consultant and an employee of Wood. Testwork in support of process design was designed by and overseen by Roy Gordon, MAusIMM, Metallurgical Manager of Pensana, who also reviewed and accepted overall process metallurgy. The metallurgical evaluation and factors including process flowsheet design and costs and assumptions for the bulk sample that relate to Mineral Resources have been reviewed and accepted by Messrs Henderson and Gordon. Messrs Henderson and Gordon both have sufficient experience that is relevant to the type of processing under consideration and to the activity being undertaken. Messrs Gordon and Henderson qualify as Competent Persons as defined by the JORC Code 2012.

[1] NdPrO refers to combined Nd_2O_3 and Pr_6O_{11} content

5 MODIFYING FACTORS

The key Modifying Factors used to estimate the Ore Reserve are based on the experience of Snowden Optiro, Wood and Pensana employees in this type of deposit and style of mineralisation. Table 5.1 summarises the status of material aspects of the August 2022 Longonjo Ore Reserve estimate, against the items listed in the table as the Competent Person's assessments of Ore Reserve estimation for the Longonjo deposit.

Table 5.1 Longonjo Competent Persons Assessment JORC Code (2012) Table 1, Section 4

<table>
<tr><th>Item</th><th>JORC Code explanation</th><th>Comments</th></tr>
<tr><td>Mineral Resource for conversion to Mineral Reserves</td><td>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.</td><td>Mineral Resources for the Longonjo deposit were estimated and reported by Rodney Brown BSc (Geo), Dip. Met, MAusIMM, MAIG – who is the Principal Consultant (Resource Evaluation) of SRK – using the JORC Code 2012 Edition in August 2022, based on a Datamine block model labelled “RESM_180722.dm”. No cut-off grade is applied for the rare earths Mineral Resources and is commensurate with other carbonatite deposits.

Mineral Resources are reported inclusive of the Ore Reserves.</td></tr>
<tr><td>Site visits</td><td>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.</td><td>The sites comprise the Longonjo mine site and process concentrator facility, the Lobito port in Angola and the Salt End refinery in the UK. A site visit to Angola was completed by the Competent Person, Frank Blanchfield. Visits by others proved difficult due to COVID-19 travel restrictions.

Regular meetings via “Teams” were held with personnel on both sites and with the Project Management Team in Australia, UK, South Africa and elsewhere to keep abreast of progress.

As a proxy for site visits, e-meetings were held with the site experts. In addition, site drone footage, photos taken from site visits by Frank Blanchfield and others, photos and videos from testwork, diamond core photos of metallurgical sample intervals and samples sent from site for testwork at ALS and Nagrom Laboratories, together with:
• A video on the geological resource core with Chief Geologist Grant Hayward describing this
• A 360° video of the plant site and photos of test pitting at the plant site
• Photos of the tailings dam area.

All were made available for viewing by the team, including by Frank Blanchfield as verification for his site visit observations and Roy Gordon as Competent Persons.

Regular management meetings were held as were weekly testwork reviews from the Nagrom Laboratory which included the Wood process engineering team.</td></tr>
<tr><td>Study status</td><td>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 Prefeasibility 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.</td><td>The Pensana Rare Earths Project has been under technical investigation as a Feasibility Study (FEL3) including the preparation of Capital and Operating Cost Estimates to the appropriate AACE (American Association of Cost Engineers) standard (Class 3) and a full Financial Review and Model.

Key consultants for the Feasibility Study are listed below:
<table>
<tr><th>Area of expertise</th><th>Consultant</th></tr>
<tr><td>Lead Engineer; Process plant engineering capital and operation cost estimation; Tailings storage facilities design</td><td>Wood Group</td></tr>
<tr><td>Project management and Owner representative; Site infrastructure; Bulk services; Mining; Tailings storage facilities execution; Surface water management; Cost estimation; Risk assessment and opportunity analyses</td><td>Paradigm Project Management (PPM)</td></tr>
</table>
</td></tr>
</table>

Item	JORC Code explanation	Comments	
		Capital cost estimate review; Audit and verification	Project Cost Consultants (PCC)
		Mineral Resource and Reserve estimates and model	Snowden Optiro; SRK Consulting
		Mine scheduling; Mining plan; Pit optimisation	Snowden Optiro
		Environmental and social impact assessment (ESIA) and baseline studies	HCV Africa
		Environmental and social assessment; Stakeholder engagement – Angola	Grupo Simples; Holisticos
		Power grid stability (Angola)	Dar al Handasah
		Labour rates (Angola)	AMMA; Gravcon; Allied PD
		Legal (Angola)	AVM Advogados
		Legal (Australia)	DLA Piper
		Legal (UK)	BCLP
		Metallurgical pilot plant – comminution and flotation	ALS
		Metallurgical pilot plant – MREDS and refinery	Nagrom
		Metallurgical testwork – flotation	Auralia Metallurgy
		Kiln materials handling testwork	ANSTO
		Metallurgical testwork – comminution	Bureau Veritas Minerals
		Mineralogy testwork	ALS Mineralogy
		Solvent extraction consultant	Michael Nees (Nees Consulting LLC)
		Corrosion consulting and testing	Dr Stephen Clarke (SJC Materials)
		Nanofiltration and membrane technology	BMS Engineers
		Geological consultant	Dr Wally Witt; Dr Piet Siegfried
		Geotechnical studies	ARQ Consulting
		Geotechnical studies (Longonjo site)	SRK Johannesburg
		Geotechnical studies (Saltend site)	EEG
		Tailings testwork	Wood; ePrecision
		Tailings rheology	P&C; Slurrytec
		Hydrology; Borefield testing and modelling	HCV Africa
		Sample assays	Nagrom Laboratories
		RE market analysis and forecasts	Roskill; Adamas; CRU
		NdPr metal production	Kingston Technologies
		Environmental permitting (UK)	Ivy House
		Bulk services costs (Saltend Refinery)	px Group
		NORM independent survey	Mark Sonter
		Planning – Saltend	On-Line Design
		Radiation monitoring program	Radiation Advice & Solutions
Cut-off parameters	*The basis of the cut-off grade(s) or quality parameters applied.*	The resource block model was converted to a mining block model. Cash flow positive blocks were assessed as a criterion for Ore Reserve determination, considering all operating costs and revenue from the saleable oxides within the block.	

<table>
<tr><th>Item</th><th>JORC Code explanation</th><th>Comments</th></tr>
<tr><td></td><td></td><td>The ore inventory was subject to a cut-off of 0.3–0.4% NdPrO for plant feed consideration.</td></tr>
<tr><td>Mining factors and assumptions</td><td>The method and assumptions used as reported in the Prefeasibility 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 mining method(s) and other mining parameters including associated design issues such as pre-strip, access, etc.

The assumptions made regarding geotechnical parameters (e.g. pit slopes, stope sizes, etc), grade control and pre-production drilling.

The major assumptions made and Mineral Resource model used for pit and stope optimisation (if appropriate).

The mining dilution factors used.

The mining recovery factors used.

Any minimum mining widths used.

The manner in which Inferred Mineral Resources are utilised in mining studies and the sensitivity of the outcome to their inclusion.

The infrastructure requirements of the selected mining methods</td><td>Snowden Optiro completed a mining study for the Longonjo Project in 2021–2022. The study reflects the latest understanding of the project.

An evaluation using pit optimisation to produce an economic mining shell followed by detailed pit design was used to convert the Mineral Resource to an Ore Reserve. A mine layout was developed for mining of staged designs. Mine equipment requirements were determined by contractors, who provided pricing using the Snowden Optiro mine production schedule as a basis. Selective mining using an open pit load and haul mining cycle is used for mining activities.

Geotechnical

Generally, the pits are 30 m deep and occasionally up to 70 m deep. Wood completed the original geotechnical analysis to recommend pit slope design parameters for Longonjo for a 70 m deep pit are summarised below:

Recommended pit angles
<table>
<tr><th>Weathering type</th><th>Overall slope angle (°)</th></tr>
<tr><td>Transported</td><td>28</td></tr>
<tr><td>Saprolite</td><td>28</td></tr>
<tr><td>Saprock</td><td>43</td></tr>
<tr><td>Fresh</td><td>43</td></tr>
</table>
SRK Johannesburg subsequently confirmed these pit angles in additional geotechnical testwork in Q3 2022.

Grade control

Grade control drilling is to be conducted using reverse circulation (RC) drill rigs, drilling 3” holes on a 10 m x 10 m pattern. Holes will be drilled vertically to full depth where practical (generally about 30 m although some areas are up to 70 m). Samples will be taken every 2 m to match the planned digging (bench) height.

Dilution

Based on the size and selectivity of the proposed mining equipment and minimal blasting and very low strip ratio, dilution was assumed to be minimal. However, the model was re-blocked to introduce a small amount of ore loss and dilution on any waste contacts and there was a mining recovery of 98%. Given the very low strip ratio, the likely dilution is low as mining is predominately ore.

Schedule

Snowden Optiro identified a life of mine (LOM) schedule of +20 years suitable for Ore Reserve assessment.

Production

This will be completed using track-mounted down-the-hole or top hammer drill rigs (~120 mm diameter holes).

This will be completed using track-mounted down-the-hole or top hammer drill rigs (~120 mm diameter holes). Only the unweathered zones/fresh rock are planned to be blasted. Powder factors are anticipated to be around 0.5 kg/m^3. This is only anticipated to be necessary in the latter stages of the LOM and in areas where there are fenite boulders or competent material which cannot be ripped by bulldozer or cast aside by excavation. Blasting is not planned to be undertaken in sensitive pit stages (particularly 9 and 18) which are adjacent to environmentally sensitive areas</td></tr>
</table>

Item	JORC Code explanation	Comments
		Loading is planned to be undertaken with small hydraulic excavators (backhoe ~70 tonnes) on 4 m benches or as two 2 m flitches. Hauling is planned to be undertaken with articulated haul trucks (~45-tonne capacity). This type of truck will be more suitable for the uneven ground likely to be encountered and reduces the risk associated with poor trafficability. **Rehabilitation** Progressive rehabilitation (i.e. ongoing) will occur with dump batters pushed down to shallower angles and soil spread over them using track dozers. At the completion of the Mine, the top of the waste rock dumps and tailings storage facilities will be rehabilitated along with any other areas disturbed by mining. Topsoil on disturbed zones abutting environmentally sensitive areas (9 and 18) will be rehabilitated immediately, once profiled, to allow mining activities to proceed. Geofabric will be used to mitigate potential erosion during rehabilitation. No in-pit Inferred Resources were used to quantify Ore Reserves.
Metallurgical factors and assumptions	*The metallurgical process proposed and the appropriateness of that process to the style of factors or mineralisation.* *Whether the metallurgical process is well-tested technology or novel in nature.* *The nature, amount and representativeness of metallurgical testwork 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 testwork 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?*	**Concentrator processing overview** The mineral processing flowsheet for beneficiation and the MREDS plant that is required for the upgrading of the mined material at Longonjo is commonly seen and used both in the minerals processing and specifically the rare earths industry. The separation techniques employed are considered mature technologies and include grinding, flotation, leaching, calcining and solids/liquids separation processes. **Concentrator testwork** To date, metallurgical testing has been carried out in several phases. The first phase process testwork program was conducted on composited diamond drillhole samples from a drilling program in 2018. Further work was undertaken on samples derived from a second program in 2019, predominantly targeting the monazite dominant Northern (Main) Zone. In 2020, a 3 m deep trenching program was undertaken to produce 60 wet tonnes (approximately 40 dry tonnes) of Transported/Upper Saprolite ore which was subjected to continuous flotation piloting at ALS in Perth, Australia. The initial focus during the planning stage was to produce concentrate for evaluation by external refineries. However, the focus subsequently changed to testing the concentrates for in-house extraction and separation. To overcome the issue of not being able to access the full profile of the orebody to achieve representativity, a 780 mm diameter Bauer rig was sourced from Angola, producing 180 wet tonnes of core over a 21-day period in November/December 2020, from surface down to the fresh rock interface. Approximately 90 wet tonnes were shipped to Western Australia for testing at local laboratories. Continuous flotation piloting using sparged flotation columns commenced in early June 2021, targeting production of at least 2 tonnes of high-grade REO concentrate. Vendors were brought in to conduct on-site testing of tailings and other products from the program to provide a confident basis for the Concentrator design. Interim testwork preceded continuous piloting on samples from this ore source which indicated superior grades and recoveries to the near surface ore sample pilot program undertaken in 2020.

Item	JORC Code explanation	Comments

The concentrate from both the 2020 and 2021 pilot programs produced the feedstock for REE extraction and refining testwork and continuous piloting currently underway at Nagrom in Perth, a specialist laboratory.

Extraction processing overview

The concentrate is subjected to acid roast cracking followed by leaching and rare earth extraction and purification to arrive at a mixed rare earth salt.

The mixed rare earth salt is railed from the mine and shipped to the refinery where oxides are proposed to be separated at the process plant located at Saltend in the UK. The refinery process will comprise further purification to a rare earth chloride solution which is then separated via solvent extraction into final product streams. The pure rare earth products are precipitated and packaged for shipment to final market. The final product suite will be:

- La carbonate
- Ce carbonate
- NdPr oxide
- Mixed middle (SEG) and heavy (HREE) rare earth carbonate.

Extraction testwork

Starting in 2020, mineral concentrates generated from concentrator testwork were used in flowsheet development and proof-of-concept (scoping level) definition of downstream extraction stages at Nagrom. Individual unit operations were subsequently optimised on a bench-scale for NdPrO extraction, impurity rejection and reagent consumptions ahead of continuous pilot plant operation.

Mineral concentrates from the 2020 and 2021 Concentrator pilot plants were dispatched to Nagrom for piloting of the extraction process which commenced in March 2021 and ran through that year and into 2022, and as of September 2022 is currently operating.

The aim of the pilot is to confirm bench-scale test data and generate representative downstream products for vendor testwork. Significant effort has been undertaken to optimise concentrate and acid mixing to mitigate materials handling issues which can be a common pitfall. Similarly, corrosion coupons were tested at length to ensure appropriate materials of construction are selected.

Vendors have been brought in to conduct on-site testing of tailings and other products from the program to provide a confident basis for the MREDS and Separation Facility design.

Metallurgical recoveries

Neodymium and praseodymium recoveries supported by metallurgical testwork include:

- Concentrator: ROM ore to concentrate NdPrO recovery of circa 41% based on pilot plant scale testing
- MREDS Plant: Concentrate to MREDS salt NdPrO recovery of circa 70% based on a combination of pilot and sighter tests
- Separation Facility/Refinery: MREDS salt to final NdPrO product recovery of 90–95% based on sighter tests.

The below recoveries were derived from the testwork datasets for use in mine optimisation and financial modelling in support of the Ore Reserve Statement. Actual performance will likely operate within a range of recoveries depending on feed blend and origin within the resource.

	Conc.	MREDS	Saltend	Total

Item	JORC Code explanation	Comments

Nd_2O_3	41%	72%	93%	**28%**
Pr_6O_{11}	41%	73%	93%	**28%**
La_2O_3	43%	73%	93%	**29%**
CeO_2	32%	43%	19%	**3%**
SEG	38.5%	64%	93%	**23%**
HREO+Y_2O_3	30%	39%	83%	**9%**

SEG = Sm_2O_3, Eu_2O_3, Gd_2O_3

HREO+$Y2O_3$ = Tb_4O_7, Dy_2O_3, Ho_2O_3, Er_2O_3, Tm_2O_3, Yb_2O_3, Lu_2O_3, Y_2O_3

Environmental

The status of studies of potential environmental impacts of the mining 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.

Mine site environment

Pensana commissioned and implemented the environmental and social management plan and monitoring plan described in the ESIA on the area of influence of the Longonjo Project.

The data gathered forms the baseline component of the ESIA process to support regulatory approvals for Longonjo and was conducted in line with World Bank and IFC Standard guidelines. The ESIA includes specialist assessments for air quality, biodiversity (botany, avifauna and mammals, herpetofauna, and aquatic ecosystem comprised of aquatic vegetation, invertebrate and ichthyological assessments), groundwater/hydrogeology, surface water/hydrology, cultural heritage, socio-economic, noise, traffic, health and safety, waste and soils and rehabilitation and closure.

Mine rehabilitation

A comprehensive study was undertaken to determine the most suitable progressive rehabilitation method for the Longonjo Project based on the baseline environment. Consultation and benchmarking with other mines as well as expert rehabilitation practitioners was undertaken to assist in developing the method. A closure cost quantum was calculated based on current design aspects, economic trends and current legislation.

Operations Permit – Angola

The Regulatory ESIA completed in December 2020 resulted in Ozango Minerais S.A. (Pensana's 84% owned Angolan entity), being granted an Environmental Installation Licence No. 2893069200/2021 in March 2021.

In 2021, the area corresponding to the Mining Title was changed to 31 km^2 and the project was to be subject to substantial changes in terms of project design, including the LOM extended to up to 20 years. Therefore, in this sequence, it was necessary to proceed with a new registration of the project as "Addendum to the Longonjo NdPr Mining Project ESIA" and for which the update of the 2020 ESIA was requested, and the documents previously submitted with the 2020 ESIA. In June 2022, the requested documents were submitted to the regulator, and we are awaiting approval. After conformance to construction plans is demonstrated, an Operations Permit will be granted.

Powerline from HT substation at Belem do Dando to Longonjo mine site

The data gathered forms the baseline component of the ESIA process to support regulatory approvals for the power line and was conducted in line with World Bank and IFC Standard guidelines.

All documents and studies were submitted to the regulator for approval in June 2022.

After conformance to construction plans is demonstrated, an Operations Permit will be granted.

Item	JORC Code explanation	Comments
		Operations Permits – UK Planning permission for the Saltend Refinery has been approved by the East Riding Planning Committee, with full and formal consent expected in September 2022. The EIA for the Operations Permit will be completed in Q3 2022. The Saltend Site Agreement for lease was signed and completed in August 2022 ready for Pensana site occupation in September 2022. The engineering, procurement and construction management (EPCM) contractor is expected to be appointed as Principal Contractor under the CDM regulations thereafter.
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.*	The Longonjo project site is easily accessed to within 5 km via the sealed National Road EN110, the Benguela Railway (a Consortium of Moto-Engil and Trafigura) connecting the project to the Port of Lobito and is 65 km from Huambo provincial airport. The recently upgraded Port of Lobito provides access for imports of construction materials, reagents and consumables and export of MRES product via both the EN260 and Caminho de Ferro de Benguela. There will be a requirement for some road and intersection upgrade works in Longonjo township to support the transport of construction materials, equipment, reagents and consumables to site and the export of bagged and containerised MRES product to the railway siding. Pensana is also committed to building a rail spur to the mine that will greatly help with logistics during the operational phase. Connection to the national hydro-electric power grid is available at the HT substation at Belem do Dando near Huambo. Bulk power will be provided for the operational mine through the engagement and agreement with the Angolan Power Supply authorities, namely Rede Nacional De Transporte De Electricidade, Empresa Pública (RNT). The power will be supplied via a 56 km, 220 kV overhead line from the Belem do Dango substation, situated approximately 10 km from Huambo to a newly constructed 220 kV/30 kV substation to be located at the Longonjo Mine site. RNT has confirmed that there is adequate power for the mine and has assured supply for the LOM. A grid stability and impact assessment has been completed by Dar al Handasah along with an ESIA for the design route completed by Holisticos. Bulk water supply will be from boreholes and the perennial Luluvile River which can provide the required quantities. The relevant infrastructure will need to be constructed. Employees will be primarily sourced from the Huambo and Longonjo area and supplemented from the Luanda area where the relevant skilled labour cannot be found locally. Where possible, skilled labour will be sourced within Angola and supplemented with expatriates until Angolan employees can be trained where necessary. There will be a camp constructed on site for all personnel (other than unskilled personnel drawn from the immediate vicinity of the mine) which will provide full board and lodging and recreation facilities. The Longonjo Mine licence area has adequate area for all the required infrastructure as indicated by the Site Block Plan (drawing P1717-00-00-00-20-50-001 Rev 5.1). The Saltend Refinery is located in a well-established industrial and chemical complex, Saltend Chemicals Park and is well serviced with road, port, power, water and other bulk services infrastructure. Upgrades to access road turnoffs into the site have been initiated.

Item	JORC Code explanation	Comments
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 derivation of assumptions made of metal or commodity price(s), for the principal minerals and co-products.* *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 or royalties payable, both Government and private.*	The capital cost estimate (capex), compiled by Pensana from inputs by all consultants includes direct plant and supporting infrastructure, indirect costs and is to an accuracy level of ±15% and includes appropriate contingency amounts. Reviews and audits of capex were independently conducted by Project Cost Consultants (PCC). As well as the experts/consultants noted earlier and whose expertise was drawn upon, Mr Deon van Tonder C.Eng.; MIChemE – a Wood-based Consultant with many years rare earth experience provided further specialist advice on the refinery circuit. Budget pricing for Longonjo operations was received from process plant supply and installation contractors (inclusive of engineering, process and materials handling equipment, EI&C, process water circuit, and associated structure and piping). Budget pricing for Longonjo operations was also received for civil works, concrete, fuel storage, power supply, administration, amenities and workshop infrastructure. The operating cost estimate (opex) was developed as a bottom-up estimate over the +20-year LOM to obtain average operating costs. All significant and measurable items are itemised, with smaller items estimated based on other rare earths operations and the experience/expertise of project consultants. Mining costs were derived from tenders fielded to appropriately qualified contract mining companies using pit models provided by Snowden Optiro. A contract mining model has been adopted and the unit mining rates provided by the selected tenderer has been used as the basis for the opex estimate. Rehabilitation costs guarantees have been provided within the financial model totalling 5% of capital spend as required under the Angolan Mining Code. This cost allocation additionally is supported by the rehabilitation and mine closure plan undertaken by HCVA as part of the ESIA. Specific consumption rates for reagents and consumables were estimated through a combination of equipment operating data, bench-scale testwork and mass balances derived from process modelling software. Current market pricing was obtained for all major consumables and reagents based on supplier budget pricing as of December 2021. A small general allowance was made for minor miscellaneous consumables based on historical data from similar operations. The bulk power supply will provide all the power required to operate the Longonjo Mine according to the drawn loads on the equipment list and is included at a US$ per kW/h basis. Bulk services costs including power, water, steam and fuel to the Saltend Refinery are based on rates supplied by the px Group, owners and operators of the Saltend Chemicals Park. Power costs are estimated according to the drawn loads on the equipment list and is included at a US$ per kW/h basis. Maintenance costs were estimated based on projected capital estimates for the plant using industry benchmarked factors. Remuneration rates typically expected in the respective locations for discipline personnel were used to establish operating costs, with labour rates being sourced from three contributors: AMMA, Gravcon and Allied PD. Pensana has elected to use US$ as the reporting currency and use flat exchanges rates per below across the forecast period, which is considered a reasonable estimation of a likely long run average level. • US$/A$: 0.7

<table>
<tr><th>Item</th><th>JORC Code explanation</th><th>Comments</th></tr>
<tr><td></td><td></td><td>

US$/GBP: 1.3
US$/AKZ: 0.0015.

Pensana acknowledges that wide exchange rate fluctuations are possible and could positively or negatively affect the profitability and economic viability of the Longonjo Project at any single point in time. This risk will be managed by the management team and Board of Directors who may utilise an exchange rate hedging strategy should it be considered appropriate at the time.

Annual operating costs – average years 1 to 5 (2026 to 2030) at full production

An average summary of annual operating costs forecast for the first five years of full production are set out below:
<table>
<tr><th>Opex US$ – Longonjo</th><th>Cost per annum ($ M)</th><th>US$/t ore processed</th><th>US$/t product (MRES)</th></tr>
<tr><td>Mining (ROM+OB)</td><td>16.2</td><td>10.1</td><td>502.7</td></tr>
<tr><td>Processing (Concentrator and MRES)</td><td>101.8</td><td>63.7</td><td>3155.8</td></tr>
<tr><td>Admin, overheads and other</td><td>9.2</td><td>5.7</td><td>284.9</td></tr>
<tr><td>Total opex</td><td>127.2</td><td>79.6</td><td>3,943.4</td></tr>
</table>
<table>
<tr><th>Opex US$ – Saltend</th><th>Cost per annum ($ M)</th><th>US$/kg TREO</th><th>US$/kg NdPr</th></tr>
<tr><td>Processing</td><td>48.9</td><td>5.3</td><td>14.0</td></tr>
<tr><td>Other costs</td><td>10.3</td><td>1.1</td><td>2.9</td></tr>
<tr><td>Total opex</td><td>59.1</td><td>6.4</td><td>17.0</td></tr>
</table>
Pre-production capital costs

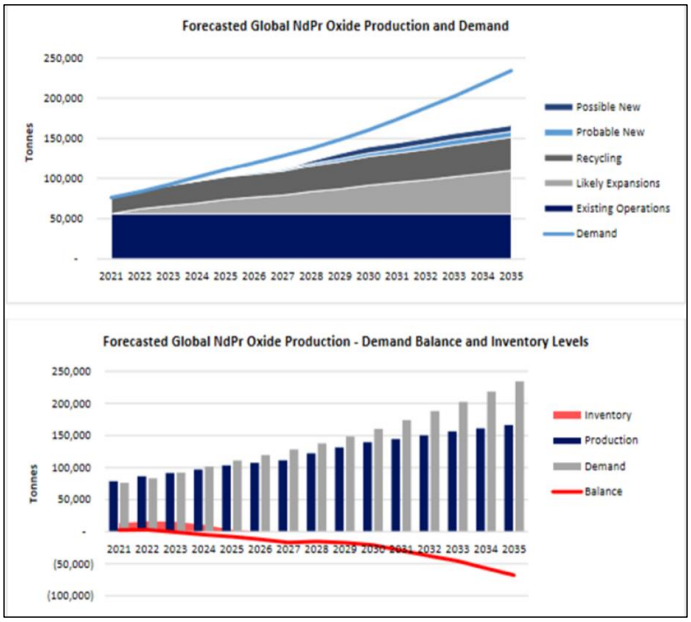
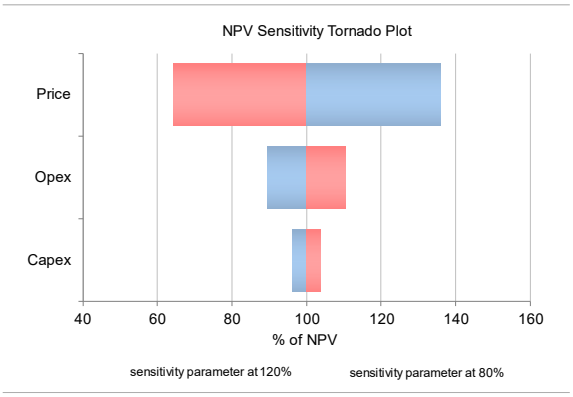
A summary of the pre-production capital estimate is set out below:
<table>
<tr><th>Capex US$ – Longonjo</th><th>Cost ($ M)</th></tr>
<tr><td>Concentrator plant</td><td>123</td></tr>
<tr><td>MRES plant</td><td>133</td></tr>
<tr><td>Mine site establishment and infrastructure</td><td>49</td></tr>
<tr><td>Total capex</td><td>305</td></tr>
</table>
<table>
<tr><th>Capex US$ – Saltend</th><th>Cost ($ M)</th></tr>
<tr><td>Saltend separation facility</td><td>197</td></tr>
<tr><td>Total capex</td><td>197</td></tr>
</table>
</td></tr>
<tr><td>Revenue factors</td><td>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.</td><td>The grade of the process feed and calcium content is supported by the information in the Mineral Resource estimate and driven by the mining and production schedule. Processing recoveries were estimated based on a metallurgical test program completed during the Feasibility Study, using scalable processing equipment.

Spot sell prices, in US$, were sourced from the Adamas Intelligence - Rare Earth Market Outlook to 2035 - Q2 2022 report. These rare earth oxide prices were used as the basis for Saltend Refinery product sales.

Based on the above and advice provided by industry experts, Pensana is confident that a long term NdPrO sell price of US$150/kg and above is achievable once the NdO, PrO, NdPrO supply moves into deficit in 2023 onwards and will contribute approximately 94% of the overall project revenue.</td></tr>
</table>

Item	JORC Code explanation	Comments
		The balance of revenue will be derived mainly from sales of separated high purity lanthanum (payability 70%) and cerium (payability 25%) products with a minor contribution from the heavy rare earth products contained in the Longonjo feedstock. Financial modelling work done in relation to this ore reserve statement relies solely on the Longonjo ore inventory and no allowance has been made for the inclusion of third-party sources for the Saltend Refinery.
Market assessment	*The demand, supply and stock situation for the particular commodity, consumption trends assessment 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.*	The opaque nature of rare earths marketing and near monopoly by China of the rare earth market gives rise to differences between industry expert forecasts. Historically, Pensana has considered a combination of historical records and predictions from Adamas Intelligence, Roskill, CRU along with recent trends in the Chinese domestic market (SMM etc.) in its business modelling. For purposes of financial modelling work done as part of the Ore Reserve Statement, the Q2 2022 Adamas Intelligence Base Case pricing was used as input. The following are key extracts from the Q2 2022 “Adamas Intelligence - Rare Earth Market Outlook to 2035” - report: • Adamas Intelligence forecasts that global demand for NdFeB magnets will increase at a compound annual growth rate (CAGR) of 8.6%, bolstered by double-digit growth from electric vehicle and wind power sectors. This will translate to comparable demand growth for the rare earths elements (i.e. neodymium, praseodymium, dysprosium and terbium) these magnets contain. • Following a pandemic-induced lull in 2020, Adamas Intelligence data indicates that global consumption of NdFeB magnets jumped 18.1% in 2021 on the materialisation of some latent demand from the year prior coupled with a surge in electric vehicle sales of all types. • Adamas forecasts that global production of neodymium, praseodymium, dysprosium and terbium will collectively increase at a slower CAGR of just 5.4% through 2035 as the supply side of the market increasingly struggles to keep up with rapidly growing demand. • With total magnet rare earth oxide demand forecasted to increase at a CAGR of 8.3% and prices projected to increase at CAGRs of 3.2% to 3.7% over the same period, Adamas Intelligence forecasts that the value of global magnet rare earth oxide consumption will triple by 2035, from US$15.1 billion forecast for 2022 to US$46.2 billion by 2035. • Constrained by an expected under-supply of neodymium, praseodymium, dysprosium and terbium oxide from 2022 onward, Adamas Intelligence forecasts that global shortages of NdFeB alloys and powders will amount to 66,000 tonnes annually by 2030 and 206,000 tonnes annually by 2035 – nearly one-third of the total market. • Constrained by a lack of new primary and secondary supply sources coming to market from 2022 onward, coupled with the inability of existing producers to increase output steadily at the rate of demand growth, Adamas forecasts that global shortages of neodymium, praseodymium and didymium oxide (or oxide equivalents) will collectively rise to 68,000 tonnes by 2035 – an amount roughly equal to China’s total 2021 production.

Item	JORC Code explanation	Comments
		The following graphs are taken from that report and reflect the key market parameters.  *Source: Adamas Intelligence Report Q2 2022*
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.*	Financial modelling was completed by Pensana. Snowden Optiro is reliant on the commodity price projections advised by Pensana. Snowden Optiro is not an expert in the forecasting of commodity prices, and other than to draw attention to the sensitivity of the project to these projections, is not able to comment on the risk that these projections will change over time. The commodity price assumption is based on the Adamas Intelligence - Rare Earth Market Outlook to 2035 - Q2 2022 report. Adamas Intelligence is a specialist industrial mineral consultancy group that provides advice and trading in the rare earths oxides markets regionally. Pensana assumed prices under Adamas' Base Case scenario. The key financial metrics for just the reserve portion of the project are an internal rate of return (IRR) of 52% and net present value (NPV) of US$2.2 billion at 8% discount rate. A sensitivity analysis on the NPV is provided in the Tornado plot below, which looks to analyse the economic impact of key variables for the Longonjo Project, including: • Revenue per tonne of REO • Changes in operating costs • Changes in capital costs. *Tornado plot – NPV sensitivity* 

Item	JORC Code explanation	Comments
Social	*The status of agreements with key stakeholders and matters leading to social licence to operate.*	Pensana has undertaken an assessment of its key stakeholders that have a (statutory) interest in the project, including local government authorities, government agencies, and other interested parties (i.e. Shires, traditional owners etc.). Pensana will maintain a program of engagement throughout the life of the project. Consultation is aimed at developing relationships that are mutually beneficial to both parties. Stakeholders were engaged early in the planning process, primarily in the interests of achieving a collaborative approach to raise any concerns and provide Pensana with the means to respond to feedback and to ensure that local knowledge is considered in the design and management of the project. A stakeholder register and records of engagement are maintained. Pensana has developed a Resettlement Action Plan and an agricultural project that fits under the Livelihood Restoration Plan that is being developed with the objective to benefit the affected parties due to loss of lands and crops within the mining license and tailings storage facility areas, in order to ensure food security for the people affected. To ensure a more prosperous future for local populations, this project now includes a component of agricultural development in a sustainable way that will also provide agriculture products for the mine employees to replace food imports from other sources. **Operations Permit – Angola** The Regulatory ESIA completed in December 2020 resulted in Ozango Minerais S.A. (Pensana's 84% owned Angolan entity), being granted an Environmental Installation Licence No. 2893069200/2021 in March 2021. In 2021, the area corresponding to the Mining Title was changed to 31 km^2 and the project was to be subject to substantial changes in terms of project design, including the LOM extended to up to 20 years. Therefore, in this sequence, it was necessary to proceed with a new registration of the Project as "Addendum to the Longonjo NdPr Mining Project ESIA" and for which the update of the 2020 ESIA was requested, and the documents previously submitted with the 2020 ESIA. In June 2022, the requested documents were submitted to the regulator, and we are awaiting approval. After conformance to construction plans is demonstrated, an Operations Permit will be granted. **Powerline from HT substation at Belem do Dando to Longonjo mine site** The data gathered forms the baseline component of the ESIA process to support regulatory approvals for the power line and was conducted in line with World Bank and IFC Standard guidelines. All documents and studies were submitted to the regulator for approval in June 2022.
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 Longonjo Ore Reserves are classified using the guidelines of the JORC Code 2012. In-pit Measured and Indicated Mineral Resources were used as the basis for deriving the Proved and Probable Ore Reserve estimates.

Item	JORC Code explanation	Comments
		Approximately 13 Mt or 100% of Measured Mineral Resources was converted to a Proved Ore Reserve (about 45% of the total Ore Reserve) and 17 Mt of the Indicated Resources were converted to Probable Ore Reserves. This classification assessment of Proved was based on the latest pilot plant and other testwork results, which relate to samples representative of the first seven years of production; completed metallurgical evaluation; and due consideration of the Modifying Factors taken into account and referred to in this Ore Reserve Statement.
Other	*The status of agreements with key stakeholders and matters leading to social licence to operate.* *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.*	Longonjo permitting is summarised as: • Presidential decree no 59/20 approving the project and investment published in the Government Gazette April 2020. • Mining permit issued 12 May 2020 for 15 years, renewable up to 35 years per Angolan Mining Code and Mining Investment Contract. • Construction permit issued in February 2021. • Operations permit to be issued on completion of construction • ESIA update for additional scope of tailings storage facility to allow for increased LOM and MRES plant underway. • Resettlement Action Plan and Livelihood Restoration Plan processes underway. • All quarterly and annual submissions to the Ministry of Mineral Resources Petroleum & Gas required under the terms of the Mining Investment Contract have been submitted timeously. • Angolan Sovereign Wealth Fund (FSDEA) is a 22% shareholder in Pensana plc and hold 10% interest in Ozango Minerais. As such, this holding on behalf of the Angolan state is demonstration of in-country support for the project. Saltend permitting is summarised as: • Planning permission for the Saltend Refinery has been approved by the East Riding Planning Committee, with full and formal consent expected in September 2022. • The EIA for the Operations Permit will be completed in Q3 2022. • The Saltend Site Agreement for lease was signed and completed in August 2022 ready for Pensana site occupation in September 2022. The EPCM contractor is expected to be appointed as Principal Contractor under the CDM regulations thereafter. The Ore Reserves are dependent on all existing permitting and approvals remaining in place. There are no perceived obstacles to any of the outstanding permits or approvals. Rare earth projects around the world always have naturally occurring radioactive material associated with the bastnaesite and monazite mineralisation. The challenge in all rare earths extraction is to achieve successful and economic separation of the REE product from the unwanted radionuclides. To address this issue at Longonjo mine in Angola, the team of international experts at Wood, advised by Radiation Advice & Solutions P/L, have developed a process route which extracts the rare earths to a clean mixed rare earth double sulphate (MREDS) product. This includes a final scavenging ion exchange stage which provides additional security in “mopping up” any residual radionuclides in the unlikely event that the several previous process stages have not fully removed these small (ppm) residual amounts.

Item	JORC Code explanation	Comments
		This proprietary processing methodology ensures all naturally occurring radioactive materials (NORMs) are safely sequestered in a tailings containment facility designed to the 2020 Global Industry Standard on Tailings Management. The containment facility will be resistant against erosion, leaching, intrusion by burrowing animals and constructed in accordance with ANCOLD guidelines. The rare earths, recovered to a clean, high grade MREDS, will be exported to the Company's proposed Saltend Refinery in the Humber District, UK for separation into neodymium and praseodymium rare earth oxides, for sale into the magnet metal supply chain. Separated (lower value) lanthanum, cerium, mixed middle and heavy rare earth carbonate products will be sold into the supply chains for, inter alia, glass polishing, refinery catalyst, laser, pigment and phosphor industries. This unique process route development and vertically integrated supply chain is expected to give Pensana an advantage over its competitors by delivering a sustainable supply chain provenance for the customers of the Saltend Refinery separated products in the automotive and offshore wind turbine supply chains. Pensana recognises there is a specific potential human health exposure risk to respirable dust at Longonjo. Airborne dust could be produced when rare earths are disturbed through mineral extraction, stockpiling, transportation and handling when it is dry enough to generate dust particles. In mitigation of this risk, Pensana has committed to: • Implementing a comprehensive Radiation Protection Plan (based on International Atomic Energy Agency guidance as per IAEA RS-G-1.6) which will establish the protocols, processes and procedures for managing, monitoring and controlling the exposures to and effects of radiation on our employees, contractors, communities, and environment. • Providing appropriate resources, training, education and consultation that will support and provide effect to the Radiation Protection Plan. Regular monitoring, with annual audit and review of the results, together with review of the adequacy and effectiveness of the relevant site standards, processes, procedures and protocols governing radiation management, and report of same to the Board and to Angolan regulators. Radionuclides occur naturally on Earth in significant quantities, and materials which contain these radionuclides are referred to as NORMs. Natural sources of ionising radiation include cosmic radiation from the sun, solar radiation and terrestrial radiation. The NORM associated with the naturally occurring rare earths that Pensana will mine, is an example of a source of natural terrestrial radiation. Pensana will implement worker and community radiation safety plans to manage any risk from the naturally occurring nuclides. The additional scavenging ion exchange stage referred to above provides additional confidence that more than adequate protection measures have been implemented. Pensana has not entered into any binding agreements or arrangements with marketing agencies or consultants at this time. Since Mineral Resources were originally generated in 2021, a new topography surface was validated and has been used for developing a new pit design. This has been incorporated into this latest Ore Reserve estimate.

Item	JORC Code explanation	Comments
Audits or reviews	*The results of any audits or reviews of Ore Reserve estimates.*	There are currently ongoing “external” reviews of the current Feasibility Study Report. Mineral Resource estimate, pit optimisation, design and schedule as developed for the Longonjo Feasibility Study were reviewed internally by Snowden Optiro.
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 capital cost estimates in this study relating to mining, processing and cost performance are underpinned by a Feasibility level study. The capital cost estimate has an assessed accuracy of ±15% and complies with AACE Class 3 Feasibility Study criteria. PPM and specialist company Project Cost Consultants (PCC) have conducted extensive reviews of the estimates generated by Wood (Perth and Johannesburg) and others. The extensive program of metallurgical testwork, including pilot-plant scale, gives additional confidence in the Modifying Factors that may have a material impact on Ore Reserve viability. Project risks and opportunities were assessed in a number of risk workshops. Subsequent value engineering exercises tackled items that had a high residual risk and mitigation measures were applied in most cases. These apply to both Longonjo and Saltend sites and to the logistics chain. Higher level risks still remaining were identified as: • Assuming that COVID-19 and its variants persist, this can be categorised as an external and human resource risk to be mitigated by a number of measures being put into place and by ongoing situation monitoring • Orebody variability, categorised as a technical risk and to be mitigated by production reconciliation, geochemical variability study, further mineralogy sampling, and a design blending strategy if required.