ASX RELEASE

2 September 2014

NOLANS REPORT UNDERSCORES FEASIBILITY STUDY PROGRESS

- **Nolans Development Report provides detailed analysis**
- **Production scheduled to commence in 2019**
- **Report reinforces robust Project economics on conservative assumptions**
  - **NPV of A$2 billion on an after tax basis at a 10% discount rate**
  - **IRR of 21.4% on an after tax basis**
  - **Production target of 20,000 tonnes of REO equivalent per annum underpinned by Measured and Indicated Resources**
- **Report to form backbone of Definitive Feasibility Study**

Australian rare earths company **Arafura Resources Limited** (**ASX: ARU**) ("**Arafura**" or the "**Company**") is pleased to provide a comprehensive update on its 100 per cent-owned Nolans Project in the Northern Territory, with the release of the Nolans Development Report ("NDR").

The NDR is attached to this release. It outlines the Company's development plans for Nolans and presents a detailed analysis of the work undertaken to support the Company's strategy of de-risking the Project's pathway to production.

The report emphasizes the Company's target to commence production from Nolans in 2019 and reinforces the robust economics of the Project despite currently subdued rare earth prices.

Nolans is one of the most advanced rare earth development projects globally. The Nolans Bore resource is rich in neodymium and praseodymium (NdPr) – the key rare earths used in high-strength permanent magnets. This resource composition positions Nolans as a potential world-leading feedstock provider into the rapidly expanding rare earth magnet market. The main applications for rare earth magnets are in the automotive, consumer electronics and energy sectors.

The NDR highlights the inroads Arafura has made over the past two years in reducing the costs of the Project. The updated economics of the Project follow a reconfigured production process that includes the relocation of intermediate chemical processing to the Nolans Site, and the refining (or separation) plant being located in an established offshore chemical precinct. For the purposes of the NDR, this location was assumed to be the Gulf Coast region of the USA.

Arafura Managing Director Gavin Lockyer said, "Our Development Report draws attention to the commercial appeal of the Nolans Project and is testimony to the tremendous efforts of the Arafura team and our partners to de-risk the Project's path to production.

AN EMERGING RARE EARTHS PRODUCER FOR USERS WORLDWIDE

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"Today's release ensures that all stakeholders are across the milestone achievements being made on the Project.

"This is a strategically important report for Arafura that supports our offtake and funding discussions with a number of parties."

The NDR is the launch pad for the Project's Definitive Feasibility Study ("DFS") which is scheduled for completion in mid- to late-2015. The DFS will incorporate the results of the ongoing China-based optimisation program. This program recently confirmed the efficacy of the Project's beneficiation flowsheet, and the hydrometallurgical phase of the program is expected to commence shortly.

Arafura will progress the DFS alongside key activities that will enhance funding opportunities for the Company. These activities include:

- Confirmation of provisional product sales agreements;
- Completion of flowsheet validation testwork and the Chinese optimisation program;
- Advancement of regulatory permitting for the Nolans Site, including the Project's water supply; and
- Securing an offshore site within an established chemical precinct for the RE Separation Plant.

Mr Lockyer said, "Nolans remains on track to become a significant supplier of rare earths when it comes online in the latter part of this decade. Importantly, the Project's production commencement coincides with a projected supply shortage of magnet-feed and other critical rare earths in which Nolans is particularly well endowed."

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NOLANS DEVELOPMENT REPORT

SEPTEMBER 2014

ARAFURA RESOURCES LIMITED

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COMPETENT PERSON'S STATEMENT

The information in this Development Report ("Report") that relates to Exploration Results is based on information compiled by Mr Kelvin Hussey, a Competent Person who is a Member of the Australian Institute of Geoscientists. Mr Hussey is a full time employee of Arafura Resources Limited ("Arafura"). Mr Hussey has sufficient experience that is relevant to the style of mineralisation and type of deposit under consideration and to the activity being undertaken to qualify as a Competent Person as defined in the 2012 Edition of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves. Mr Hussey consents to the inclusion in this Report of the matters based on his information in the form and context in which it appears.

The information in this Report relating to Mineral Resources is based on an estimate completed and reported by Mr John Tyrrell in August 2012, following the guidelines of the JORC Code 2004. That report, *Nolans Bore Resource Estimate*, is available for viewing on the Arafura website (www.arafuraresources.com.au). The Mineral Resources in this Report have not been updated to comply with the JORC Code 2012 on the basis that the information has not materially changed since it was last reported. Mr Tyrrell is a Member of the Australasian Institute of Mining and Metallurgy and is a full-time employee of AMC Consulting Pty Ltd. He has sufficient experience that is relevant to the style of mineralisation and type of deposit under consideration and to the activity being undertaken to qualify as a Competent Person as defined in the 2012 Edition of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves. Mr Tyrrell consents to the inclusion in this Report of the matters based on his information in the form and context in which it appears.

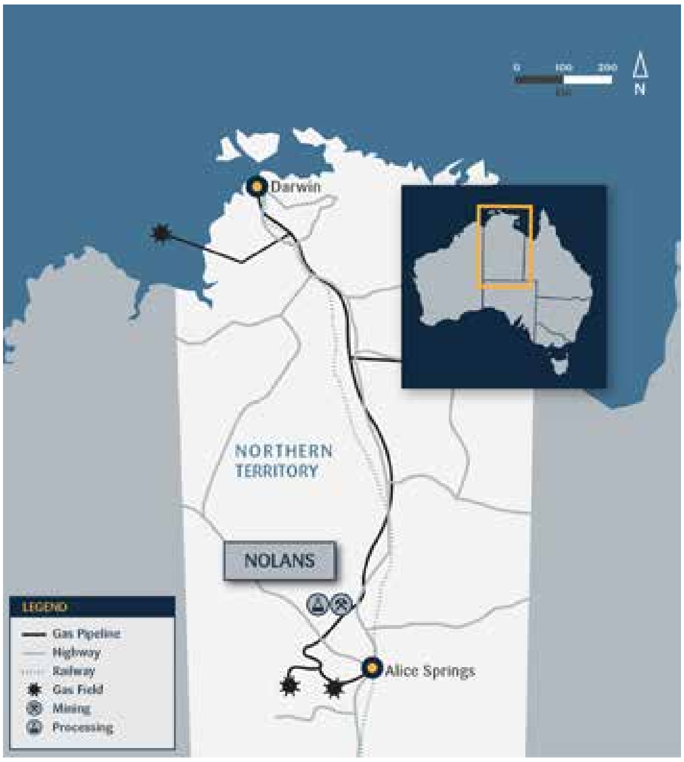
1 EXECUTIVE SUMMARY

1.1 INTRODUCTION

This Nolans Development Report describes in some detail Arafura Resources Limited's ("Arafura" or the "Company") plans to develop its wholly-owned Nolans Rare Earths Project ("Nolans" or the "Project"). Development of the Project will encompass a Mine, Concentrator, Rare Earth ("RE") Intermediate Plant and related infrastructure to be constructed and located at the Nolans Site in Australia's Northern Territory ("NT"), and a RE Separation Plant to be constructed and located within an established chemical industry precinct at an offshore location.

The Project herein described assumes that the RE Separation Plant will be developed within a specific chemical precinct on the USA Gulf Coast, although other locations with similar advantages are also under consideration. The Project is underpinned by a low risk mineral resource that has the potential to supply 10% of the world's RE demand.

▼ Figure 1.1: Nolans Project, Northern Territory



The Nolans Project will produce five high-quality separated rare earth oxide ("REO") products for sale to customers in leading growth sectors of the RE market. Most of the revenue from these products will be generated by RE products that feed the highest value segments of the market with the strongest outlook for demand. NdPr Oxide in particular is in high demand from alloy and magnet producers and the Nolans Project is strongly endowed with neodymium ("Nd") and praseodymium ("Pr"). NdPr Oxide sales will comprise some 77% of Arafura's revenue mix.

Subject to some residual confirmatory testwork being undertaken by Arafura and optimisation work being carried out in China by RE experts, the flowsheet for the Nolans Project has been determined as technically and economically viable to treat Nolans ore. In addition, the Company has taken steps to simplify and improve the flowsheet and to substantially reduce the Project's capital and operating costs. The beneficiation flowsheet has been confirmed by Chinese specialist RE laboratories as the most efficient flowsheet to take forward into development and remaining work will confirm some of the RE extraction flowsheet details and piloting in China as part of the Definitive Feasibility Study ("DFS"). The confirmatory and optimisation work is scheduled to be completed in the latter part of 2014.

Key Project information is summarised in **Table 1.1.**

▲ Table 1.1: Key Project Information

Overall Capital Costs including Contingency	A$1,408 million
Net Present Value (after tax with 10% discount rate)	A$2,045 million
Internal Rate of Return	21.4%
Mine Life – Measured and Indicated Resources	>23 years
Payback Period	Year 5 of operations
Mining and Beneficiation Operating Costs	A$4.50/kg REO
RE Processing Operating Costs	A$9.63/kg REO
Total Operating Costs	A$15.67/kg REO
Definitive Feasibility Study	Mid 2014 to Mid 2015
Estimated Construction Start Date	Mid 2016
Estimated Production Start Date	Early 2019
Total Mineral Resources (contained REO)	1,217,000 tonnes
Measured and Indicated Resources (contained REO)	706,000 tonnes
Annual REO Production	20,000 tonnes equivalent

The Company's evaluation of the Nolans Project indicates that the Nolans Project is financially robust and that it should provide a strong return on investment.

1.2 TENEMENTS AND OWNERSHIP

The Nolans Bore deposit is located on land held by Waite River Holdings Pty Ltd under the "Aileron" Perpetual Pastoral Lease. Arafura holds secure title over the deposit under EL 28473, granted in October 2011 by the NT Government under the *Mineral Titles Act*. A Mineral Lease ("ML") application for ML 26659 over the Nolans Bore deposit and surrounding areas was lodged with the NT Government by the Company through a wholly-owned subsidiary in February 2008.

The Company is preparing additional ML applications on several of its tenements to accommodate an expanded footprint for the Nolans Site to include chemical processing at the RE Intermediate Plant.

The NT's *Mining Management Act* ("Act") will facilitate tenure for access roads to the site for mining and processing purposes and Arafura is working closely with relevant government authorities to finalise an application for such tenure. The Act provides mechanisms for the Company to conduct its authorised activities at the Nolans Site and further options may also be explored with the Aileron leaseholder.

The RE Separation Plant will be located offshore within an established chemical precinct in a secure environment. The Company has conducted a global investigation of potential sites and is confident that it will be able to secure such a site with tenure and requisite approvals.

1.3 GEOLOGY AND MINERAL RESOURCES

The Nolans Bore deposit is a three dimensional, hydrothermal stockwork vein-style deposit with steeply dipping veins up to tens of metres in thickness and hundreds of metres in length, extending below 250 metres drilled depth across large parts of the deposit. Apatite, allanite and monazite are the most abundant RE-bearing mineral species.

In addition to REs, the deposit has elevated concentrations of calcium, phosphorous, thorium, uranium, strontium and fluorine. It is enriched in light REs and relatively more enriched in praseodymium, neodymium, samarium and europium than most other comparable deposits. The neodymium content of Nolans Bore is amongst the highest of any RE resource currently being considered for development anywhere in the world.

AMC Consultants Pty Ltd ("AMC") estimated, classified and reported Mineral Resources for Nolans Bore under the 2004 JORC Code in 2012 (**Table 1.2**).

Table 1.2: Nolans Bore Mineral Resources

Resources	Tonnes million	Rare Earths REO %	Phosphate P_2O_5 %	Uranium U_3O_8 lb/t
Measured	4.3	3.3	13	0.57
Indicated	21	2.6	12	0.42
Inferred	22	2.4	10	0.37
TOTAL	**47**	**2.6**	**11**	**0.41**

1% REO cut-off grade.

The resource model estimates total Mineral Resources of 47 million tonnes at 2.6% REO using a 1% cut-off grade. The resource has been subjected to 90,000 metres of drilling, including extensive diamond core drilling that supports a high degree of confidence in the Measured and Indicated ("M&I") resources that contain 707,000 tonnes of REO. These resources represent over 58% of the total in-situ RE resources at Nolans Bore.

The quantum, distribution and analysis of its diamond core drilling, and the completion of detailed mineralogical and material type analysis, justifies the Company's assessment that the Nolans Bore resource represents a low risk to the Project.

1.4 MINING

In December 2012, the Company announced an estimate of Ore Reserves for Nolans Bore, supporting a 22-year mine life for the Project. This was prepared independently by AMC under the 2004 JORC Code and was based on the M&I resources shown in Table 1.2. The Ore Reserves represented that part of the resource that could be mined by open pit methods and reflected a high level of conversion of the M&I resources to Probable Reserves.

Since this estimate was reported, the 2012 JORC Code has been introduced and Arafura has made major changes to improve the flowsheet and simplify the configuration of the Project. These changes are considered positive advancements for the Project and represent material changes to some of the technical and commercial assumptions (or Modifying Factors) that support the Ore Reserves. The Company expects there will be further material changes to some of the Modifying Factors during the DFS, and has elected to defer re-estimating Ore Reserves under the 2012 JORC Code until the latter part of the DFS. The M&I resources that are the foundation of the Ore Reserves have not changed. As such, Arafura and its consultants are using the Project's M&I resources as the basis for its mine planning.

The proposed mining operation will use conventional open-pit truck and excavator mining methods, supplemented by drilling and blasting for ore and waste. Pit optimisation studies have generated schedules showing a mine life of 25 years based on M&I resources and more than 40 years based on total resources (or life-of-mine "LOM" resources). Dilution is estimated at 11.4% (plus 0.1% mining loss) and 15.7% (plus 0.2% mining loss) respectively. Geotechnical inputs, including pit slope parameters, have been developed for pit optimisations and pit design. A series of pit shells has been produced and detailed pit design will be completed for the DFS.

A strategic mining schedule for the M&I optimisation scenario is based on a maximum overall mining rate of 10 Mtpa to produce an average of 900,000 tonnes of plant feed each year. The LOM optimisation scenario is based on a maximum overall mining rate of 10 million tonnes per annum to produce an average of 1.0 million tonnes of plant feed each year.

Mine planning studies and related work undertaken by Arafura and its consultants to date have been consistent over time and have been carried out to a high level of precision and accuracy. As a consequence the work required to consider the impact of changes to non-mining Modifying Factors, together with confirmatory pit optimisations, refinement of mine sequencing, pit design, mine scheduling and cost estimation, should not be significant or time-critical.

1.5 METALLURGICAL TESTWORK

Extensive metallurgical testwork by the Company has resulted in the development of a flowsheet that is technically and economically viable to treat ore from Nolans. This focus on metallurgical testwork has been a major contributor to setting Arafura at the forefront of the RE industry. Testwork has addressed the three discrete parts of the Nolans flowsheet; beneficiation, RE extraction and RE separation.

1. The beneficiation flowsheet developed by Arafura in Australia has been confirmed by Chinese specialist RE laboratories as the most efficient flowsheet to take forward in the DFS. A doubling of the RE head grade with 85% REO recovery has been achieved in beneficiation, which is optimum for the Nolans material types.

2. The RE extraction flowsheet steps have been defined and confirmatory testwork is underway in Australia to support a decision by the Company to take this flowsheet forward in the DFS. A sulphuric acid pre-leach circuit has been developed for the RE extraction flowsheet, replacing a hydrochloric acid pre-leach circuit that had been developed, reducing plant complexity, capital costs, and transport and logistics issues. In addition, a double sulphate precipitation circuit has been developed for RE impurity removal that will simplify plant design, increase RE recovery and reduce operating costs. Cerium oxidation has been included in the RE extraction flowsheet to produce a cerium product at the Nolans Site, reducing the amount of feed material to the RE Separation Plant and further reducing capital and operating costs.

3. The RE separation flowsheet has been developed to a level that facilitates preparation of a +/-25% capital and operating engineering cost estimate. The Company's RE separation testwork program at the Australian Nuclear Science and Technology Organisation ("ANSTO") has produced samples of five separated REO products to market specification from Nolans ore.

Work remaining includes an Australian-based targeted testwork program scheduled to be completed in 2014 that will confirm specific RE extraction flowsheet details. Additional China-based testwork is aimed at exploring alternative processing options that have the potential to provide significant savings in capital and operating costs. Should this work demonstrate that significant savings can be realised, flowsheet options will be addressed by the Company for risk, and technical and economic viability.

Additional confirmatory RE separation testwork is planned, but this will not be a major undertaking, nor will it be on the critical path for technical and engineering Project development.

1.6 PROCESSING

The Nolans process configuration has been developed by Arafura from detailed, extensive and rigorous testing through a number of phases of laboratory, pilot plant and demonstration plant scales. The Project's post-beneficiation flowsheet has changed from a single complex, intended to be located at Whyalla, to a split configuration comprising an RE Intermediate Plan at the Nolans Site and an offshore RE Separation Plant in an established chemical precinct. Sulphuric acid is now used instead of hydrochloric acid in the pre-leach circuit and the Project no longer includes a chlor-alkali plant and hydrochloric acid recycle. It is no longer necessary to produce sodium hydroxide and hydrochloric acid on site and the reduced quantities required are now imported to both processing complexes.

Process flowsheets have been developed for beneficiation, RE extraction and RE separation.

1. Beneficiation at the Nolans Mine Site will comprise crushing, grinding, magnetic separation and flotation to produce a blended concentrate. The beneficiation flowsheet is now defined with a high level of certainty and is ready to be taken to DFS level.
2. Concentrate will be pumped through a slurry pipeline to an RE extraction plant at the Nolans Processing Site. REs will be extracted from the concentrate by chemical processing to produce a high quality RE intermediate product. This flowsheet is well developed, with some parts requiring limited confirmatory work to give more detail to the certainty of the process. This is expected to be completed in the latter part of 2014. Detailed process design criteria and equipment selection and sizing have already been undertaken. Tailings, residue and radionuclide retention will be confined to the Nolans Site.
3. Rare earths will be separated into the final REO products at the offshore RE Separation Plant using solvent extraction followed by precipitation and calcination. The Company's detailed research program at ANSTO, including mini-piloting and RE separation trials, has delivered design parameters for scale-up to a production scale installation, as well as corresponding mass balance and raw material requirements. All five of Arafura's REO products produced in the laboratory are derived from Nolans ore, and all conform to or exceed a 99% purity target specification.

Development of the Nolans Project will proceed into DFS and Project development using the current flowsheet. Part of the DFS will include integrated piloting of the beneficiation and RE extraction processes. At the same time, the Company has leveraged its Chinese relationships to access RE research expertise and industrial experience in China to confirm the selected flowsheets and to investigate opportunities that may result in a materially positive impact on the Project's economics. This work is not expected to delay the development of the Project.

1.7 INFRASTRUCTURE AND LOGISTICS

Arafura's decision in 2013 to relocate intermediate chemical processing to the Nolans Site in the Northern Territory and to develop the opportunity of an offshore RE Separation Plant was strongly influenced by the positive impact on the economics of the Nolans Project, and transport and logistics considerations. Overall, the Project's logistics have been simplified and total volumes have been reduced, including a significant reduction in movements of radioactive, hazardous and dangerous goods.

The Nolans Mine Site is well located ten kilometres west of the all-weather Stuart Highway, 65 kilometres from the Darwin-Adelaide railway, and 135 kilometres by road from the major Central Australian town of Alice Springs. The Amadeus Basin to Darwin natural gas pipeline passes directly adjacent to the Nolans Processing Site and within five kilometres of the Mine Site. The location of the Concentrator has been fixed near the Mine, access roads to and around the Nolans Site have been positioned, site buildings have been specified, and a 400-person accommodation village has been conceptually designed. Raw and potable water sources adequate to service the operation have been identified.

The infrastructure requirements for the Nolans Project have been well defined through work undertaken to date on roads, buildings, communications, and power and water supply. A power plant will be co-located at the RE Intermediate Plant and a conservative approach has been taken to power generation requirements. It is likely that, with further work as part of the DFS, these will be rationalised, resulting in a reduced capital cost. Tailings and residue storage facilities have been identified and specified by the Company and its consultants.

The proximity of the Project to Alice Springs provides an opportunity to base much of the Project's maintenance and operations infrastructure associated with its road transport operations in Alice Springs, with potential benefits to the local community. The impact of this opportunity and the envisaged road transport operations will be included in ongoing community consultation.

The Company expects around 350,000 tpa of in-bound raw materials to be delivered to the Nolans Site, mostly as intermodal cargo, and has engaged with the major operators and service providers to ensure access to infrastructure and to incorporate the most efficient solutions for cargo movements. Most inbound reagents will be containerised. Inbound sulphur will be containerised in Darwin and delivered to an on-site sulphur burning acid plant that will produce sulphuric acid for the RE Intermediate Plant. Caustic soda and hydrochloric acid will be shipped direct from suppliers or via Darwin in dedicated ISO tank containers for on-forwarding to Nolans.

Out-bound RE intermediate product cargos will utilise the backhaul capability of the rail and road capacity and the Port of Darwin infrastructure. The RE chloride intermediate product from the RE Intermediate Plant will be packed in bulk bags and transported in standard shipping containers via Darwin and international shipping routes to the offshore RE Separation Plant.

The development of an RE Separation Plant within an established international chemical precinct is integral to the Project. The Company is well advanced in its site selection process and has identified appropriate locations in Asia, the USA, the Middle East and Western Europe. The shortlisted sites are all established chemical precincts with road, rail and port facilities and easy access to raw materials such as hydrochloric acid, obviating the need for the Company to construct a dedicated chlor-alkali facility. Arafura has based its capital and operating cost estimates on locating its RE Separation Plant within a chemical precinct on the USA Gulf Coast, but all of the shortlisted locations offer large capital and cost savings compared with the Australian-domiciled alternative.

1.8 ENVIRONMENT, HEALTH, SAFETY AND COMMUNITY

The Nolans Site is subject to government approvals processes stipulated by the Australian and Northern Territory governments under well-defined regulatory frameworks. These governments have determined that the appropriate level of assessment for the environmental approvals process at the Nolans Site is an Environmental Impact Statement ("EIS"). Environmental and social assessment for the DFS has been based on studies undertaken for the preparation of the EIS (geology, water, air, noise, flora, fauna, rehabilitation, socio-economic issues, traffic and transport, radiation, cultural heritage and visual and planning matters), as well as historical studies and supporting data.

Arafura has completed a number of baseline environmental studies to an advanced stage and the remaining studies required under the approvals process are well understood and have been scoped in readiness for implementation. Work completed to date has not identified any significant environmental or community matters that could adversely impact on regulatory approval of the Project at the Nolans Site.

Following the Company's decision in 2012 to base the RE Intermediate Plant at the Nolans Processing Site, a number of the general studies required for the Nolans EIS are being expanded and some more specific and detailed studies are necessary to encompass processing at the Nolans Site. These are currently underway and based on Arafura's discussions with the Northern Territory regulator, the Company expects that the Nolans Processing Site will not be designated a major hazard facility.

The NT regulator has indicated that the existing guidelines will require minor review and amendment to ensure that the EIS addresses the overall impact of the reconfigured Project, including the Processing Site, Mine Site and Processing Site access, accommodation village, groundwater borefield, and borefield access. Arafura is working towards a guideline reassessment by the NT Environmental Protection Authority leading to the reissue of amended guidelines and an extension of the EIS to December 2016.

The Project is targeting compliance with International Management Standards 9001 for Quality, 14001 for Environment and 18001 for Health and Safety to ensure that its management systems are internationally recognised. The key operational management issue is the management of radioactive materials and the potential for the Project's workforce to be exposed to excessive levels of radiation. The Company is developing mitigation and management measures that will be implemented to ensure that the expected annual occupational radiation dose is below the regulated occupational exposure limit to maintain the safety and well-being of all personnel and to ensure that external radiation levels result in negligible radiation exposure to the public.

The Project's RE Separation Plant will be constructed and operated in an existing world-scale and operational chemical precinct outside Australia. The shortlisted locations have established regulatory frameworks and are within jurisdictions that have significant chemical processing facilities and that are experienced in expanding, adding, approving and regulating such facilities. This plant will have considerable capital and operating cost savings over an equivalent plant built in Australia, and due diligence undertaken by the Company to date indicates that the plant will satisfy widely accepted chemical industry management practices and standards and comply with local, regional and national regulatory requirements.

Arafura has open and transparent engagement and consultation with the community as a core value. Communication and engagement strategies are tailored to local communities where the Company operates and will be further and appropriately expanded as the Project nears implementation.

1.9 SALES AND MARKETING

Arafura maintains an active presence in RE markets around the world and understands that to position itself strongly in the established regional markets of Europe, Japan, South Korea and the USA, a combination of direct sales to end users and partnering with strategic distributors is important for global reach and access to customers. Consequently, the Company has in place a comprehensive marketing strategy and a robust sales plan that involves regular contact with prospective customers around the world. The Company has forged long-term relationships with key end users and strategic trading partners involved in key markets where the Company plans to place its products.

Arafura expects global demand for REs to grow at a compound annual growth rate ("CAGR") of 6-7%, leading to a total global RE market of approximately 180,000 tonnes in 2020. Total supply through to 2020 is forecast to grow at a CAGR of 5-6%, with a dependency on China's continued production and advancement of non-Chinese projects. Global RE demand is underpinned by strong forward growth in the renewable energy, automotive and electronic sectors, with supply constrained for most REs due to Chinese industry consolidation, export restrictions and long development times for non-Chinese projects to enter the supply chain.

The Nolans Project will derive most of its revenue from RE products whose target markets have the most value and growth prospects. NdPr is a critical rare earth for high performance advanced magnets in the automotive sector and wind turbines and is a high value growth product that will make up some 77% of Arafura's projected revenue. RE growth in the catalyst, battery, and phosphor market segments should also be strong and support the sale of Arafura's other REO products.

With the Nolans Project moving closer to execution, interest in the Project's product suite is increasing, assisted by a successful evaluation of Arafura's five REO products by key target customers, removing barriers to product validation and establishing Arafura's authenticity as a future supplier. Arafura has made available samples of high quality REOs for pre-qualification testing by potential customers in the regional markets of Japan, South Korea, Europe and the USA where the Company intends to place its product upon commercialisation of the Project.

Arafura has a long-standing relationship with ThyssenKrupp and a Letter of Intent between the parties for supply of up to 3,000 tonnes per annum of REO products into the German market is maturing into a more conventional offtake agreement, which is currently under negotiation. A Memorandum of Understanding has also been signed with a South Korean multinational company and is being progressed towards securing the sale of a further 3,000 tonnes of REO products. Discussions with other prospective customers in key regional markets are progressing well and the Company is confident that it can secure future supply chain diversification of its products

1.10 CAPITAL AND OPERATING COSTS

The estimated capital and operating costs of the Nolans Project are significantly lower than those contained in Arafura's August 2012 Base Case. The reductions flow mainly from subsequent improvements to the Project's flowsheet and the Company's decision to relocate the RE Intermediate Plant from Whyalla to the Nolans Site and the RE Separation Plant from Whyalla to a synergistic chemical precinct in an appropriate offshore location. Amongst other things, this has removed a requirement to build a chlor-alkali plant and has resulted in savings in capital and operating costs due to not having to transport large volumes of material between the Nolans Mine Site and Whyalla.

The total capital cost of the Project (**Table 1.3**) is estimated at A$1,408 million based on engineering cost estimates provided by Lycopodium and AMEC, adjusted by Arafura for flowsheet changes and transport and logistics estimates. This is 26.4% lower that the capital cost estimate for the August 2012 Base Case. The capital costs include a contingency of A$196.7 million, which is 16.2% of the Project's direct, indirect and owner's costs.

Table 1.3: Capital Costs Summary

Area	A$m
Mine	6.6
Concentrator	132.2
RE Intermediate Plant	243.6
Ponds and Co-Products	64.7
Infrastructure	114.4
Ancillaries	182.5
RE Separation Plant	102.1
Ponds and Co-Products	1.0
Infrastructure	23.1
Ancillaries	2.6
Transport and Logistics	16.7
Indirect Costs	252.4
Owner's Costs	69.6
Sub-Total	**1,211.5**
Contingency	196.7
TOTAL	**1,408**

Arafura has reviewed its Project operating costs and estimates the operating cost for the Nolans Project to be \$15.67/kg REO (**Table 1.4**) compared with A\$20.55/kg REO in the August 2012 Base Case. The A\$15.67/kg operating cost can be subdivided into an Australian cost of A\$10.69/kg REO and a USA cost of US\$4.47/kg REO, converted to Australian dollars at an \$A:\$US exchange rate of 0.897. This 24% improvement arises from the flow-on effect of higher concentrate grades in beneficiation, improvements in RE extraction processing and reduced transport and logistics costs due to the relocation of the RE Intermediate and RE Separation Plants.

Table 1.4: Operating Costs Summary

Plant	A$/kg REO[1]
Mine	2.64
Concentrator	1.86
RE Intermediate Plant	7.84
RE Separation Plant	1.79
Transport and Logistics	1.54
TOTAL	**15.67**

[1]USA cost components converted using A$1 = US$0.897

1.11 FINANCIAL EVALUATION

Financial evaluation of the Nolans Project indicates a Net Present Value ("NPV") of A$2,045 million and an Internal Rate of Return of 21% over an assumed 23-year Project life. The NPV is calculated on an after-tax basis with a 10% discount rate. The Project is able to pay back its capital within five years of operation.

The key assumptions underpinning the Project are:

- Measured and Indicated Resources are sufficient to support the financial evaluation;
- The construction period is 36 months and the operating period is 20 years;
- Capital costs are escalated at 3.2% per annum during the construction period;
- An annual provision of 1.4% of total direct capital costs for sustaining capital expenditure is included in the financial projections, as well as an annual allowance of approximately A$7.5 million (in real terms) for tailings and residue storage facilities ("TSFs/RSFs");
- Additional capital expenditures of A$115 million for plant expansion and A$82 million for TSFs/RSFs are included in years seven to ten of operations;
- Production is ramped up over eight quarters following the construction period to 20,000 tonnes of REO equivalent per annum;
- A Nolans REO product price of US$36.64/kg is assumed for the first year of production in 2019 as the starting point for the price forecast;
- A growth rate has been calculated for Arafura's NdPr product and no price growth attributed in real terms to all other products;

- A Consumer Price Index escalation of 2.7% per annum has been applied to sales and costs;
- An exchange rate of A$1 = US$0.897 has been assumed for 2014, gradually reducing to US$0.813 by 2017 and remaining constant thereafter; and
- The financial evaluation is based on the Nolans Project being funded entirely from equity.

A sensitivity analysis has been undertaken. This demonstrates that the Project is financially resilient and relatively insensitive to adverse capital and operating cost escalation. It is more sensitive to adverse movements in REO prices and exchange rates, but notwithstanding that the Company's assumed REO product price is conservative on an historical basis, the Nolans Project can, if necessary, operate effectively under sustained periods of more adverse prices.

1.12 RISK ASSESSMENT

The Company has an enterprise risk management system in place to identify and mitigate risks involved in developing the Nolans Project. This system ensures that corporate and Project risks are identified on an on-going basis, and that risk mitigation strategies and actions are put into place to manage and mitigate the key risks.

A formal project risk assessment has identified the risks that could be expected to impact on the Project and risk mitigation strategies have been developed for the higher risks.

1.13 PROJECT EXECUTION

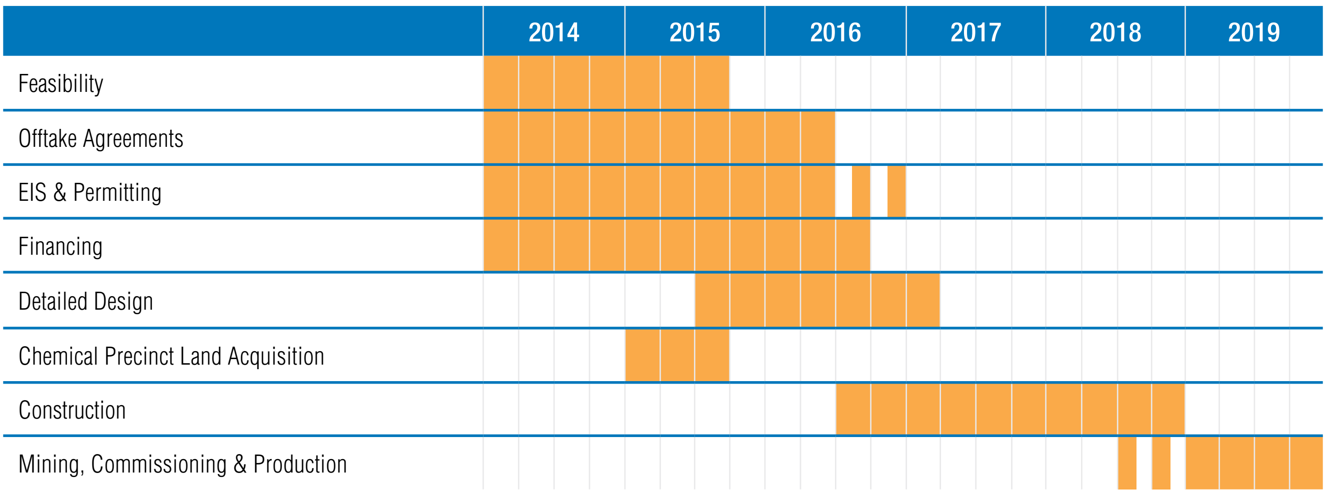
Arafura has near-completed process development for the Nolans Project and has confirmed that the Project is technically and commercially viable. As a result, the Company has commenced project planning with a Project Execution Plan ("PEP") under development. The PEP focuses on the main actions required to be completed before project execution including the remaining testwork validation, work necessary for the Company to complete the DFS, including cost estimation, to ±15% accuracy, fund raising activities for the Project, awarding and execution of Engineering, Procurement and Construction Management ("EPCM") contracts, and development of the Project.

A detailed schedule has been developed by the Company and a high level summary targeting a start to construction by the middle of 2016 and scheduled first product by the middle of 2019 is shown in **Figure 1.2**.

The Company has used reputable engineering consultants to develop the engineering and operating cost estimates for Nolans. Execution and delivery of the Project will be complex and will require the management of a significant number of external designers, engineers, vendors, sub-contractors and other parties to achieve a successful outcome. Arafura does not have, within its current organisation, the internal resources to adequately manage the complexity of a project of this size. In view of this, the Project's capital costs have been estimated on the basis that the Company will use a standard EPCM approach. Other engineering and construction models will be examined in the DFS in order to optimise Project outcomes, but a cost estimate for an EPCM contractor is included in the Project's capital cost estimates. Other specialist contractors will be engaged as required.

Much of the work needed to complete the Nolans DFS is well advanced and the Company's focus is moving to complete this study, with a target date of mid to late 2015. As the DFS approaches completion, the Company will intensify its efforts to secure the necessary funds to develop the Project.

Figure 1.2: Nolans Summary Schedule



Estimates of times are indicative only and are subject to change. Arafura reserves the right to vary the timetable without notice,

2 TITLE AND OWNERSHIP

KEY FEATURES

- Valid mineral titles secured over the Nolans Site.
- Clear pathway to finalise land use agreements and compensation arrangements with local stakeholders.

2.1 NOLANS SITE

Title over the Nolans Bore deposit is secured under Exploration Licence ("EL") 28473. EL 28473 was granted under the *Mineral Titles Act* ("Act") to Arafura Resources Limited by the Northern Territory Government's Department of Mines and Energy ("DME") in October 2011 for an initial period of four years.

Arafura executed an exploration agreement over a predecessor tenement to EL 28473 in 2003 with the Central Land Council ("CLC") acting on behalf of the traditional native title custodians of the immediate region. EL 28473 has now been incorporated into this agreement by a deed of variation made between Arafura and the CLC in 2013.

Arafura Rare Earths Pty Ltd, a wholly-owned subsidiary of Arafura Resources Limited, lodged an application for a Mineral Lease ("ML", as ML 26659, herein referred to as the 'Nolans Mine Site') with the DME over the Nolans Bore deposit and surrounding areas in February 2008. Grant of this application awaits the finalisation of an Indigenous Land Use Agreement ("ILUA") with the native title custodians and their CLC representatives. The Company is preparing additional ML applications on EL 28473, EL 28498 and EL 29509 to accommodate the expanded footprint of the Nolans Site to include the Nolans Mine Site and the Nolans Processing Site (**Figure 2.1**).

Quarrying of carbonate material on EL 28473 for use at the Nolans Processing Site requires the Company to obtain an Extractive Mineral Lease ("EML"). The process to secure valid title over the carbonate material is well underway.

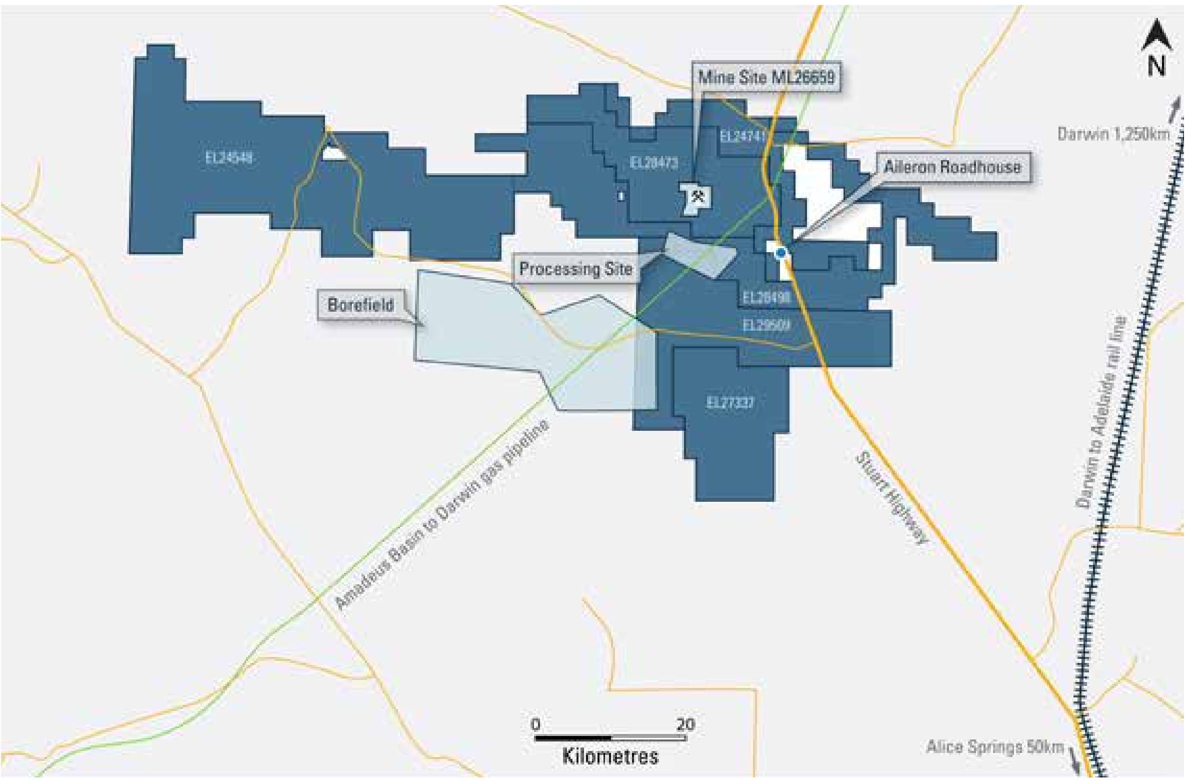
Tenure required for the placement of access roads to the Processing Site and from the Processing Site to the Mine Site, the borefield and its access corridor, is enabled under the *Mining Management Act* by virtue of an Access Authority. This form of authorisation does not require a significant level of assessment by the DME in order to grant, and the Company is working closely with the relevant authorities to finalise the application process. There may be a requirement for a separate ILUA covering access to the borefield area, however this is yet to be formally determined.

Background land tenure to the Nolans Site is the "Aileron" Perpetual Pastoral Lease (PPL 1097) held by Waite River Holdings Pty Ltd. Arafura has commenced discussions with the leaseholder to negotiate a compensation arrangement. The leaseholder is not permitted to recover compensation in relation to minerals on the land that includes the Nolans Bore deposit. Should Arafura and the leaseholder not agree on a suitable compensation arrangement, then the rights prescribed under the Act will apply.

2.2 CHEMICAL PRECINCT

The Nolans Project contemplates the construction and operation of a RE Separation Plant in an offshore jurisdiction. A final location is yet to be secured, however the Company's investigations are focussed on sites that have existing freehold or leasing capacity.

Figure 2.1: Nolans Site



3 GEOLOGY AND MINERAL RESOURCES

KEY FEATURES

- 47 million tonne Mineral Resource defined from surface down to 215 metres.
- 1.2 million tonnes of contained REOs.
- Mineralisation open at depth.
- Rare earth mix highlights premium neodymium content.
- Low resource risk:
  - 90,000 metres of exploration, metallurgical and geotechnical drilling in 676 holes
  - High proportion of diamond core drilling
  - Maximum drill spacing of 40 x 40 metres

3.1 EXPLORATION AND RESOURCE DEFINITION

The Nolans Bore rare earth elements-phosphorus-uranium ("REE-P-U") deposit was discovered in 1995 by PNC Exploration as a result of on-ground exploration of a discrete airborne radiometric response.

Systematic exploration of the Nolans Bore site has been undertaken by Arafura since 2000 after first-pass geochemical sampling of fluorapatite (herein referred to as 'apatite') occurrences returned up to 9.9% REE and 14.7% P.

Table 3.1 outlines the scope of drilling and costeaning activities completed by Arafura at Nolans Bore to date. A total of 628 reverse circulation ("RC") and diamond core ("DD") holes have been drilled into the Nolans Bore deposit, including 92 DD holes from surface and 140 DD extensions to RC holes. The quantum (27,060 metres) and overall proportion (31%) of DD drilling are considered sufficiently high to provide good geological control and support the estimation of higher confidence (Measured and Indicated) Mineral Resources (see Section 3.5 MINERAL RESOURCES).

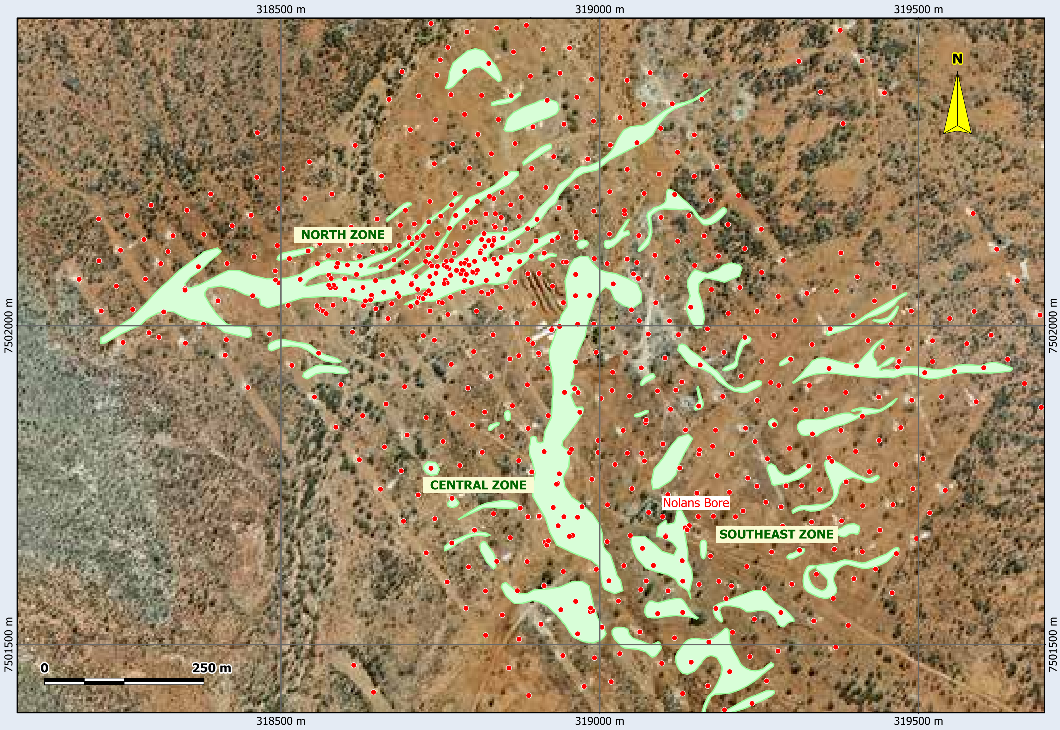
▲ Table 3.1: Exploration Activity at Nolans Bore, 2000-2011

Year	Costean		RC Drilling		Diamond Core Drilling			Wide Diameter Drilling		Total Metres
	number	metres	number	metres	number from surface	number of tails	metres	number	metres	
2000	6	890								890
2001			12	856						856
2004			20	1,525	5		518			2,043
2005			58	7,532	1	11	1,042			8,574
2006			41	3,462	17		1,322			4,784
2007	3	222	103	10,018	6	3	704			10,944
2008			85	7,815						7,815
2009					7		793			793
2010			9	992				48	1,656	2,648
2011			208	27,761	56	126	22,681			50,442
TOTAL	**9**	**1,112**	**536**	**59,961**	**92**	**140**	**27,060**	**48**	**1,656**	**89,789**

As shown in **Figure 3.1**, nearly all of the exploration and resource definition activity has been confined to an area measuring 1.5 x 1.2 kilometres centred on 318950 mE 7501900 mN (MGA53, GDA94). Most of the deposit has been drilled on a nominal 40 metre-spaced inclined pattern (-60° inclination) along NW-SE sections to a nominal 250 metre drilled depth (i.e. 215 metre vertical depth). One part of the deposit, the Central North Zone ("CNZ"), has been drilled on 20 metre centres.

Figure 3.1: Nolans Bore Drill Hole Layout and Distribution of Mineral Resources.

Resources shown at 600 mRL (60 m below surface)



3.2 DEPOSIT GEOLOGY AND MINERALISATION

The geology of the Nolans Bore deposit is documented in Arafura (2012a) and there have been numerous detailed petrographic and scanning electron microscopy ("SEM") studies of the mineralogy (e.g. ANSTO, 2001; Pontifex & Associates, 2005; England and Pooley, 2009; ALS Ammtec, 2012a; Schoneveld, 2013).

There is limited outcrop at Nolans Bore with most of the area covered by a thin veneer of soil and alluvium up to around four metres thick. Systematic drilling of the site indicates the widespread presence of Nolans Bore-type mineralisation, with steeply dipping veins up to tens of metres in thickness and hundreds of metres in length, extending below 250 metres drilled depth across large parts of the deposit. The full extent of the deposit is yet to be outlined but deeper drilling has demonstrated mineralisation and alteration extends down to at least 430 metres below surface in the CNZ.

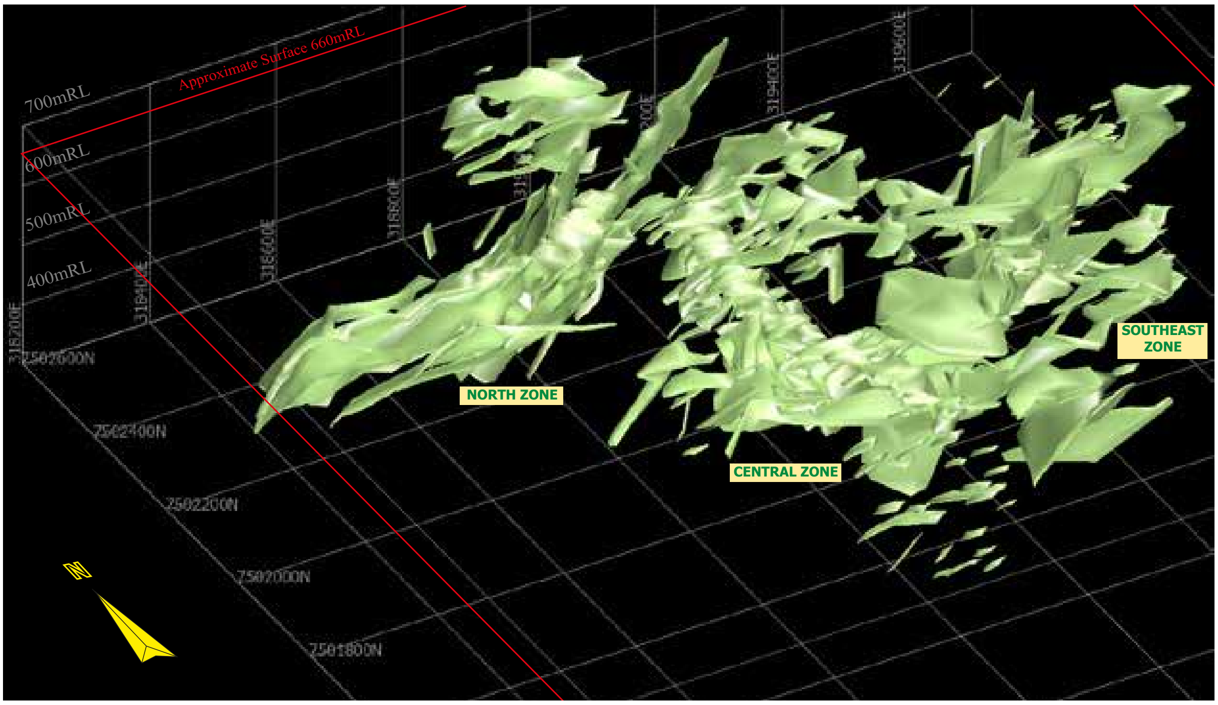
Nolans Bore is a three-dimensional, hydrothermal stockwork vein-style rare earths deposit (**Figures 3.1 and 3.2**). The mineralisation and associated alteration are hosted by metamorphosed Palaeoproterozoic igneous and sedimentary rocks. Large intrusive bodies of coarse-grained to pegmatitic granitoid (herein referred to as 'pegmatite') also form a major component of the host country rocks. Their distribution and geometry is a key consideration in developing a geological model for the resource.

The mineralisation and its associated alteration are geologically and radiometrically distinct from the country rocks at Nolans Bore. The mineralisation and alteration tends to be various shades of brown, cream, green and white and markedly contrast with the relatively uniform grey, black, white and pink of the quartzofeldspathic country rocks. Apatite is the most abundant REE-bearing mineral species identified at Nolans Bore, followed by allanite.

Two broad styles of REE-bearing mineralisation have been outlined at Nolans Bore. 'Apatite style' mineralisation ranges from discrete narrow fine-grained veins to wide intervals of massive coarse-grained breccias. These apatite-rich rocks comprise up to about 95% apatite and typically contain abundant mineral inclusions of REE-bearing minerals such as monazite group minerals (herein referred to as 'monazite'), allanite, thorite and numerous other REE phosphates, silicates and carbonates. This mineralisation style is largely deficient in calcsilicate minerals although narrow calcsilicate alteration zones can occur along the margins of these apatite veins. The apatite itself contains variable amounts of REE but a higher proportion of REE are hosted in the mineral inclusions.

The other mineralisation style is the geologically and mineralogically more complex 'calcsilicate style', best expressed and most prominent in the Central Zone ("CZ") of the deposit but also found in the North Zone. Calcsilicate mineralisation tends to be lower grade than the apatite style, and is typically dominated by apatite, allanite, epidote, amphibole and pyroxene. This mineralisation style occurs as prominent veins and as infill associated with apatite-allanite-amphibole breccias, and is typically flanked by extensive epidote-rich calcsilicate alteration. In contrast to the apatite style, most of the REE in the calcsilicate style are hosted by allanite and allanitic epidote with REE carbonates, monazite, cerium silicates, crandallites and apatite hosting the remainder of the REE.

Figure 3.2: Isometric View of Nolans Bore Resource



Key geochemical features of the Nolans Bore deposit include elevated calcium, phosphorus, REE, thorium, uranium, strontium, yttrium and fluorine, and low high-field strength elements such as niobium and zirconium. The mineralisation shows a strongly fractionated light REE ("LREE")-enriched chondrite-normalised REE pattern that, despite variations in mineralogy and the degree of weathering, is remarkably consistent throughout the deposit. The REE patterns also highlight that Nolans Bore is relatively more enriched in praseodymium, neodymium, samarium and europium than most other LREE-enriched deposits.

3.3 MATERIAL CLASSIFICATION

Arafura has developed an advanced understanding of the mineralisation at Nolans Bore through the quantum, distribution and analysis of its diamond core drilling (Table 3.1), and the completion of detailed mineralogical and beneficiation testwork programs as outlined in Section 5.2 (BENEFICIATION TESTWORK).

3.3.1 MINERALISATION

The two broad styles of mineralisation (see Section 3.2 DEPOSIT GEOLOGY AND MINERALISATION) are further subdivided into six material type categories based on geological and mineralogical characteristics, and metallurgical performance (Arafura, 2013a; **Table 3.2** and **Figure 3.3**). This subdivision provides the means to selectively mine and preferentially process the best performing material early in the life of the operation, while deferring the lesser performing material types in mine scheduling.

▲ Table 3.2: Nolans Bore Material Types

Style	Material Type	Description	Proportion
Apatite MT123	1	Cream/green apatite	17%
	2	Brown apatite	7%
	3	Brown apatite with kaolin and/or clay	21%
Calcsilicate MT456	4	Apatite and allanite	9%
	5	Apatite, allanite and calcsilicate	44%
	6	Apatite, allanite and calcsilicate with kaolin and/or clay	2%

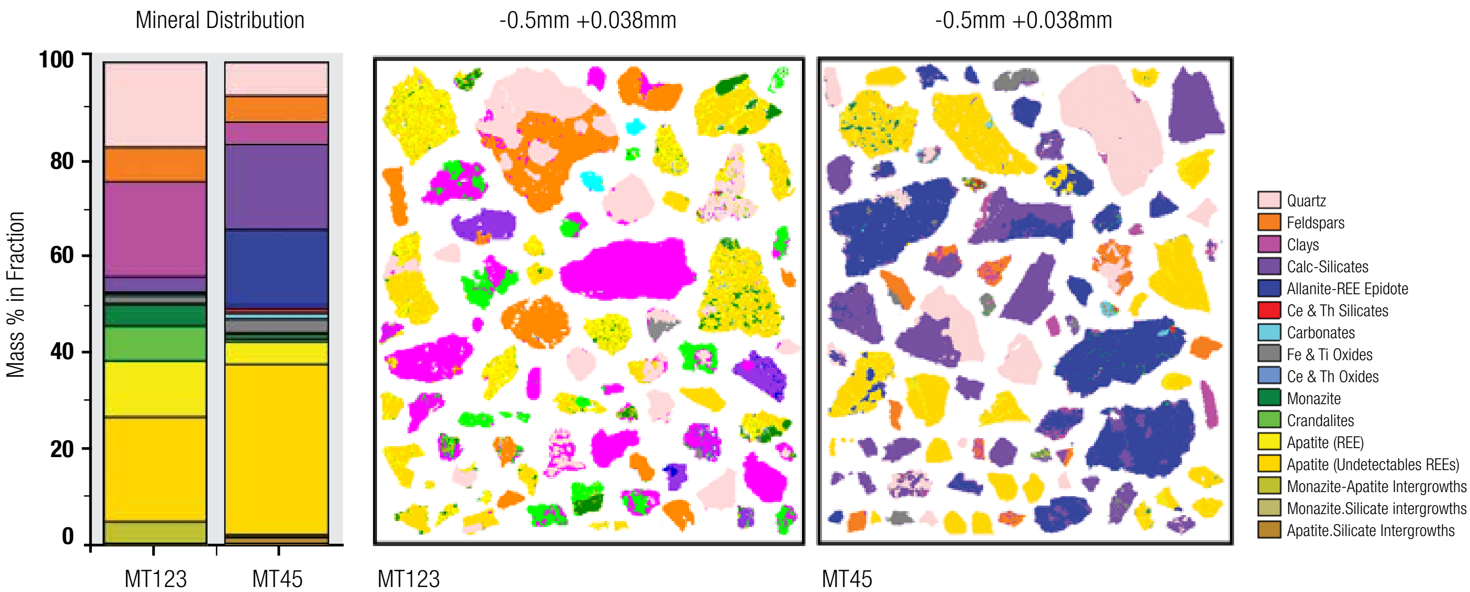
▼ Figure 3.3: Nolans Bore Material Types (1 top – 6 bottom).

Intervals shown grade from 3.1% to 8.0% REO.

The mineralogical contrast between the apatite and calcsilicate mineralisation styles is highlighted in **Figure 3.4**.

▼ Figure 3.4: QEMSCAN mineralogy (ALS Ammtec, 2012b) of Nolans Bore Material Type composites prepared for metallurgical testwork.

Composites shown grade 4.1% and 3.9% REO respectively



3.3.2 WASTE ROCK

In addition to the material types identified in **Table 3.2** and **Figure 3.3**, Arafura is in the process of developing a number of waste rock material types. Factors used to classify these material types include the level of radioactivity and whether the rocks are fissile, blocky, clayey, oxidised or fresh. The volumes of the identified waste rock material types to be extracted during mining will be modelled and some material types may ultimately be merged into broader categories.

Waste rock characterisation will be used to assist mine planning and scheduling, and the design, environmental management and rehabilitation of waste rock storage. The Company regards this process as an integral step towards mining, as all naturally occurring radioactive material ("NORM") that exceeds 1 Bq/g must be identified and managed once it is mined.

Modelled waste rock blocks that have radioactivity levels of 1-5 Bq/g will be assigned to a low-level radioactive NORM material type. The upper limit for this material type broadly equates to the highest level of radioactivity identified in the surrounding region. All waste rock blocks that exceed 5 Bq/g will be assigned to a separate more strongly radioactive NORM material type. A preliminary assessment of the Company's geological database indicates that zones of mineralisation and alteration excluded from Mineral Resources and parts of the pegmatite are likely to fall into these categories; however volumes and dilution are being considered in the block model and estimation process.

3.4 HYDROGEOLOGY

A hydrogeological investigation of the proposed Nolans Bore Mine site was completed in 2010-11 in order to estimate dewatering requirements during mine operations (Environmental Earth Sciences, 2011).

The hydraulic properties of the aquifer at Nolans Bore were estimated and consequent dewatering predictions made, resulting in a simple dewatering design involving either abstraction from wells within the mineralised zone and/or in-pit sump pumps.

Outcomes of the investigations include:

- the Nolans Bore aquifer generally corresponds to the mineralisation and in places is highly porous with the surrounding rocks having a much lower permeability;
- the combination of high permeability and limited area extent of the aquifer is beneficial for dewatering; and
- the impact of dewatering on downstream resources such as the Woodforde River and western Ti Tree Basin should be insignificant, other than for a potential increase in discharge to Kerosene Camp Creek if abstracted groundwater is not used on-site and is suitable for release.

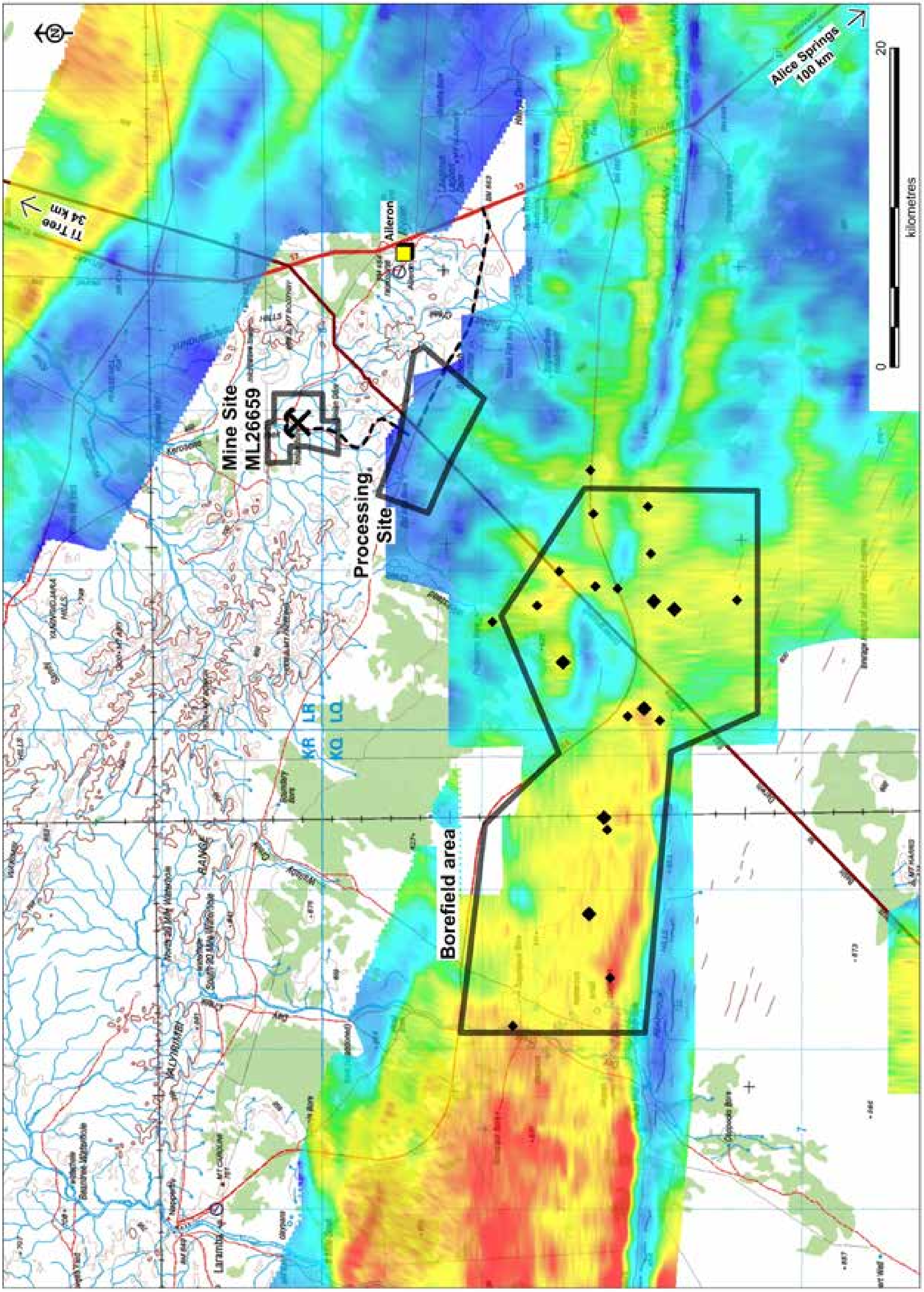
Hydrological investigations to identify a sustainable water supply for the life of Project have focussed on potential groundwater supplies in the Cainozoic basins within about forty kilometres of Nolans Bore. Arafura's initial efforts commenced in 2010/11 and were concentrated in the well documented Ti Tree Basin aquifers to the northeast of the Nolans Mine Site. However, for a number of reasons Arafura shifted its attention towards exploring the groundwater potential of the inferred aquifers in the concealed and poorly constrained northern Burt and eastern Whitcherry basins (herein referred to as the "Southern basins") to the southwest of the Mine Site.

Arafura completed an exploratory (Stage 1) water drilling program in the Southern basins in late 2012. This exploration program was successful in encountering groundwater in all exploration bores, including two bores in a high yielding thick sandstone aquifer. Generally, the water table is shallow, around 20 metres below surface and groundwater quality better than expected.

Since Stage 1 drilling, modelling of all available regional geophysical and geological data has been completed to better document and understand the Southern basins and guide Stage 2 water exploration activities. Research has shown that historic water bore and exploration drilling in the Whitcherry Basin about 30-50 kilometres to the west of Arafura's Stage 1 drilling intersected similar stratigraphic units indicating potential for a widespread, laterally persistent aquifer at depth. This work suggests that the basin has a series of deep palaeochannel feeders and that it appears to deepen and widen towards the west (**Figure 3.5**).

Figure 3.5: Regional groundwater investigations in the Southern basins area south-west of the Nolans Mine Site

Hotter colours in the airborne electromagnetic image indicate the possible extent of buried aquifers and associated palaeochannels. Arafura's Stage 1 and 2 water bores are shown as black diamonds, with the larger diamonds being production bores.



Stage 2 drilling during May-June 2014 comprised further targeted drilling in the Southern basins, including drilling through the entire Cainozoic sequence into the underlying basement units. All bores drilled to date have intersected ground water with air lift yields greater than 30 l/s in most holes (**Figure 3.6**). A second small supplemental drilling program is planned for the latter part of 2014 together with controlled pump testing of production bores sited in the best aquifers, dispersed across the entire area. The Stage 2 program has provided a greater understanding of the basin's aquifer structure, its quality and behaviour, and more precise measurement of the potential storage volumes and sustainable yields.

The Company is confident that, on the basis of its exploration and ongoing investigative drilling program, it has successfully defined a sustainable supply of water from the Southern basins for the life of Nolans Project.

▼ **Figure 3.6: Groundwater Drilling in the Southern basins**

3.5 MINERAL RESOURCES

Estimates of Mineral Resources for Nolans Bore were prepared and reported on four occasions during 2001-2009 (Exploremin, 2001; 2005; 2006; 2009).

In 2012 Arafura commissioned AMC Consultants Pty Ltd ("AMC") to provide an updated estimate of Mineral Resources incorporating the results of all drilling and costeaning activity undertaken at the Nolans Bore site during 2000-2011 (**Table 3.1**). AMC was provided with a comprehensive database comprising assay, geology, collar, radiometric, survey and density records (**Table 3.3**) and a report detailing Arafura's data collection and validation procedures, and QA/QC protocols (Arafura, 2012b).

▲ **Table 3.3: Input Data to Nolans Bore Resource Estimate**

Data Type	Number of Records
Assay	29,066
Geology	17,767
Collar	1,176
Radiometric	79,969
Survey	6,697
Density	16,456

AMC worked closely with Arafura to construct a wireframed geological interpretation of the deposit and used this to subset the drillhole data and create a volume block model. As the drillhole spacing varies across the deposit (see **Figure 3.1**), two separate prototypes were adopted. The north prototype (corresponding to the CNZ) had a parent cell size of 12.5 metres in easting and northing dimensions (X and Y respectively) and 5 metres in elevation (Z). The south prototype (corresponding to the Central and Southeast zones) had a larger parent cell size of 25 metres in X and Y and 5 metres in Z. The block model origins were set at 318060 mE, 7501000 mN and 320 mRL. The current land surface is around 660 m RL. The number of parent cells in X, Y and Z was set to 142 x 134 x 76 or 71 x 67 x 76 for the north and south prototypes, respectively.

Interpreted wireframes were grouped into eight numerically coded divisions defined by position, geological interpretation, and oxidation state. The raw drillhole data was subset by interpreted wireframes for mineralisation and waste. After validation, the assay samples were composited into two metre equal-length samples for statistical studies. This analysis indicated that no top-cuts were necessary for the primary elements of interest, REE%, P% and U%. Each coded division had different estimation, search, and variogram parameters to allow for independent estimation. Estimation of grade was completed in two stages, with REE%, P%, and U% estimated first, and the individual REEs in the second stage.

Grades for the mineralised domains were estimated using ordinary kriging, whilst the background and waste domains used inverse distance squared. Each estimate used a three pass approach, where model cells without a grade estimate in the first pass went through a second pass, and likewise for a third pass if necessary. Each successive pass saw the search ellipse dimensions being multiplied by factors of 2.5 and 4 respectively. The minimum number of samples for the first pass was ten, with the maxima being from 25 to 35. The minimum number of samples allowed for the third pass was two.

Generally the variograms were modelled to represent continuity along the strike of the interpreted wireframed domains and the search ellipse directions reflected this. Cell discretisation was set to 5x5x3 points in the cell X, Y, and Z directions respectively. Where grades were kriged, negative kriging weights were allowed and a maximum of six samples were allowed to be used from any one drillhole.

Arafura provided AMC with drillhole intersections coded for 5-metre averaged material type within the wireframed objects and they were estimated into the resource model using nearest neighbour estimation. Drillhole data was constrained by the mineralisation wireframe in which a drillhole fell and search ellipse orientations mirrored those used for grade estimation. The same parent cell protocol was used as in grade estimation with the more closely drilled northern part of the model estimated into smaller parent cells.

Density data was provided as both drill core measurements and down-hole geophysical readings. These showed very close correlation and were combined to produce the density values assigned to the block model. The density data in each wireframed object was averaged separately and split on oxidation state boundaries to populate the wireframed objects in the volume model with density data.

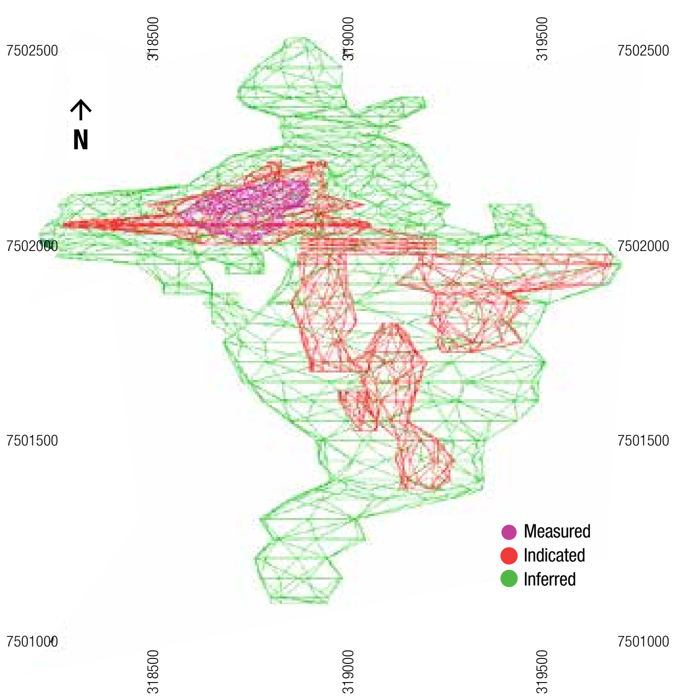
Mineral Resources for Nolans Bore were estimated, classified and reported following the guidelines of the JORC Code 2004 (AMC Consultants, 2012a; Arafura, 2012c, d). The drillhole spacing, number of the estimation pass, number of samples used in the estimate, and the local continuity apparent from the geology, the interpretation and the variography were all considered in the resource classification. Higher confidence Measured and Indicated resources account for 54% of the total in-situ resources of REO at Nolans Bore (**Table 3.4** and **Figure 3.7**).

Table 3.4: Nolans Bore Mineral Resources

Resources	Tonnes million	Rare Earths REO %	Tonnes REO	Phosphate P_2O_5 %	Tonnes P_2O_5	Uranium U_3O_8 lb/t	Tonnes U_3O_8
Measured	4.3	3.3	144,000	13	572,000	0.57	1,120
Indicated	21	2.6	563,000	12	2,610,000	0.42	4,090
Inferred	22	2.4	511,000	10	2,220,000	0.37	3,610
TOTAL	**47**	**2.6**	**1,217,000**	**11**	**5,410,000**	**0.41**	**8,830**

1% REO cut-off grade. Numbers may not compute exactly due to rounding.

Figure 3.7: Nolans Bore Resource Classification Wireframes



Arafura is in the process of developing a volume block model for waste rocks at Nolans Bore. The extension of the block model to include waste rocks (in addition to Mineral Resources) builds on the differentiation of new waste rock material types (see Section 3.3.2 WASTE ROCK) and includes the estimation of uranium and thorium grades for all waste rocks. This waste rock block model will encompass low-grade mineralisation and alteration and localised narrow zones of high-grade mineralisation that has been excluded from the Mineral Resources.

3.6 RARE EARTHS COMPOSITION

The average in-situ REO composition for each resource category is shown in Table 3.5. The neodymium content of Nolans Bore is amongst the highest of any rare earths resource currently being considered for development anywhere in the world.

Table 3.6 outlines the in-situ REO composition of each of the six material types, aggregated by Arafura's REO product range.

▲ Table 3.5: Nolans Bore REO Composition

Rare Earth Oxide REO	Average In-situ Composition			
	Measured Resources	Indicated Resources	Inferred Resources	Total Resources
Lanthanum as La_2O_3	19.3%	19.0%	19.2%	19.1%
Cerium as CeO_2	48.7%	48.7%	48.7%	48.7%
Praseodymium as Pr_6O_{11}	5.9%	6.0%	5.9%	5.9%
Neodymium as Nd_2O_3	20.4%	20.7%	20.5%	20.6%
Samarium as Sm_2O_3	2.3%	2.3%	2.3%	2.3%
Europium as Eu_2O_3	0.39%	0.39%	0.39%	0.39%
Gadolinium as Gd_2O_3	0.96%	0.98%	1.01%	0.99%
Terbium as Tb_4O_7	0.07%	0.08%	0.09%	0.08%
Dysprosium as Dy_2O_3	0.33%	0.31%	0.32%	0.32%
Holmium as Ho_2O_3	0.05%	0.04%	0.04%	0.04%
Erbium as Er_2O_3	0.08%	0.09%	0.10%	0.09%
Thulium as Tm_2O_3	0.01%	0.01%	0.01%	0.01%
Ytterbium as Yb_2O_3	0.06%	0.05%	0.06%	0.06%
Lutetium as Lu_2O_3	0.01%	0.01%	0.01%	0.01%
Yttrium as Y_2O_3	1.47%	1.31%	1.36%	1.35%

Numbers may not compute exactly due to rounding

▲ Table 3.6: Nolans Bore REO Composition by Material Type

Materal Type	Tonnes million	Rare Earths REO %	Average In-situ Composition				
			NdPr Oxide	SEG Oxide	HRE Oxide	La Oxide	Ce Oxide
1	8	3.0	26.8%	3.7%	1.9%	18.9%	48.7%
2	3	3.2	26.5%	3.7%	2.0%	19.1%	48.8%
3	10	2.8	26.0%	3.6%	2.0%	19.6%	48.7%
4	4	2.7	26.8%	3.7%	1.9%	18.9%	48.6%
5	21	2.3	26.6%	3.7%	1.9%	19.1%	48.7%
6	1	2.5	26.6%	3.7%	1.9%	19.1%	48.7%
ALL	**47**	**2.6**	**26.5%**	**3.7%**	**2.0%**	**19.1%**	**48.7%**

1% REO cut-off grade. Numbers may not compute exactly due to rounding.

3.7 FORWARD WORK PLAN

The geology work program planned for the remainder of the definitive feasibility study ("DFS") includes the following:

- Ongoing waste rock characterisation and modelling;
- Continue sterilisation program, specifically targeting the Nolans Mine Site waste rock and tailings storage facility ("TSF") areas, and the Nolans Processing Site;
- Definition evaluation program for raw materials including carbonate resources; and
- A limited diamond core drilling program to allow detailed assessment of the stratigraphy of the Cainozoic aquifers and their hydrological characteristics.

Depending on the final Project Execution Plan ("PEP") and mining contractor mobilisation, additional work to be undertaken for the DFS may include:

- Drilling and modelling for grade control and production planning of initial ore exposure; and
- Development of the operational grade control system.

4 MINING

KEY FEATURES

- Numerous detailed mining studies have been undertaken by Arafura since 2007.
- Ore Reserves for the Nolans Project were estimated in 2012.
- The mining studies are well advanced in terms of a Definitive Feasibility Study and require updating when all modifying factors are finalised.
- Selective mining and knowledge of material types and their metallurgical performance along with reduced operating costs have improved pit optimisation outcomes and enhanced mine production schedules.

4.1 INTRODUCTION

Building on a significant body of detailed mine planning studies, undertaken since 2007 as part of various work programs including scoping, pre-feasibility and feasibility studies (Table 4.1), this Nolans Development Report summarises recent enhancements to the Nolans Project and the mining studies undertaken to support those enhancements.

This report also summarises further work required to complete the mining component of the Project to definitive feasibility study ("DFS") standard.

▲ Table 4.1: Timeline of Mining Studies and Work Programs

Year	Work Program or Study	Reference
2007	Scoping Study – mining, infrastructure and transport	GHD (2007)
	Bulk sampling program (costeaning)	Arafura (2008)
2009	Geotechnical sampling, laboratory testwork	SMG Consultants (2009)
2010	DFS-level study on Nolans including mine, concentrator, village, tailings disposal, concentrate and other by-products transport and logistics, water supply and management	Lycopodium (2010) AMC Consultants (2010a) AMC Consultants (2010b)
	Project value optimisation	Whittle Consulting (2011)
	Bulk sampling program (Bauer wide diameter drilling)	Arafura (2011a)
2011	Geotechnical drilling, sampling and testwork	Environmental Earth Sciences (2011) WA School of Mines (2011)
2012	Geotechnical rock mass characterisation and pit slope stability	AMC Consultants (2012b)
	Ore Reserves estimated[1]	AMC Consultants (2012c) AMC Consultants (2012d) AMC Consultants (2013a)
2013	Mining selectivity	AMC Consultants (2013b)
	Nolans Site location study	Lycopodium (2013)
	Bauer bulk sample representativity	AMC Consultants (2013c)
2014	Mining study update – pit optimisation and scheduling	AMC Consultants (2014)

[1] Ore Reserves were estimated for Nolans Bore by AMC and reported by Arafura on 11 December 2012 in accordance with the JORC Code 2004. Since that time the Company has materially changed some of the Modifying Factors that support these Ore Reserves. The Company expects there will be further changes to the Modifying Factors for the Nolans Project. A new estimate of Ore Reserves will be completed and reported in accordance with the JORC Code 2012 by the Company once further studies are complete.

Since the release of the August 2012 Base Case, work has included:

- Enhanced definition of mineralisation styles and material types. This has enabled development of selective mining and optimised process options; and
- Pit optimisation studies based on the updated project configuration. These have generated strategic production schedules that show:
  - REO production in excess of twenty-five years based on Measured and Indicated Resources and the proposed production profile; and
  - An indicative mine life of greater than forty years based on Measured, Indicated and Inferred Resources.

Mining studies carried out by Arafura have been undertaken by reputable Australian mining consultants. These studies have been completed to a high level of accuracy and precision which, when final modifying factors for processing, transport and logistics, environmental and social aspects are completed, will facilitate a short mining study to finalise mine designs, life of mine production schedules and re-estimation of Ore Reserves.

4.2 MINE PLANNING CRITERIA

4.2.1 OPTIMISATION SCENARIOS

Mineral Resources (Table 3.4) were estimated for Nolans Bore in 2012 (AMC Consultants, 2012a) and this resource model has been used as the basis for the following optimisation scenarios:

- Measured & Indicated ("M&I") Case: This evaluates the production schedule based on Measured and Indicated Resources; and
- Life of Mine ("LOM") Case: This evaluates the full potential of the Nolans Bore deposit and considers all resource classifications including Inferred Resources.

The results of the optimisation scenarios are shown in the following sections.

4.2.2 MINING METHOD, MINING LOSS AND DILUTION

After considering a number of factors including mine production schedule requirements and ore selectivity, the mining method selected for the Nolans Project is hydraulic excavator and trucks. Drilling and blasting will be required for both ore and waste, with no allowance made for any free dig material. All ore will be crushed at the beneficiation plant located at the mine. All mined waste will be stored in land forms outside the pit limits.

Mining method selection was based on qualitative analysis of various methods, with all other methods excluded as being unsuited to Nolans due to the style of mineralisation, material characteristics, or other operational considerations (AMC Consultants, 2010a). The truck and excavator mining method formed the basis of the assumptions applied in mining selectivity, dilution studies and mining cost estimates and was selected for the following reasons:

- A high degree of ore selectivity and blending is achievable;
- It is cost effective and often the lowest cost option;
- A high degree of operational flexibility is possible, particularly for multiple pit stages for Nolans and the bench geometry associated with nested pit stages;
- It is a low capital cost option;
- It has a proven track record and is perceived as low risk by mining contractors; and
- Arafura has a preference for contractor mining.

The equipment selected for the selective mining was 90 tonne rear dump trucks loaded by 110 tonne hydraulic excavators.

Diluted block models were used for all mine planning in this Development Report. In both the M&I and LOM cases, the diluted resource models were re-blocked to a block size of 3.125 mN x 3.125 mE x 2.5 mRL to introduce ore loss and dilution to the model. The selective mining units were considered appropriate for the size of the selected equipment. The amount of ore loss and dilution is shown graphically on a typical section for the M&I Case in **Figure 4.1**.

Overall, this resulted in 11.4% dilution and 0.1% mining loss for the M&I Case and 15.7% dilution and 0.2% mining loss for the LOM case (AMC Consultants, 2014; **Tables 4.2** and **4.3**).

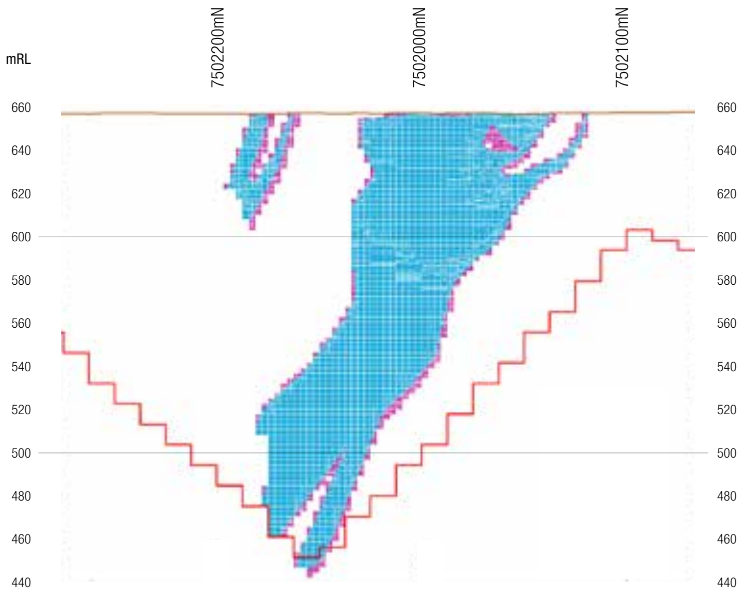
Table 4.2: Mining Loss and Dilution – M&I Case (RF 1.0 Pit)

Item	Unit	Resource	REO	U_3O_8	P_2O_5
Resource Model	kt	25,738.8	707.2	5.2	3,189.4
Mining Loss	kt	26.3	0.5	0.0	2.4
Dilution	kt	2,922.6	-	-	-
Diluted Model	kt	28,635.1	706.7	5.2	3,187.1
Resource Model	%	100.0	100.0	100.0	100.0
Mining Loss	%	0.1	0.1	0.1	0.1
Dilution	%	11.4	-	-	-
Diluted Model	%	111.3	99.9	99.9	99.9

▲ Table 4.3: Mining Loss and Dilution – LOM Case (RF 1.0 Pit)

Item	Unit	Resource	REO	U_3O_8	P_2O_5
Resource Model	kt	47,298.3	1,216.4	8.8	5,406.4
Mining Loss	kt	86.7	1.6	0.0	7.0
Dilution	kt	7,426.8	-	-	-
Diluted Model	kt	54,638.4	1,214.8	8.8	5,399.4
Resource Model	%	100.0	100.0	100.0	100.0
Mining Loss	%	0.2	0.1	0.1	0.1
Dilution	%	15.7	-	-	-
Diluted Model	%	115.5	99.9	99.9	99.9

▼ Figure 4.1: Impact of Dilution and Mining Loss – M&I Case Section View 318800 mE, North Zone Optimised Pit Shell



Mining Loss / Dilution

- Resource Mined
- Waste
- Mining Loss
- Mining Dilution
- Natural Surface
- Pit Shell (M&I RF1)

4.2.3 GEOTECHNICAL

The 2011 Nolans Bore drilling campaign (**Table 3.1**) included 2,477 metres of geotechnical drilling in fifteen dedicated diamond core holes. This was followed by a comprehensive program of geotechnical core logging, data collection and analyses and laboratory testing. The results of this work were used to assess the rock mass strengths and carry out slope stability analyses.

The 2011 geotechnical drilling program was designed around the 2010 ultimate pit design. However, revised optimisation inputs and additional resource drilling since 2010 resulted in a significantly larger (and deeper) resource and, as a result, significantly larger pit shells which extend beyond and below the coverage of the 2011 geotechnical drilling program. To compensate for the limited geotechnical information in the vicinity of the expanded pit limits, a conservative factor of safety ("FOS") was adopted in the slope stability analysis.

By increasing the FOS, no additional drilling is required for the DFS, and mining could commence based on the pit slope angles shown in **Table 4.4**. However, additional drilling may provide some benefit by reducing the FOS potentially allowing steepening of the pit walls, reducing stripping ratio and improving project economics.

Geotechnical inputs, including pit slope parameters, have been developed for pit optimisations and pit design (**Table 4.4**). The locations of the geotechnical domains are shown schematically in **Figure 4.3**.

▲ Table 4.4: Pit Slope Angles for Optimisation

Geotechnical Domain	Maximum Overall Slope Angle Degrees	Pit Optimisation Slope Angle[2] Degrees
1	44.9	38.6
2	48.5	42.0
3	36.1	30.8
4	51.2	45.5
5	35.9	30.9
6	50.7	44.4
7	50.7	48.7

[2] Allowances made for access ramps and optimisation slope errors.

4.2.4 SELECTIVE MINING

The recently developed understanding of Nolans Bore mineralogical and metallurgical material types (see Sections 3.2 DEPOSIT GEOLOGY AND MINERALISATION and 3.3 MATERIAL CLASSIFICATION).

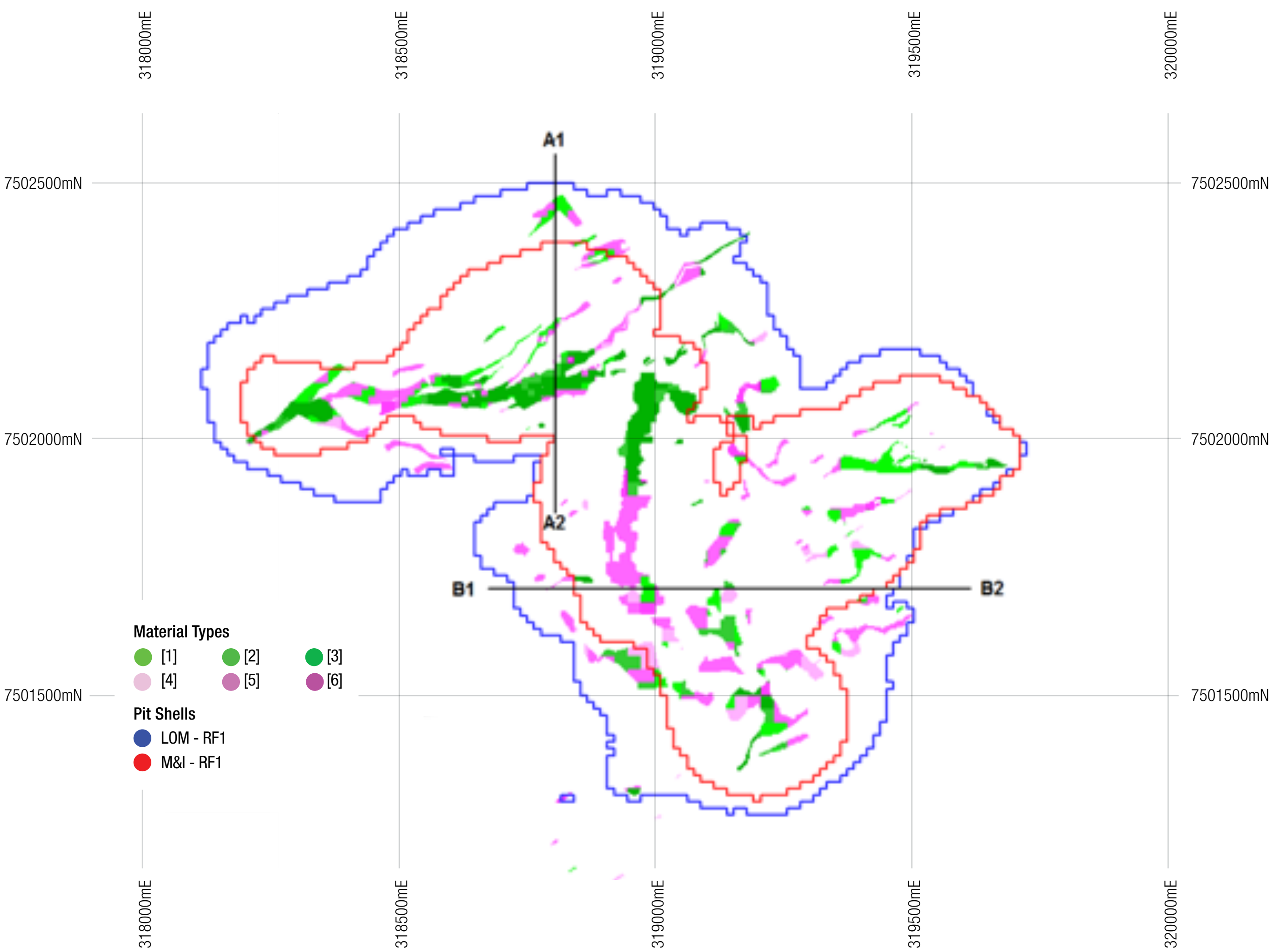
Arafura commissioned a selective mining study (AMC Consultants, 2013b) to assess:

- Mining selectivity – to determine whether material types 1, 2 and 3 (MT123) and material types 4, 5 and 6 (MT456) could be mined selectively; and
- Mining schedule – to determine if workable mining and processing schedules were achievable involving deferral of MT456 to the beneficiation plant or the campaign treatment of the two material types.

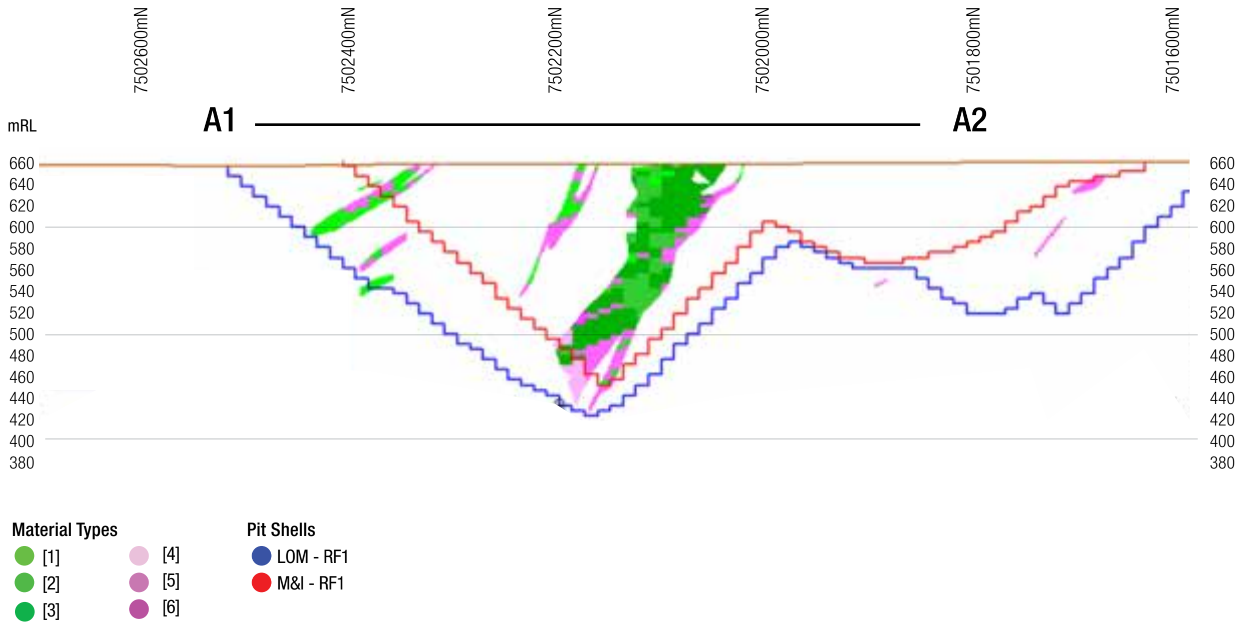
Figure 4.2 highlights the large contiguous bodies of the two mineralisation styles at Nolans Bore.

Figure 4.2: Material Types and Pit Shells at Nolans Bore

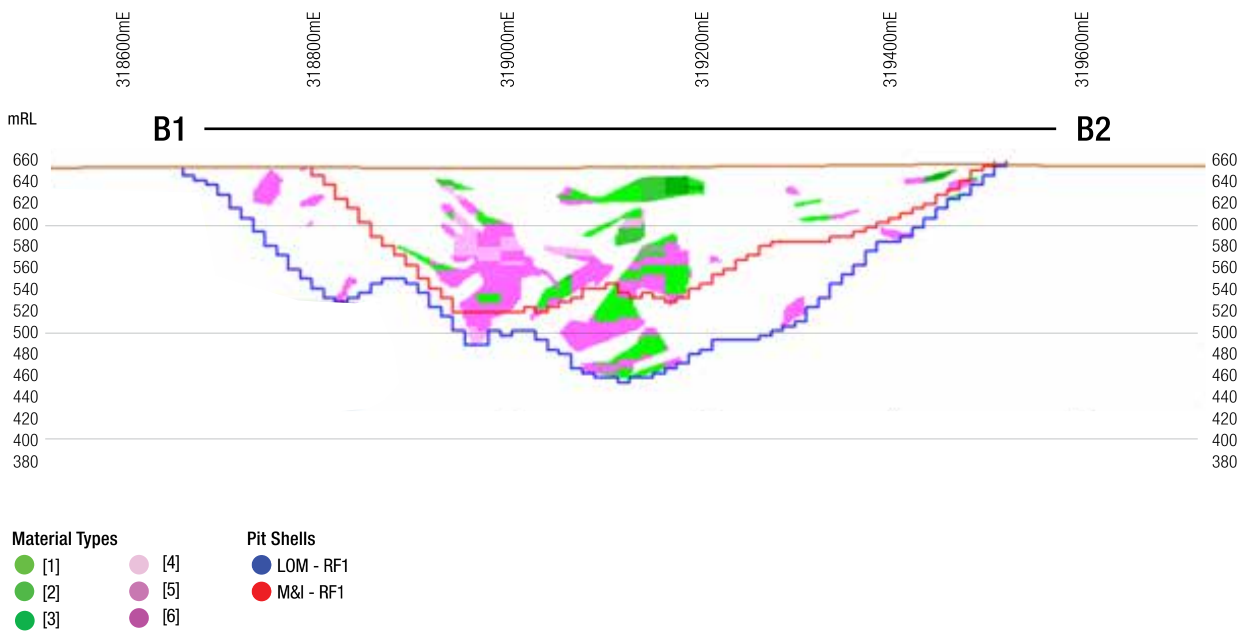
Plan View 600mRL



Section View 318800mE (A1-A2)



Section View 7501700mN (B1-B2)



4.3 MINE DESIGN

The outcomes of the selective mining study were as follows:

- Zones of MT123 and MT456 are widespread with little intermingling of the two ore categories;
- Ore can be selectively mined at Nolans using the selected equipment when categorised into two groups, MT123 and MT456;
- Appropriate selectivity can be achieved using excavators in the 110 tonne class size. These size excavators were selected in previous mining studies, including the estimate of Ore Reserves in 2012 (AMC Consultants, 2012d); and
- REO production rates of 20,000 tpa are achievable when beneficiation of MT456 is deferred for the first five years of processing, including the ramp-up period whilst limiting stockpile size to 4 Mt.

4.3.1 PIT OPTIMISATION

A series of pit optimisations using Whittle Four X software was completed (AMC Consultants, 2014) using the key parameters summarised in Table 4.5. These are compared with the parameters that were selected in estimating Ore Reserves in 2012.

▲ Table 4.5: Optimisation Parameters

Parameter	Unit	Current	2012 Ore Reserves
Metal Prices REO Uranium Phosphate	US$/kg	US$43.01 - -	US$71.60 US$106.00 -
Exchange Rate	A$:US$	0.85	1.00
Discount Rate	%	10	10
Processing, Admin and Ore Costs	A$/t processed	$274	$470
Mining Costs	A$/t mined	$5.60	$5.60
Total REO Recovery[3]	%	85	61
Diluted Resource Model	-	Yes	Yes
Selective Mining by Material Type	-	Yes	No
Concentrator Throughput	Mtpa	0.75 (Yr 1-7) 1.1 (Yr 8+)	1.1
Mining Rate Limit	Mtpa	10	15
Mining Vertical Advance Rate	m	30	30
ROM Stockpile Limit	Mt	4.0	4.0
Rail Limit	kt	-	483

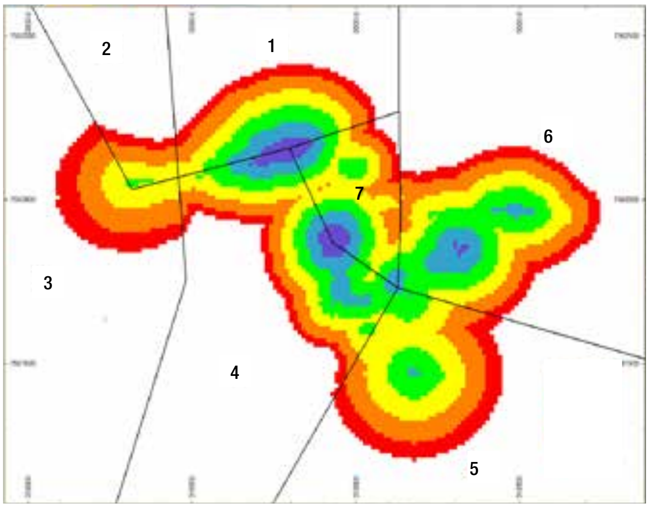
[3] Variable Concentrator metallurgical recovery based on the material type and P_2O_5 grade in the concentrator feed and average metallurgical recovery of 91.9% for REO for the RE Intermediate and RE Separation plants combined.

The enhanced processing performance and improved processing, administration and logistics costs have resulted in reduced cut-off grades when compared to the 2012 Ore Reserves pit optimisations. Although not markedly different in quantities in the optimum pits generated, the overall value is higher due to a lower strip ratio as material previously mined as waste is now converted to profitable mineralisation and becomes plant feed.

4.3.2 PIT DESIGN

The pit optimisation software produced a series of pit shells for both the M&I and LOM cases. Pit shell selection was carried out to make allowance for minimum mining width considerations and to determine optimum pit staging and mine scheduling. Seven pit stages were selected for mine scheduling for both the M&I and LOM optimisation scenarios (**Figure 4.3**). Detailed pit designs will be finalised when final pit optimisations are completed as part of the DFS.

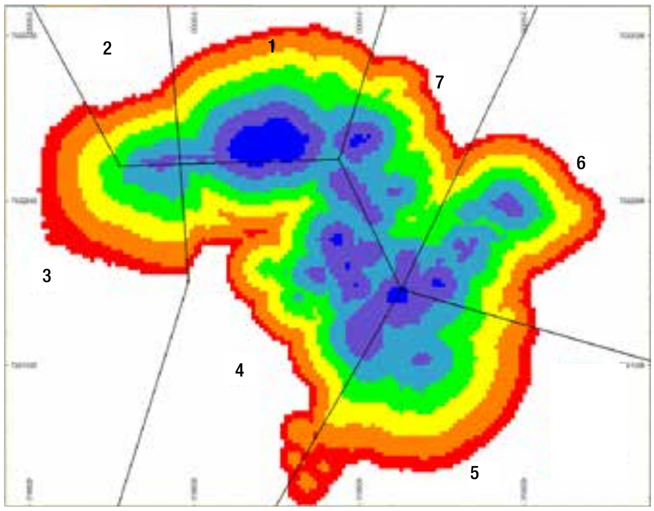
M&I Case



Elevation (mRL)

[FLOOR,435] [435,475] [475,515] [515,555] [555,595] [595,635] [635,CEILING]

LOM Case

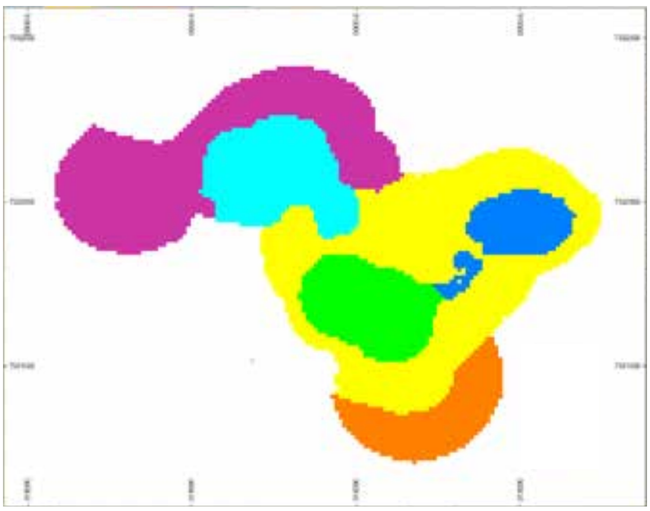


Elevation (mRL)

[FLOOR,435] [435,475] [475,515] [515,555] [555,595] [595,635] [635,CEILING]

▼ Figure 4.3: Pit Shells showing Geotechnical Domains 1-7 (above) and Scheduling Stages (below)

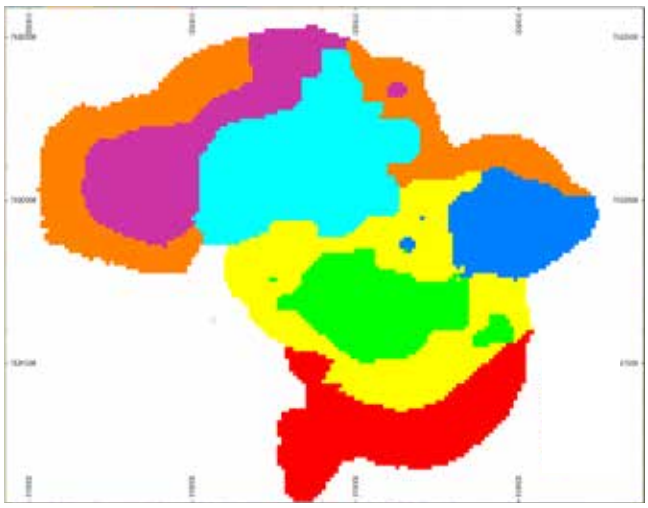
M&I Case



Stage

[1] [2] [3] [4] [5] [6]

LOM Case



Stage

[1] [2] [3] [4] [5] [6] [7]

4.3.3 PRODUCTION SCHEDULES

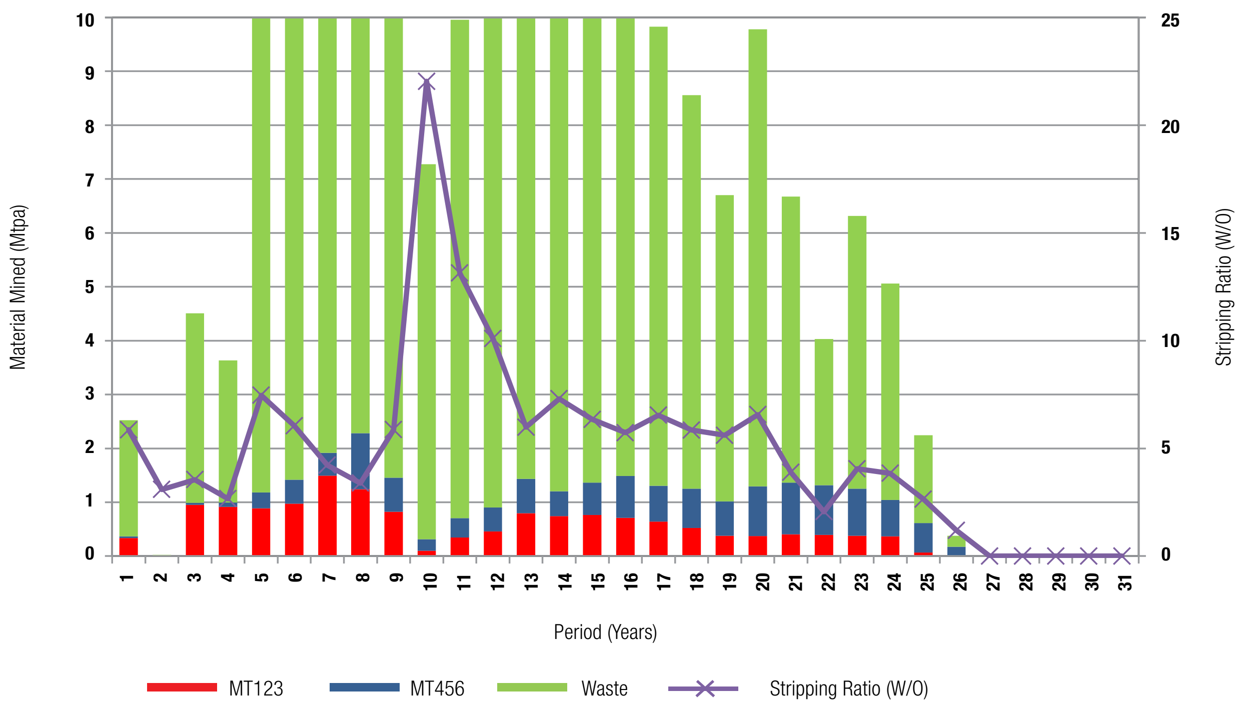
Mine production schedules were generated from the pit optimisation shells based on a philosophy of selective mining and processing where MT456 is initially deferred, in preference for MT123 and a high grading strategy, whereby lower grade plant feed is initially stockpiled in preference to the processing of higher grade plant feed.

The strategic mining schedule for the M&I optimisation scenario is based on a maximum overall mining rate of 10 Mtpa as shown in **Figure 4.4**. Pre-stripping commences in Year 1 and provides waste for TSF and ROM pad construction and sufficient plant feed for plant start-up and commissioning which commences in Year 2. The mining rate is scaled back in Year 2 as sufficient plant feed is generated in Year 1.

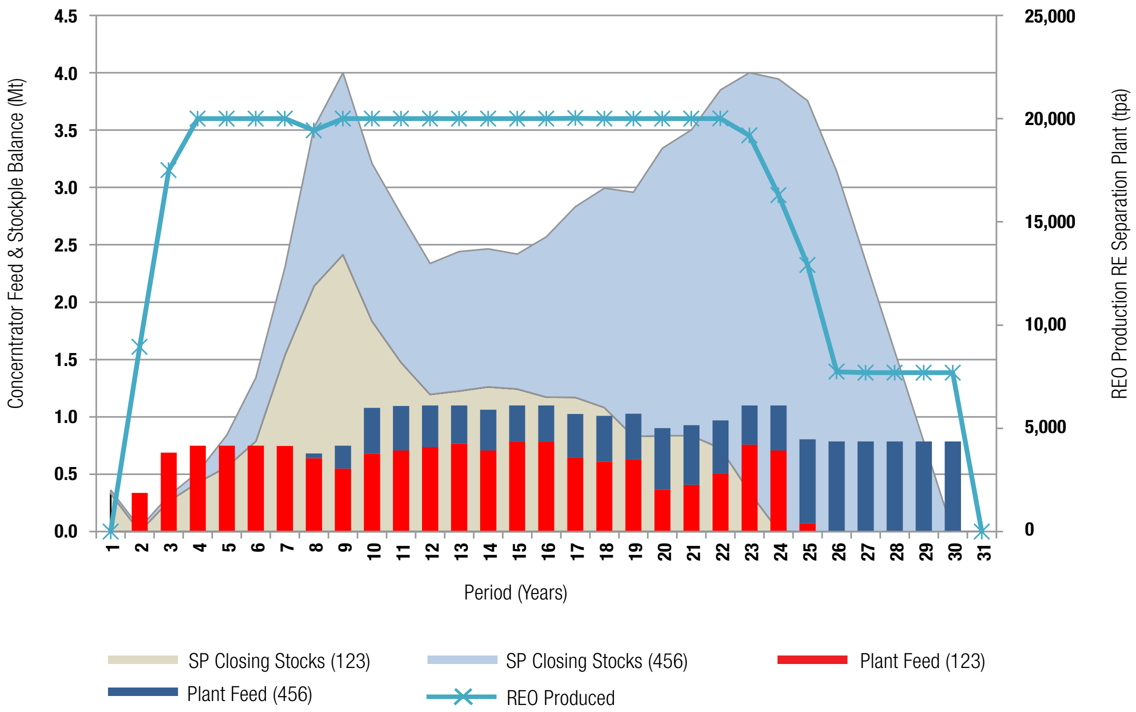
The selective mining and stockpiling strategy results in the plant feed and stockpile profiles and REO production as shown in **Figure 4.5**.

The LOM case production schedule is also based on a maximum overall mining rate of 10 Mtpa (**Figure 4.6**) to produce an average of 1.0 million tonnes of plant feed each year, resulting in an indicative mine life of around forty years (**Figure 4.7**).

Figure 4.4: Mine Production Schedule – Material Mined – M&I Case



▼ **Figure 4.5: Plant Feed, Stockpiling and REO Production – M&I Case**



▼ **Figure 4.6: Mine Production Schedule – Material Mined – LOM Case**

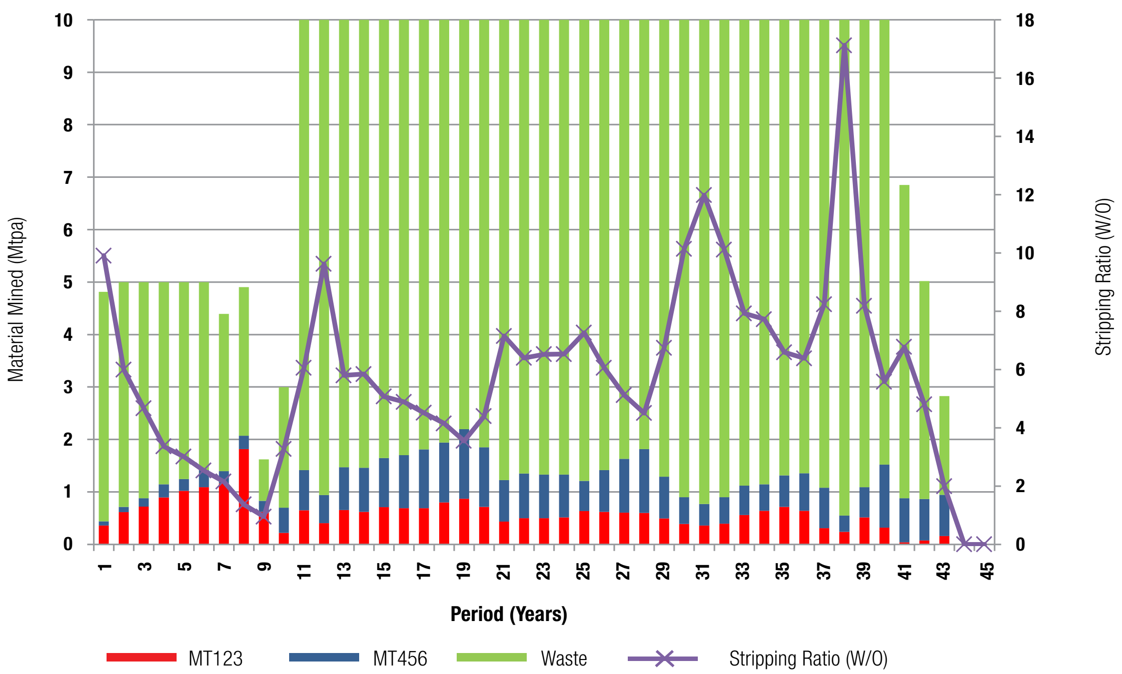
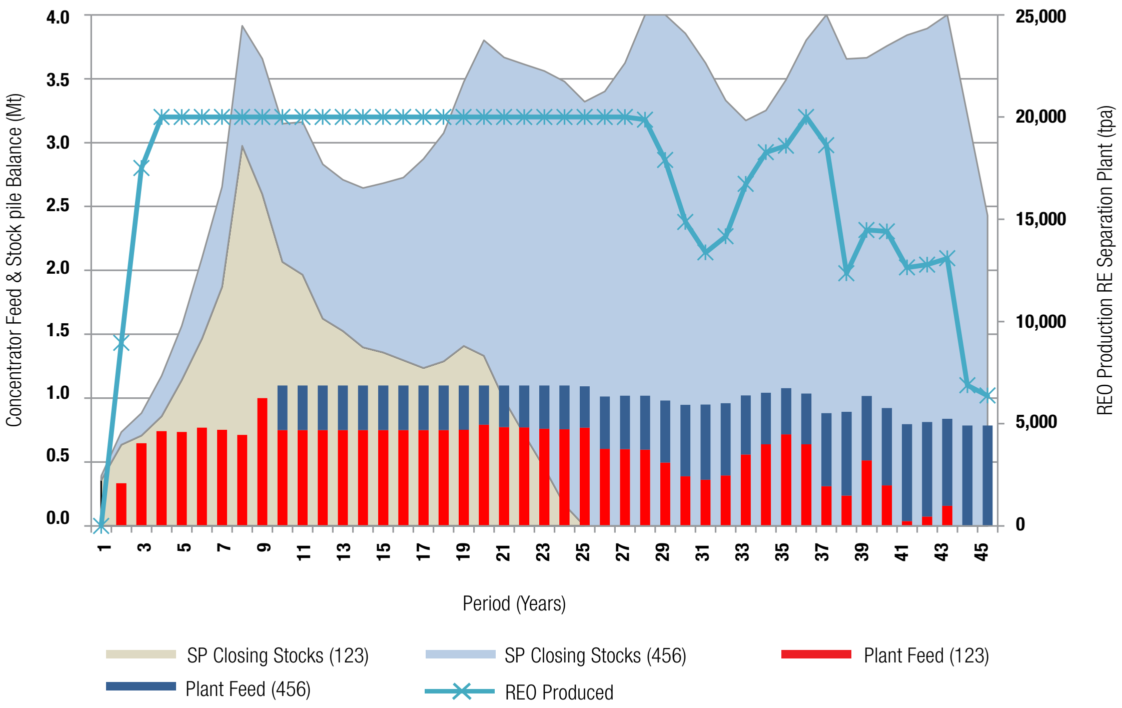


Figure 4.7: Plant Feed, Stockpiling and REO Production – LOM Case



4.4 CAPITAL AND OPERATING COSTS

The 2012 Ore Reserves mining capital and operating costs have also been used (un-escalated) in this pit optimisation and scheduling study. Mining capital costs are summarised in Table 4.6.

Operating costs were estimated from first principles for the 2012 Ore Reserves using in-house estimating software and databases (AMC Consultants, 2013a). The mining unit costs by activity and cost element are summarised in **Table 4.7** and **Table 4.8**.

Table 4.6: Mining Capital Costs
(no contingency)

Capital & Replacement	Establishment A$m	Production A$m	TOTAL A$m
EPCM	0.2	-	0.2
Contractor Mob/Demob	3.0	0.5	3.5
Miscellaneous Equipment[4]	2.1	2.3	4.4
Technical Equipment[5]	1.3	0.9	2.2
TOTAL	**6.6**	**3.7**	**10.3**

Table 4.7: Mining Unit Cost by Activity
(over entire material movement)

Activity	Cost A$/t
Load and Haul	$2.27
Drill and Blast	$1.38
Grade Control	$0.05
Ancillary	$1.02
Crusher Feed Rehandle	$0.22
Management and Supervision	$0.62
Miscellaneous Operational Overheads	$0.18
Clearing and Topsoil Harvesting	$0.03
TOTAL	**$5.78[6]**

[4] Pumps, standpipes, radiation dosimeters, discriminators etc.
[5] Survey, mine planning, geotechnical.
[6] Cannot be directly compared to Mining Costs in **Table 4.5** as some components are treated differently in the optimisation calculations.

▲ **Table 4.8: Mining Unit Cost by Cost Element**
(over entire material movement)

Cost Element	Cost A$/t
Operations Labour	$1.65
Maintenance Labour	$0.36
Maintenance Parts	$0.75
Consumables (fuel and lube)	$0.78
Consumables (GET)	$0.09
Consumables (general)	$0.61
Contract Costs (incl. admin, profit, ownership)	$1.36
Miscellaneous Items	$0.18
TOTAL	**$5.78**

4.5 ORE RESERVES

Ore Reserves reported in accordance with the JORC Code 2004 were estimated for Nolans Bore in 2012 (AMC Consultants, 2012d; Arafura, 2012e). Since that time, the Company has materially changed some of the modifying factors that support these Ore Reserves, and these changes are described in this Development Report.

Accordingly, the original modifying factors that supported the Ore Reserves have not been used in the current financial evaluation of the Project. The key Project and economic assumptions used in the financial evaluation (see Section 12 FINANCIAL EVALUATION).

The Company will update and finalise the modifying factors as it completes further optimisation of the Nolans Project and a new estimate of Ore Reserves will be reported in due course. This new estimate is not expected to be materially different to the 2012 estimate.

4.6 FORWARD WORK PLAN

The mine planning studies undertaken on the Nolans Project over the past five years have demonstrated that the chosen mining method, mine and pit design, mine sequencing and scheduling, equipment selection and capital and operating costs have remained consistent.

This feature and the fact that the supporting studies such as geotechnical, geomechanical, selective mining, equipment selection, cost estimation have been completed to a feasibility study level of accuracy and precision indicate that any additional mining component of a DFS will be quite limited in nature. The mining component of the DFS would consist of a collation of the final non-mining modifying factors and running confirmatory pit optimisations, refinement of mine sequencing and pit design, mine scheduling and cost estimation.

However, to ensure a smooth continuation from feasibility through to project execution, the DFS mine planning program could include:

- More detailed dilution estimates including a blasting study;
- A mining contractor selection, evaluation and short-listing process seeking expressions of interest and budget estimates from competent mining contractors; and
- Additional geotechnical drilling, testwork and analyses to increase pit slope angles, leading to improved stripping ratios.

To enable a mining contract scope of work of sufficient detail for tendering in the project execution phase, the mine planning program would also investigate more detailed strategies for:

- Dust management;
- Acid rock drainage management;
- Radiation exposure management (mining personnel);
- Pit dewatering;
- Synergies with initial plant earthworks at Nolans Bore, with respect to mining fleet; and
- Mine closure.

The final mine plan and optimisation will be produced during the DFS once the process flowsheet is “frozen” and process recoveries and plant cost estimates are known. Ore Reserves will be estimated from this mine plan. Additional sample drilling may be required for the final mine plan, depending on the Proved Reserves requirement for funding.

5 METALLURGICAL TESTWORK

KEY FEATURES

- Extensive beneficiation testwork has confirmed that a flowsheet comprising grinding, wet magnetic separation and flotation delivers the optimum performance for Nolans ore types.
- On average, a two times REO upgrade with 85% REO recovery has been achieved in beneficiation.
- A sulphuric acid pre-leach circuit has been developed for the RE extraction flowsheet simplifying plant complexity, transport and logistics.
- A double sulphate precipitation circuit has been developed for RE impurity removal that simplifies plant design, increases the target RE recovery and reduces operating costs.
- Cerium recovery is now included in the RE extraction flowsheet, further reducing capital and operating costs.
- RE separation is now proven, producing five REO sample products to market specification from mineralisation.

5.1 INTRODUCTION

Arafura's extensive and systematic metallurgical testwork program has resulted in the development of a process flowsheet (see Section 6: PROCESSING) that is technically and economically viable for the treatment of Nolans ore. As the geological and metallurgical understanding of the orebody has grown, the testwork has undergone refinement and Arafura has challenged the boundaries of rare earths processing technology as it is currently understood. The Company's strong focus on metallurgical testwork has been a major contributor to positioning Arafura at the forefront of the rare earths industry.

The metallurgical testwork has been undertaken in three major processing areas:

1. Beneficiation;
2. Rare earth extraction ("RE extraction"); and
3. Rare earth separation ("RE separation").

The beneficiation flowsheet developed by Arafura in Australia is currently undergoing optimisation by Chinese specialist RE laboratories to provide certainty that the most efficient flowsheet is included in the definitive feasibility study ("DFS").

The RE extraction flowsheet has undergone significant development and revision to define the current process, and yields substantial advances for the Project.

RE separation testwork has been conducted by the Company over a number of years and market quality REO products have been produced and tested.

5.2 BENEFICIATION TESTWORK

5.2.1 INTRODUCTION

Detailed preliminary beneficiation testwork was conducted up to 2010 by Bateman Engineering (Bateman, 2007; Bateman, 2008a; Bateman, 2009a; Bateman, 2010a). In 2007, approximately 200 tonnes of mineralisation was excavated to obtain a representative sample of the first two years of process feed. It was screened, crushed and subjected to a dense media separation ("DMS") process that proved successful in beneficiating the ore and improving waste rejection. Half the beneficiated material was fed to a pilot plant (ANSTO, 2008d; ANSTO, 2008e) and the other half was used to develop a process to maximise the recovery of phosphoric acid (Bateman, 2008b; Bateman, 2008c). The Company now considers the DMS and phosphoric acid flowsheets too complex and costly to commercialise.

Following the collection of bulk mineralised samples and extensive drill core in 2010 and 2011; respectively, the Company has developed a comprehensive knowledge of the mineralogy of the Nolans Bore deposit. The current beneficiation flowsheet has evolved from the Company's early experience and from detailed work completed during 2011-2013 (Arafura, 2011c; Arafura, 2013c). This more recent work is described below.

5.2.2 MINING STUDIES AND OPTIMISATIONS TO SUPPORT SAMPLE SELECTION

The development and allocation of material types for Nolans Bore is described in Sections 3.3 (MATERIAL CLASSIFICATION) and 4.2.4 (SELECTIVE MINING), where it is shown that selective mining can be undertaken based on material types. This is an important outcome as there are clear mineralogical and beneficiation performance differences between the apatite and calcsilicate styles of mineralisation in the resource.

Mining studies show that, in a bulk sense, the apatite and calcsilicate material types predominately occur in discrete zones, which supports the concept of selective mining of each of the main material type groupings. This selective mining analysis shows that preferential mining on a material type basis can be achieved for an extended period, with apatite mineralisation being exclusively fed to the concentrator for approximately seven to nine years whilst still maintaining a practical mine design and stockpile limits.

Based on this analysis, semi-continuous beneficiation development testwork has focussed on apatite composite samples MT1-3 with secondary confirmatory testing on other material types.

5.2.3 BENEFICIATION FLOWSHEET DEVELOPMENT SUMMARY

Metallurgical testwork programs were conducted at a number of commercial laboratories in Australia during 2011-2013 (**Table 5.1**). The focus of these programs was on reducing mass recovery to concentrate to assist in decreasing reagent requirements in downstream processing.

The program comprised the following:

- Ore characterisation
  - Analysis (chemical/elemental) of multiple samples of varying material types and head grade; and
  - Quantitative mineralogical analysis on crushed and/or sized ore samples of varying material types and head grade;
- Process unit testing of:
  - Flotation (**Figure 5.1**);
  - Gravity separation;
  - Dry magnetic separation; and
  - Wet magnetic separation (**Figure 5.2**).
- Flowsheet development adopting different combinations of the tested process unit operations; and
- Quantitative mineralogical analysis of flowsheet products to improve the understanding of gangue mineral deportment in order to assist flowsheet enhancement testwork.

Figure 5.1: Froth Flotation

Figure 5.2: Magnetic Separation using WHGMS 500

▲ Table 5.1: Detailed Beneficiation Testwork: 2011-2013

Date	Laboratory	Program	Samples Tested	Reference
2011	Nagrom	Compositing and blending of rock/material type samples from Bauer drill intervals	Bauer composites – FBC, RTA, RTB, RTC	Nagrom (2012a)
	ALS Ammtec	Dry magnetic separation testwork on RC chip samples	30 RC chip samples	ALS Ammtec (2011a)
	Bureau Veritas Amdel	Sample characterisation (head assay, size by assay), wet magnetic separation, flotation, dry magnetic separation, heavy liquid separation, wet tabling	Bauer composites – FBC, RTA, RTB, RTC	Bureau Veritas Amdel (2012a)
	Nagrom	Slimes samples tested through UF600 Falcon and Wet High Gauss Magnetic Separation (WHGMS)	283257 (-38µm fraction), 284323 (-38µm fraction)	Nagrom (2011a)
	Nagrom	Assaying of individual Bauer intervals used in compositing rock/material type samples	28 Bauer intervals	Nagrom (2011b), Nagrom (2012b)
	ALS Mineralogy	QEMSCAN analysis on composite ore samples	Bauer composites – FBC, RTA, RTB, RTC	ALS Ammtec (2012d)
2012	Bureau Veritas Amdel	Flowsheet development trialling combinations of dense media separation, wet magnetic separation, regrind, flotation (Flowsheets 1 to 3)	Bauer composites and intervals – RTA, RTB, RTC, RTAL, RTBL, RTCL	Bureau Veritas Amdel (2012a)
	KPYSPY; ALS Ammtec / WARK	Whole of ore grind/flotation – differential rougher & rougher/cleaner	Bauer composites – FBC, RTAL, RTBL, RTCL	KPYSPYMET (2012)
	ALS Mineralogy	QEMSCAN analysis on Flowsheet 3 products for different composite ore samples	Bauer composites and intervals – RTA, RTB, RTAL, RTBL	ALS Ammtec (2012e)
	Bureau Veritas Amdel	Flowsheet development trialling combinations of wet magnetic separation and flotation	Bauer composites and intervals – RTA, RTB, RTC, RTAL, RTBL, RTDL	Bureau Veritas Amdel (2012b)
	Bureau Veritas Amdel	Flowsheet development trialling combinations of wet magnetic separation, gravity separation and rougher/ cleaner flotation	Bauer composites and intervals – RTA, RTB, RTC, RTAL, RTBL, RTDL	Bureau Veritas Amdel (2012c)
	ALS Mineralogy	QEMSCAN analysis on composite ore samples	Bauer composites – MT123 composite, MT45 composite	ALS Ammtec (2012b)
2013	Nagrom	Flowsheet development trialling combinations of wet magnetic separation, gravity separation and rougher/ cleaner flotation	Bauer composites – MT123 composite, MT45 composite	Nagrom (2013a)
	Nagrom	Bulk concentrate production – stage 1 (grinding, wet magnetic separation, gravity separation, regrind, dewatering)	Bauer composites – MT123 composite, MT45 composite	Nagrom (2013b)

Small improvements in beneficiation have a significant benefit in downstream processing costs, and, to this end, Arafura recognised the importance of having sufficient, representative mineralised samples on hand for ongoing test programs. Much of the testwork described below used material from bulk samples collected by the Bauer drilling rig as part of a wide diameter (780 mm) drilling program in 2010 (**Table 3.1** and Arafura, 2011b). This drilling program focussed largely on the CNZ and the CZ of the deposit and collected a total of 1,368 bulk samples, or approximately 1,500 tonnes, of mineralised material to a maximum depth of 75 metres (**Figure 5.3**). Whilst a substantial volume of this bulk sample material has been used for material type studies and metallurgical investigations, 825 bulk samples still remain at the Nolans Site should any future need arise.

Testwork samples are listed in **Table 5.2**, described in Arafura (2012j) and Arafura (2012k), and can be broadly characterised as follows:

- Apatite dominated samples - material types 1-3, samples RTA, RTC, RTAL, RTCL, RTDL and RTEL;
- Calcsilicate dominated samples - material types 4-5, samples RTB and RTBL; and
- Sample FBC was a blended sample of the two mineralisation styles.

Access to adequate samples of material type 6 (MT6) has been limited due to its very low proportion in the resource. Consequently MT6 was not used in the testwork program.

▼ Figure 5.3: Nolans Bulk Samples from Bauer Program

▲ Table 5.2: Head Assays of Testwork Samples

Sample	Material Type	Fe_2O_3 %	SiO_2 %	Al_2O_3 %	CaO %	P_2O_5 %	Th ppm	U ppm	REO %
MT123	1-3	2.4	40.2	13.0	16.3	14.7	3223	275	4.1
MT45	4-5	6.6	31.2	6.9	27.2	17.1	3938	163	3.9
RTA	1-2	2.5	24.3	5.0	31.8	24.2	4970	499	6.0
RTB	4-5	6.5	17.9	3.0	36.9	24.8	6680	272	5.2
RTC	3	2.2	46.1	20.7	2.9	8.5	5920	445	6.1
FBC	1-5	4.5	24.0	5.7	31.0	22.7	4890	298	5.4
RTAL	2	1.3	46.7	10.8	16.1	12.4	1970	201	2.7
RTBL	4	8.8	30.6	8.1	26.2	16.5	2840	151	3.1
RTCL	3	1.5	53.3	28.0	1.1	3.1	791	51.5	0.7
RTDL	3	1.0	59.0	12.1	7.7	7.7	2500	193	2.6
RTEL	3	1.7	52.5	24.0	1.4	5.0	2220	179	2.8

Beneficiation Flowsheet Development using Rock Type Composites

A characterisation testwork program on samples RTA, RTB, RTC and FBC evaluated head sample analysis, different processing units including desliming classification, gravity separation (heavy liquid separation, wet tabling), flotation (numerous parameters and reagents), wet magnetic separation, and dry magnetic separation (rare earth magnet). The conclusions from this program were as follows:

- Clear mineralogical differences were observed between each of the Bauer composites. This supported the development of material type designations, and assisted in understanding preferable treatment processes;
- Wet magnetic separation produced significantly different RE upgrade and RE recovery performances between material types, clearly demonstrating its value and justifying its inclusion in the beneficiation flowsheet;
- Dry magnetic separation offered little potential with poor RE upgrades at >50% recoveries and so was dismissed as a viable option;
- Direct flotation testing did not achieve major gains in RE mineral selectivity; and
- Gravity separation exhibited variable results with mineralogical variation. Dense media testing resulted in significant recovery losses and wet tabling offered little potential in RE upgrade.

Magnetic Susceptibility Characterisation

A testwork program was conducted on thirty RC chip samples of varying grade and mineralogy to characterise the magnetic susceptibility with respect to rock type/lithology. The testwork included head sample analysis, size by assay analysis, and magnetic separation testwork of selected size fractions (-0.5+0.18 mm and -0.18+0.038 mm) at four different magnetic field strengths.

The following samples were tested:

- Massive apatite (material types MT1 and MT2);
- Allanitic apatite (MT4 and MT5);
- Kaolinitic apatite (MT3); and
- Calcsilicate (MT5 and MT6).

The test results showed there was a significant variation in magnetic susceptibility, and, hence, RE recovery and RE upgrade, with head grade and mineralogy. Allanitic apatite was the “best” performing rock type for RE recovery, although not all allanitic apatite samples performed well.

Whole Ore Flotation Testwork

A laboratory flotation testwork program was conducted using four samples (FBC, RTAL , RTBL and RTEL) with the main development study focussed on the FBC sample. Differential rougher and differential rougher/cleaner tests were conducted with the aim of producing a low RE – high phosphate grade concentrate, and a high RE – low phosphate grade concentrate.

A number of flotation parameters and reagents were tested with the following conclusions:

- Low RE containing phosphate minerals could be selectivity floated using fatty acid-type collectors whereas high RE containing minerals could be selectivity floated using hydroxamate-type collectors;
- Increased temperature had an adverse effect on flotation selectivity;
- High pulp density conditioning appeared to be beneficial for RE mineral selectivity;
- Flotation time cut-off between phosphate mineral flotation and RE mineral flotation was critical to achieving better RE upgrade; and
- Cleaner flotation of RE concentrates produced poor RE upgrades. Regrind of rougher concentrates did not improve flotation selectivity and resulted in increased RE losses to tailings unless additional collector was added, which in turn reduced RE upgrades.

Development of Beneficiation Hybrid Flowsheet through Multiple Testwork Programs

Using the ore characterisation testwork results and the positive results of the whole ore wet magnetic separation testwork, the Bateman flowsheet was revised to incorporate wet magnetic separation and flotation to target RE mineral recovery, whether phosphates or silicates. Samples tested were: RTA, RTB, RTC, RTAL, RTBL, and RTCL.

Five flowsheets were tested leading to Flowsheet 6 (“FS6”) as the flowsheet to take forward to design.

Two large material type bulk composites, apatite MT123 and calcsilicate MT45, were prepared for additional testwork. These two composites were used to refine and test the flexibility of FS6 with respect to head grade and mineralogical variability.

The following conclusions were drawn based on the results of this comprehensive flowsheet development program:

- FS6 is the preferred beneficiation flowsheet for the Nolans ore body, and this is shown and further described in Section 6 (PROCESSING) of this Development Report;
- Apatite mineralisation should be targeted for the first 7-9 years of operation, which will achieve twofold RE upgrade at 85% RE recovery; and
- Calcsilicate mineralisation, which is processed during subsequent years, can be upgraded to a similar level but at a lower RE recovery with minimal modifications to the beneficiation flowsheet.

The results from testing of FS6 are shown in **Table 5.3**.

Table 5.3: Beneficiation Testwork Results from Flowsheet 6

Sample	Material Type	Head Grade		Concentration Grade		Concentrate Recovery		
		REO %	P_2O_5 %	REO %	P_2O_5 %	Mass %	REO %	P_2O_5 %
MT123	1-3	4.1	14.7	8.1	30.5	42.8	85.3	88.9
MT45	4-5	3.4	17.5	7.6	12.0	28.6	64.7	19.6

5.3 RARE EARTH EXTRACTION TESTWORK

5.3.1 INTRODUCTION

Extensive RE extraction metallurgical testwork has been conducted on Nolans ore, dating as far back as 2006 when the Company received a A$3.3 million Australian Government AusIndustry Commercial Ready Grant. This dollar-for-dollar grant facilitated piloting activities at the Australian Nuclear Science and Technology Organisation ("ANSTO") during 2007-2008 (**Table 5.4**), and was pivotal to the development of the Nolans flowsheet as it provided Arafura with the means to research and develop RE extraction technology, something not attempted at any significant scale outside of China since the early 2000s. China, which has a monopoly on commercial RE extraction, specifically prohibits the export of RE technology and it is primarily through Arafura's co-funded pioneering work at ANSTO that advances in non-Chinese RE extraction have been possible.

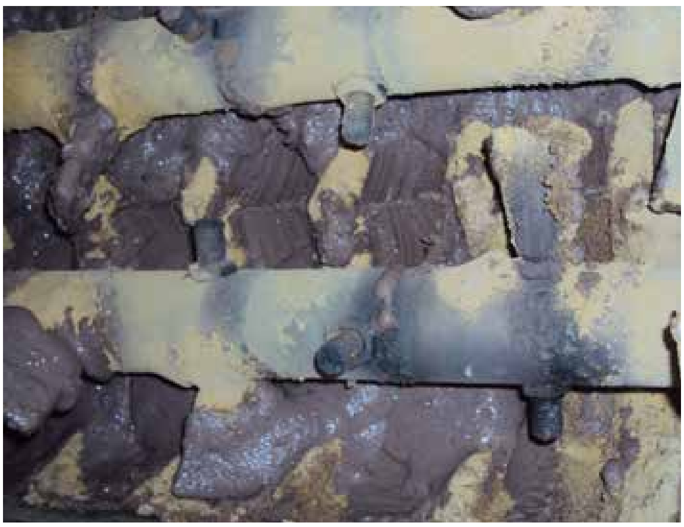
A summary of testwork development stages leading to the current flowsheet design is shown in **Table 5.4**.

Table 5.4: RE Extraction Testwork Programs

Date	Stage	Objectives/Outcomes	Reference
2006-2009	Preliminary laboratory testwork and small scale piloting	Preliminary extraction process development	ANSTO (2006a), (2006b), (2007), (2008a), (2008b), (2008c), (2009b)
2009-2011	Advanced laboratory testwork and small scale piloting	HCl pre-leach and acid bake flowsheet Phosphoric acid and uranium by-products Preliminary HCl regeneration testwork Preliminary mixed RE carbonate intermediate Enhanced mixed RE carbonate product Completion of pilot testwork and reporting for RE extraction, from concentrate to RE carbonate intermediate (Figure 5.4)	ANSTO (2008d), (2008e), (2009a), (2009d), (2009e), (2009f), (2010a), (2010b), (2011c), (2011d), (2011e) Bateman (2008b), (2008c), (2008d), (2009b), (2009c), (2010b) CSIRO (2008)
2011-2012	Pilot and demonstration scale testing Testwork review and options studies	Demonstration plant - HCl pre-leach, RE recovery, acid bake, impurity removal and RE carbonate precipitation - constructed and commissioned HCl regeneration piloting and demonstration Phosphate and uranium by-products Two-stage impurity removal Desktop studies for process options for 2012 Base Case	AMEC (2011), (2012a) ANSTO (2012a), (2012b), (2012f) Arafura (2011b), (2012f), (2012g), (2013b), (2013i), (2013k) Bureau Veritas Amdel (2012d), (2012e), (2012f) Murdoch University (2012a), (2012b) SGS Minerals (2011a), (2011b), (2012b), (2012c), (2012d), (2012e), (2012g)
2012-2014	Trade-off study testing	Proof of concept testwork and process development for SAPL + acid bake + DSP Phosphoric acid pre-leach Direct acid bake (**Figure 5.5**) Impurity removal and RE carbonate precipitation testwork to refine 2012 Base Case.	See **Table 5.5**

▼ **Figure 5.4: Mixed RE Carbonate Intermediate**

▼ **Figure 5.5: Acid-Concentrate Mixer, External (above) and Internal (below)**



The conduct and outcomes of RE extraction batch testwork programs completed by the Company during 2012 and 2013 are summarised below, with the results more fully documented in Arafura (2014a). These programs were conducted to refine the hydrochloric acid ("HCl") pre-leach-RE carbonate flowsheet, explore the opportunity of phosphoric acid pre-leach and to further develop the direct acid bake ("AB")-sulphuric acid pre-leach ("SAPL")-double sulphate precipitation ("DSP") flowsheet. Summaries of the programs are contained in the following sections and include:

- Purification of water leach solution;
- Precipitation of RE carbonate;
- SAPL of RE concentrate;
- DSP;
- Construction of a laboratory-scale continuous kiln; and
- RE solubility studies.

Testwork programs that contribute to the current phase of development are shown in **Table 5.5**, and the mass balance and flowsheet development arising from this comprehensive testwork (see Section 6 PROCESSING).

▲ **Table 5.5: RE Extraction Testwork: 2012-2014**

Date	Program	Reference
2012	Phosphoric acid pre-leach	Arafura (2012i), SGS (2013f)
	DSP	ALS (2012d), Arafura (2012h)
	Base Case optimisation	SGS Minerals (2012a)
2013	Base Case optimisation	Arafura (2013d), Arafura (2013f), Bureau Veritas Amdel (2013), Murdoch University (2013a), Murdoch University (2013b), SGS Minerals (2013c)
	DSP	Arafura (2013j), SGS Minerals (2013a), SGS Minerals (2013e)
	SAPL	SGS Minerals (2013b)
	SAPL-DSP	Arafura (2013e), Arafura (2013g), SGS Minerals (2013d)
	Sulphation	Arafura (2013h)
	Trade-off study	Arafura (2013l)
2014	Trade-off study	Arafura (2014a)

5.3.2 PURIFICATION OF WATER LEACH SOLUTION

The original testwork on thorium and phosphate removal from the water leach liquor ("WLL") used a single stage precipitation process which, when tested on a continuous basis, yielded notable losses of REs to the iron-thorium precipitate ("ITP"). In addition, aluminium was only partially removed from the liquor into the ITP, the remainder reporting to the RE carbonate precipitate.

The Company subsequently developed a two stage RE purification process aimed at minimising losses of REs and reducing aluminium in the RE carbonate precipitate to acceptable levels. Previous batch testwork confirmed that the two-stage RE purification process could successfully reduce thorium, iron, aluminium and phosphate impurities to trace levels.

The testwork comprised RE purification tests to evaluate the effect of magnesia versus magnesite for pH adjustment, the effect of temperature, and the Fe:P and (Fe+Al):P ratios on RE losses and impurity precipitation during the process. Tests on re-dissolution of the recycled precipitate from the second stage of purification were also performed (Arafura, 2013f; SGS Minerals, 2013c).

Major outcomes of this work were:

Stage 1

- Magnesia reagent requirements were significantly less than for magnesite;
- The percentage precipitations for each impurity (thorium, uranium, phosphorus, iron and aluminium) at the target pH were similar for all reagents;
- The Rare earth co-precipitation was within the expected range for each reagent tested and followed the trend light REs ("LRE") ≥ middle REs ("MRE") > heavy REs ("HRE");
- Magnesite was used to test the effect of temperature on the extent of co-precipitation of the REs with the impurities. The most effective temperature to minimise RE precipitation whilst maximising the reactivity of the magnesite was identified; and
- The importance of the Fe:P molar ratio was confirmed as iron precipitates phosphate from solution thereby minimising the precipitation of REs as phosphates. The results of these tests confirmed the minimum Fe:P ratio required for effective precipitation of thorium, whilst minimising the co-precipitation of REs.

Stage 2

- At the higher terminal pH, the reagent additions and reaction times were much greater for magnesite than for magnesia. Magnesia is viewed as a better reagent for this duty as the final pH is above the region where magnesite is reactive;
- Iron, phosphorus, thorium and uranium were all almost completely precipitated during Stage 2, leaving only aluminium at minimal concentrations;
- Rare earth co-precipitation was higher than expected from previous testwork, and the likely root cause was the higher testing temperature; and
- Precipitate was mixed with WLL to simulate the solids recycle from Stage 2 Purification back to the beginning of Stage 1 Purification to recover co-precipitated RE's. Complete dissolution of the precipitate was observed within minutes.

5.3.3 PRECIPITATION OF RARE EARTH CARBONATE

Testwork was conducted to precipitate RE carbonate from an RE sulphate solution by the addition of a concentrated solution of sodium carbonate.

A stock RE sulphate solution was produced and subsequent RE carbonate precipitation tests were performed to evaluate the effect of sodium carbonate solution concentration, stoichiometric addition rates and reaction temperature, on the quality of the RE carbonate product. A series of washing tests were also completed to investigate the removal of entrained impurities from the product (Arafura, 2013d; Bureau Veritas Amdel, 2013).

The main findings from this testwork are summarised below.

- Magnesium concentration in the product increased as sodium carbonate addition increased whilst the total sulphur decreased. This was attributed to magnesium carbonate replacing magnesium and other sulphates in the product. The optimal addition rate was defined as a percentage of the stoichiometric requirement for precipitation of RE carbonates;
- An increase in the sodium content of the product was observed only at the highest stoichiometric addition of sodium carbonate tested. This was attributed to entrained sodium carbonate in the washed product;
- Higher concentrations of the sodium carbonate solution influenced sulphate and magnesium content of the product when compared to lower concentrations;
- Magnesium and total sulphur in the product are influenced by reaction temperature and can result in a reduced RE content of the product;
- Sodium content of the product remained virtually constant over a temperature range and the transition temperature where this increases sharply was identified;
- The conditions were clearly determined to produce a final product with the lowest sodium, magnesium and sulphate content;
- Sodium carbonate washing proved to be effective in reducing certain impurities and the effects of wash temperature explored are now well understood; and
- The barren liquor from the precipitation tests generally indicated near complete RE recovery.

5.3.4 RARE EARTH SOLUBILITY STUDIES

This work was designed to determine the limit of RE solubility in the various stages of processing.

Solubility of La, Ce, Pr and Nd sulphate salts in water at different temperatures was compared to the measured solubilities of these four RE3+ ions in WLL (Murdoch University, 2013a; Murdoch University, 2013b). The main findings of the testwork were:

- The solubilities measured were lower than published literature data indicating the effect of other components in the WLL. The presence of low concentrations of Na+ and K+ ions has a large impact upon the solubility of the RE sulphates, especially those of La(III), Ce(III) and Nd(III);
- The solubility of REs in acidic sulphate liquors depends on the acidity, temperature and the concentration of other cations and anions (Na^+, Ca^{2+}, Al^{3+}, SO_4^{2-} and PO_4^{3-}), and this work has clearly defined the effects of the variables tested; and
- The chemical form in which the RE metal ions precipitate in water leach solutions was studied and the drivers for this precipitate established.

5.3.5 SULPHURIC ACID PRE-LEACH (SAPL) OF RARE EARTH CONCENTRATE

Tests were conducted on Nolans concentrate, subjecting it to a sulphuric acid pre-leach followed by acid bake and subsequent water leach ("SAPL/AB/WL") (Arafura, 2013g; SGS Minerals, 2013b; SGS Minerals, 2013d).

These tests were conducted to simulate both a counter-current and a co-current pre-leach process. In the counter-current tests, the pre-leach stage used the free acid in WLL from a previously conducted acid bake and water leach, and the pre-leach liquor was the feed material for a double sulphate precipitate ("DSP") process. The recycle of acidic liquor from the water leach generated higher sulphate concentrations in the pre-leach liquor, and the corresponding reduction in the solubility of REs resulted in low RE tenors to downstream processing. The simpler co-current process did not exhibit these solubility limitations and this configuration was used for further testwork. In this co-current process, the pre-leach stage used fresh sulphuric acid, with the pre-leach liquor subsequently passing to the water leach of the acid baked solids. The REs were recovered directly from WLL as a precipitate.

The main testwork findings were:

- The co-current SAPL/AB/WL process offers the advantage of no solubilised REs reporting back to the solids;
- Careful management of sulphate levels in both SAPL and AB resulted in lower total sulphur in the final WLL without impacting the RE concentration and maintaining sub-saturation conditions. The individual RE extraction efficiencies were in descending order LRE>MRE>HRE. This maximises the production opportunity for the key LRE magnet feed material, NdPr; and
- The optimum sulphuric acid addition quantity and conditions have been defined.

5.3.6 DOUBLE SULPHATE PRECIPITATION (DSP)

Full details of Arafura's DSP testwork programs are documented in Arafura (2012h), (2013e), (2013g) and (2013j), ALS (2012d), and SGS Minerals (2013a) and (2013d).

The main outcomes from the DSP testwork were as follows:

- LREs were precipitated almost completely within a two hour reaction time, MRE precipitation was marginal and, as expected with the DSP process, HRE precipitation recovery was somewhat lower. Recoveries exhibited some improvement with the extension of the precipitation time;
- The DSP precipitation process exhibits a moderate degree of co-precipitation of calcium and substantial rejection of thorium which both demonstrated similar trends to those outlined above for extended precipitation times;
- Only traces of aluminium, uranium and iron co-precipitated;
- A comparison of the performance of both sodium sulphate and potassium sulphate-based precipitations was carried out and resulted in significantly lower recoveries being demonstrated by the potassium double sulphate salt;
- Differing feed liquor compositions had very little impact on the efficiency of RE precipitation;
- Near complete recovery of La, Ce, Pr and Nd was achieved at lower molar ratios, and MRE and HRE recoveries can be increased slightly by using higher molar ratios; and
- The DSP process is quite selective and readily rejects iron, aluminium and uranium, and is less selective in rejecting calcium and thorium which then require further downstream processing for adequate removal.

5.3.7 SULPHATION BAKING

A large number of sulphation bakes in a variety of static, batch rotary and continuous rotary kilns (**Figures 5.6** and **5.7**) have been conducted during process development (ANSTO, 2011; SGS Minerals, 2013c; SGS Minerals, 2013d).

▼ Figure 5.6: Internal of Rotary Sulphation Kiln Processing

▼ Figure 5.7: Sulphation Kiln Discharge

The main results of the testwork were:

- The optimum sulphation temperature profile for Nolans feed material was defined and validated;
- Understanding of the solids handling characteristics of the feed, in-process and product materials; and
- Off-gas composition and scrubbing requirements including potential corrosion issue management.

5.3.8 RADIONUCLIDE DEPORTMENT

A detailed study into the deportment of radionuclides through the whole process (ANSTO, 2011e; ANSTO, 2012g) was an integral part of the aforementioned testwork. The presence of radionuclides in rare earth deposits is well documented and a critical part of the development of any processing flowsheet is to clearly understand the deportment of radionuclides not only for the more common head of chain elements thorium and uranium, but also all of the daughter decay products.

From the initial assessments, Arafura developed a detailed radionuclide balance which has subsequently been refined and enhanced as additional data became available from the deportment studies. This has provided the Company with an understanding of the radionuclide components of all process streams.

5.3.9 RARE EARTH EXTRACTION FLOWSHEET DERIVED FROM METALLURGICAL TESTWORK

As a result of extensive metallurgical testwork, flowsheets were developed and then tested for technical and economic viability. Mass balances have been calculated for the selected flowsheet (see Section 6 PROCESSING) of this Development Report.

5.4 RARE EARTH SEPARATION TESTWORK

A substantial number of RE separation testwork programs have been completed by the Australian Nuclear Science and Technology Organisation ("ANSTO") for the Nolans Project. A representative selection of these programs is listed in Table 5.6.

▲ Table 5.6: RE Separation Testwork Programs

Date	Program	Reference
2009	RE products from RE carbonate intermediate	ANSTO (2009c)
2011	Separation of light, middle and heavy RE fractions	ANSTO (2011a)
	Separation of NdPr from Ce/La (SX and selective Ce precipitation)	ANSTO (2011b)
2012	REO piloting of middle and heavy RE fractions	ANSTO (2012c)
	REO piloting of NdPr fraction	ANSTO (2012d)
	REO piloting of Ce fraction	ANSTO (2012e)
2013	REO piloting of La fraction	ANSTO (2013)

The first RE separation testwork commissioned by Arafura was in 2009 (ANSTO, 2009b and 2009c). This work targeted the production and quality of multiple rare earth products:

- Product 1: RE concentrate rich in Sm, Eu and Gd (MREs);
- Product 2: RE concentrate rich in Y and HREs;
- Product 3: RE concentrate rich in Ce;
- Product 4: RE concentrate rich in Nd and Pr; and
- Product 5: RE concentrate rich in La.

In order to produce a representative feed sample for solvent extraction ("SX") testwork, pre-leach residue and precipitate ("PLRP") and RE phosphate ("$REPO_4$") from other testwork phases of the Company's development program were treated through various process steps of baking and water leach, $REPO_4$ acid curing, neutralisation purification, ion exchange for uranium removal, RE carbonate precipitation, and selective HCl re-dissolution (ANSTO, 2009b). Some of these process steps were tested continuously for the first time.

Arafura entered into a significant undertaking to investigate and develop the necessary know-how for the separation and production of separated REOs. The main objective of the test program was to define the basic parameters, process configuration and operating conditions for SX circuits appropriate to the production of the target products.

Process development testwork using batch, semi-continuous and a fully continuous mini-pilot plant is reported in ANSTO (2011a) and ANSTO (2011b). This initial development work produced REO products which was a significant step forward in itself but it was evident that the processes required further refinement in order to produce a product that would comply with market requirements. Nonetheless this testwork helped define the forward development route to deliver the defined product range and associated quality.

Subsequent testwork focussed on minimising impurities in the final products by improving the reagents (and their uses), the impurity removal stages prior to the separation processes, and the absolute levels of separation between the target REE and the residual REEs within each product (**Figure 5.8**). The resulting separated chloride solutions were fully precipitated and calcined to REOs to yield representative products for further testing of the separation processes (ANSTO, 2012c; ANSTO, 2012d; ANSTO, 2012e; ANSTO, 2013).

▼ **Figure 5.8: SX Circuit for Production of Separated REOs**

5.5 SUMMARY

An extensive and very comprehensive body of metallurgical testwork has been completed by the Company to develop a technically and economically viable flowsheet from beneficiation to RE separation and REO production for the Nolans Project.

This program of development testwork is substantially complete with the final phases of validation and optimisation currently being carried out by rare earth experts and organisations in China. The validation and optimisation program includes additional variability testing to complement the large number of samples already tested and this will be followed by a full program of integrated pilot testing for completion during 2015.

6 PROCESSING

KEY FEATURES

- The Nolans Project involves three processing facilities in two separate geographic locations.
- The beneficiation processes are well tested, delivering consistent and repeatable upgrade and recovery curves.
- The SAPL-DSP flowsheet is undergoing the final phase of testing prior to commencement of pilot testing and final feasibility.
- Tailings and residues storage facilities at the Nolans Site retain the radionuclides from processing of Nolans ore.
- The selected RE extraction flowsheet maximises recovery of the high revenue NdPr product stream.
- The design of the RE Separation Plant has been advanced with Arafura's test data and validation by Chinese RE experts.
- Ramp-up rates are realistic and achievable.

6.1 MASS BALANCING

6.1.1 INTRODUCTION

Extensive detailed mass balances have been defined for the key process flowsheets using SysCAD modelling software (Simulus Engineers, 2013). This builds on earlier work (Simulus Engineers, 2012) that described the August 2012 Base Case.

Since 2012, there has been ongoing refinement of flowsheet scenarios designed to improve the economics of the Project, and modifications to the reagent supply philosophy to accommodate a split plant scenario. This has incorporated significant developments such as:

- The assessment of sulphuric acid pre-leach ("SAPL"); and
- Improvements in operating conditions and reagent consumptions.

The SysCAD model now includes outcomes from SAPL process testwork (see Section 5 METALLURGICAL TESTWORK). This updated model generates detailed mass and energy balances as inputs to the preparation of cost estimates (see Section 11 CAPITAL & OPERATING COSTS) of this Development Report.

Several substantial process modifications have been incorporated in the mass and energy balance model including the following flowsheet options:

- Direct acid bake and double sulphate precipitation ("DSP")
  - 1,200 kg/t sulphuric acid addition scenario; and
  - 1,500 kg/t sulphuric acid addition scenario;
- SAPL + DSP; and
- SAPL + DSP + no cerium oxidation.

The Company has determined the SAPL-DSP flowsheet is the optimum flowsheet to take into development. The mass balance for this flowsheet is shown in **Figure 6.1**.

6.1.2 COMMON TO ALL SCENARIOS

Split plant

In the most recent modelling, the flowsheet has changed for all scenarios, from a single processing complex previously intended to be located at Whyalla, to a split flowsheet with the RE Intermediate Plant at the Nolans Site, and the RE Separation Plant in an established offshore chemical precinct. Hydrochloric acid has been replaced with sulphuric acid in the pre-leach process eliminating the requirement for a chlor-alkali plant and a hydrochloric acid recycle unit. On-site production of sodium hydroxide and hydrochloric acid is no longer required as reduced quantities of both reagents can now be imported for use at both the RE Intermediate and RE Separation complexes.

Radionuclides

The radionuclide balance has been recalculated across the entire flowsheet. Radionuclides form an integral part of mass balance modelling for all scenarios. The total radioactivity at years 1, 5, 10 and 100 is calculated within the model along with individual isotope activity as a component for each stream output. This allows clear identification of in-growth and decay over time for all of the process flows.

Concentrate

Based on beneficiation testwork, the concentrate grade has been increased from 4.2% to 7.2% REO. The revised concentrate grade has been standardised and used as a common input to all modelled scenarios.

6.1.3 DIRECT ACID BAKE

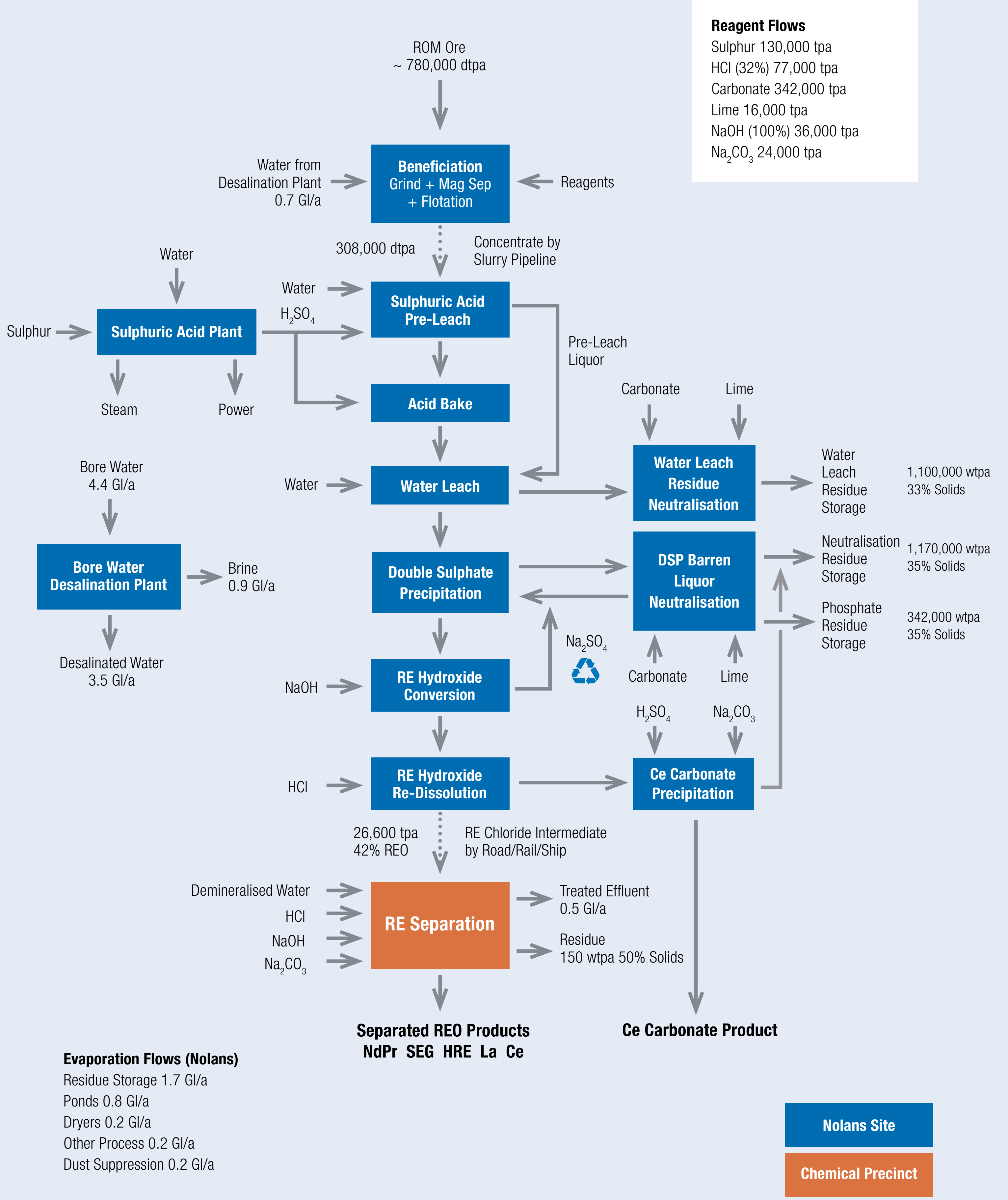
Two alternative direct acid bake ("AB") conditions have been tested and modelled. These cases differ considerably from the August 2012 Base Case and outcomes are consistent with testwork results. The model was rebuilt to take account of the following process changes:

- Water leach;
- DSP;
- Double sodium sulphate conversion to RE hydroxide;
- RE hydroxide dissolution;
- Uranium production;
- Impurity removal; and
- RE chloride intermediate production.

6.1.4 SULPHURIC ACID PRE-LEACH (SAPL)

The current process has the SAPL stage prior to AB. The leachate then feeds into water leach and onto DSP. This flowsheet is described in Section 6.5.2 (PROCESS DESCRIPTION).

▼ Figure 6.1: Nolans Project Mass Balance



6.2 PROCESS DESIGN CRITERIA

Detailed process design criteria ("PDC") have been specified for all equipment in the flowsheet configuration for the Concentrator, RE Intermediate Plant and the RE Separation Plant (Arafura, 2013m; Arafura, 2014b).

The information and calculations in the PDCs are extensive. The result is a robust preliminary engineering basis for further development and detailing during the final stages of the definitive feasibility study ("DFS").

6.3 FLOWSHEET

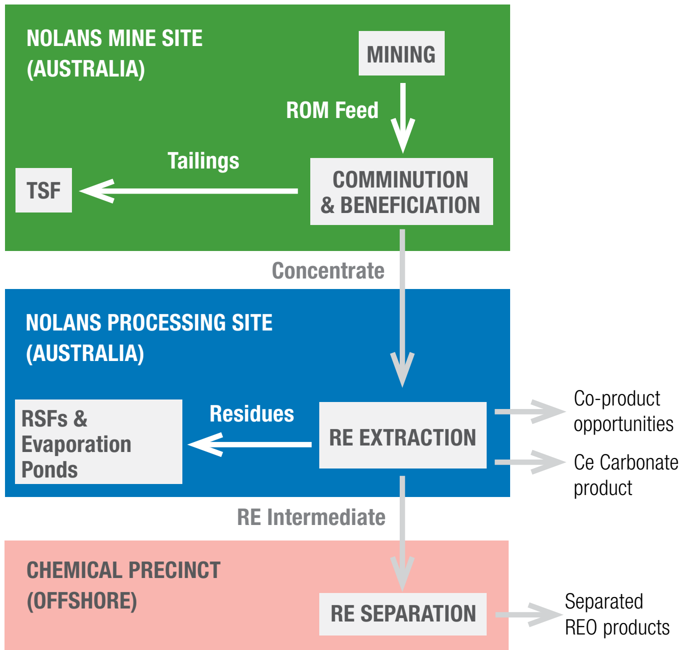
The Nolans process configuration (Figure 6.1) has been developed by the Company over several years of intense effort. It is based on detailed, extensive and rigorous testing through a number of phases of work including laboratory, pilot plant and demonstration plant scales of testwork (see Section 5: METALLURGICAL TESTWORK). All phases of this work have used mineralisation from the Nolans Bore deposit to develop and validate the flowsheet from comminution through to generating final REO products.

As stated above, the Company's testwork has also enabled it to develop a detailed radionuclide balance for the process. Understanding the deportment of radionuclides is critical to process design, equipment selection, and residue and exposure management, and forms a platform of knowledge to develop protocols for long-term operational management.

The process blocks developed for the Nolans Project fall into three geographical and processing categories (**Figure 6.2**):

- Comminution and beneficiation;
- RE extraction; and
- RE separation.

▼ **Figure 6.2: Nolans Project Configuration**



6.4 NOLANS MINE SITE

The Mine and Concentrator, with ancillary support utilities, overburden, tailings storage ("TSFs") and other general facilities, will be located at the Nolans Mine Site.

6.4.1 MINE TO MILL

The distribution of material types in the ore body lends itself to a selective mining strategy and this has been adopted by the Company. Selective mining is designed to maximise Project value by processing higher grade material in the early years of the Project, deferring the processing of lower grade material until later years. Processing of calcsilicate material types 4-6 will also be deferred until several years after start-up so as to minimise the cost profile during the early years of the Project.

Plant feed (MT123 and MT456) is mined from the open pit mine and stockpiled on the Run of Mine ("ROM") pad adjacent to the primary crusher. The ROM plant feed is rehandled once and is processed soon after being mined.

Lower grade ("Long Term Stockpile") material mined during the early years of the Project is stockpiled off the ROM pad and is rehandled twice – once from the Long Term Stockpile to the ROM, and again from the ROM to primary crusher.

Re-handling of plant feed from the ROM pad to the primary crusher is a relatively straight-forward exercise achieved with a front end loader.

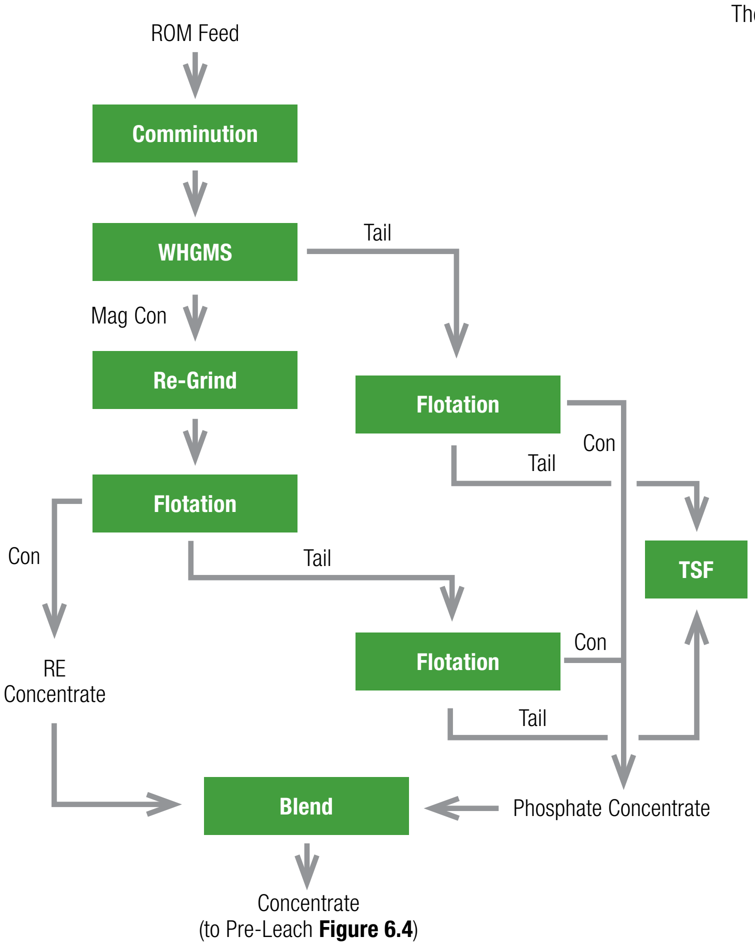
6.4.2 CONCENTRATOR

At the Nolans Mine Site, ROM material is fed into a Concentrator comprising comminution and beneficiation circuits. The latter circuit employs wet high intensity magnetic separation and flotation circuits. The beneficiation process produces a concentrate by targeting both the RE-bearing and phosphate-bearing minerals with the associated rare earths, and rejecting gangue and low grade minerals as waste. The comminution and beneficiation flowsheet is shown in **Figure 6.3**.

ROM material is fed to a conventional crushing circuit using a front end loader and subsequently conveyed to a single ball mill for grinding. The processing rates for the concentrator are relatively modest, and this negates the need for large scale equipment in this area of the plant. Ground material is fed to a magnetic separation circuit to produce a magnetic concentrate. This concentrate is reground and upgraded further using flotation to produce a higher grade RE concentrate. The magnetic tails are also processed through a flotation circuit to produce a higher grade phosphate concentrate. The RE and phosphate concentrates are then combined as the feed material and pumped to the RE Intermediate Plant.

The beneficiation flowsheet achieves an RE upgrade of approximately two and RE recoveries of 85%. This scenario satisfies the dual objectives of maximising Project value and longevity.

Figure 6.3: Comminution and Beneficiation Flowsheet



6.5.1 INTRODUCTION

The RE Intermediate Plant is located at the Nolans Processing Site, approximately ten kilometres south of the Nolans Mine Site in a more favourable environmental setting (Section 9.2.4: NOLANS PROCESSING SITE).

The Processing Site hosts RE extraction processing units, a sulphuric acid plant, process residue storage facilities ("RSFs"), evaporation ponds and other infrastructure to support the operation. A range of options were assessed for concentrate transfer and it was determined that the use of a slurry pipeline connecting the Concentrator to the RE Intermediate Plant was the optimum solution.

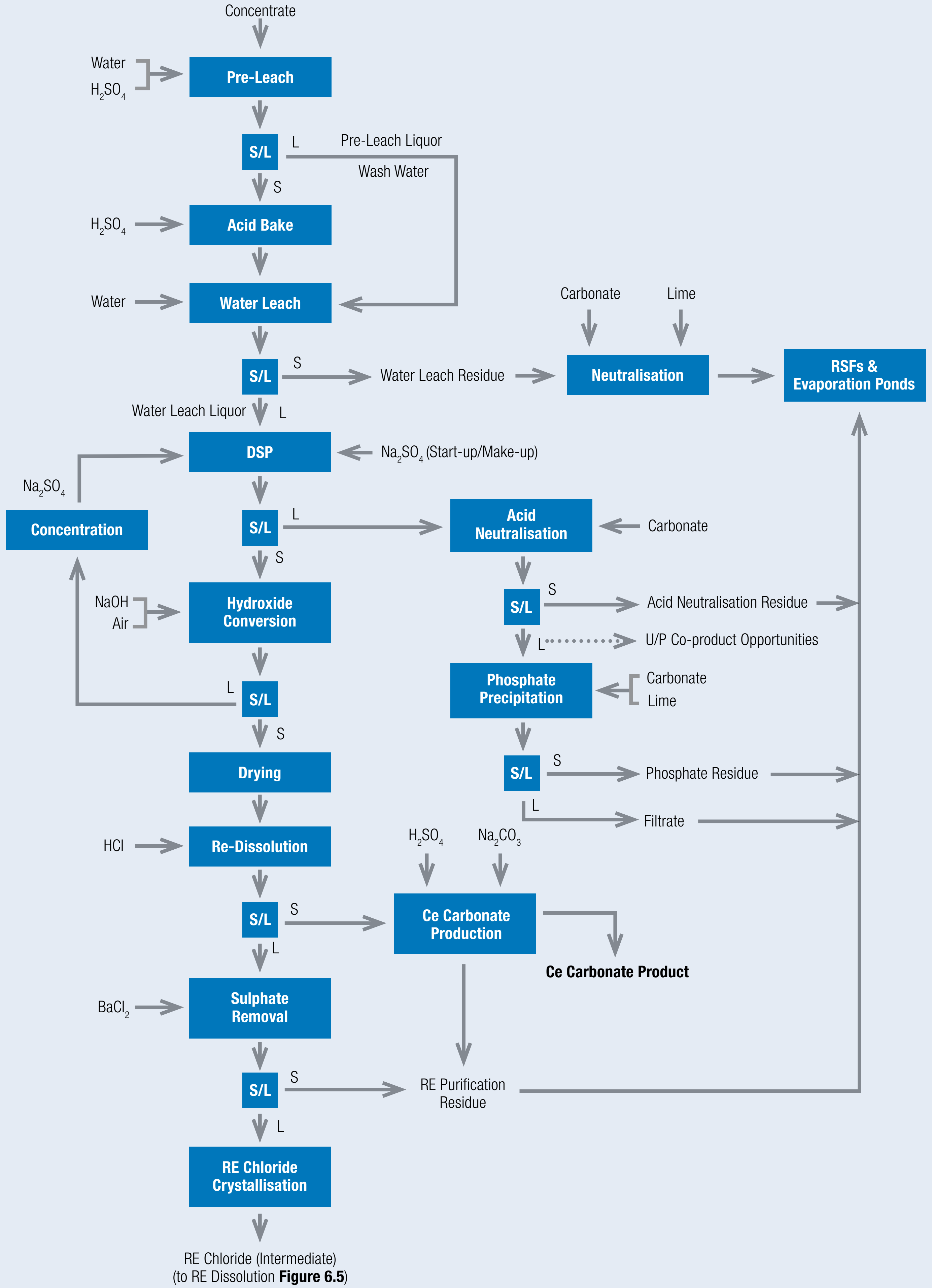
The RE Intermediate Plant comprises the following major processing facilities:

- SAPL;
- Sulphation and water leach;
- DSP and purification; and
- RE chloride intermediate and cerium carbonate production.

The RE Intermediate Plant has several ancillary plants associated with it, such as a sulphuric acid plant, steam and power generation, and water treatment, as well as other infrastructure and services.

The RE extraction flowsheet is shown in **Figure 6.4**.

Figure 6.4: RE Extraction Flowsheet



6.5.2 PROCESS DESCRIPTION

Sulphuric Acid Pre-Leach

Concentrate is received from the Concentrator as a slurry at the RE Intermediate Plant and following dewatering is fed to the SAPL process stage. The SAPL process produces a solid feed, containing the majority of the REs, for the sulphation process. It also produces a pre-leach liquor containing the remaining REs, for use in the water leach process. The solid feed material from the SAPL is dewatered prior to being transferred to the sulphation process.

Sulphation (Acid Bake)

A relatively low temperature acid bake process using concentrated sulphuric acid is used to sulphate the solid feed material and liberate the REs for subsequent processing and extraction. This lower temperature process minimises the energy requirement for the sulphation process and also offers a broader range of processing technologies.

Water Leach

The sulphated material is leached with a mixture of pre-leach liquor, filtration wash filtrates and water. The water leach liquor ("WLL') is processed to recover REs and the solid residues are neutralised in the acid neutralisation section prior to final on-site disposal in the water leach RSF.

Double Sulphate Precipitation

WLL produced in the water leach section passes to the double sulphate precipitation ("DSP") stage. The addition of sodium sulphate in the DSP stage selectively precipitates the REs as a double sulphate salt. This is subsequently filtered and washed for further processing.

Liquor streams containing elevated levels of sodium sulphate are collected and evaporated for re-use in the DSP stage. Evaporation ponds are used to evaporate excess process fluids, and the Company intends to design and manage the Nolans Site as a zero process water discharge facility.

The RE-depleted DSP filtrate is neutralised with carbonate and lime in a two stage impurity removal process to produce a thorium-rich residue and a phosphate residue that contains most of the uranium present in the Nolans ore. These residues will be stored and managed on-site in dedicated RSFs.

This is the section of the process that offers the potential for future uranium and phosphate co-product development.

Conversion to Hydroxide

The DSP solid salt is mixed with sodium hydroxide to convert it to a RE hydroxide solid. This solid is washed and dried prior to further processing. The drying stage is an important stage that serves multiple purposes. During the drying operation, in the presence of air, most of the cerium which is present as Ce^{3+} is oxidised to Ce^{4+}. This assists subsequent separation from the other REs to produce a cerium carbonate product during intermediate-stage processing.

Hydroxide Dissolution

The dried RE hydroxide undergoes a selective re-leach with dilute hydrochloric acid to produce a mixed RE chloride liquor containing low levels of cerium. As the cerium is predominantly in the oxidised Ce^{4+} state it remains relatively insoluble in the solid phase during this selective re-leach process.

Intermediate Processing Products

The RE chloride liquor from hydroxide dissolution is treated with barium chloride to remove residual excess sulphates and subsequently crystallised as an RE intermediate feed for transport and further processing at the RE Separation Plant.

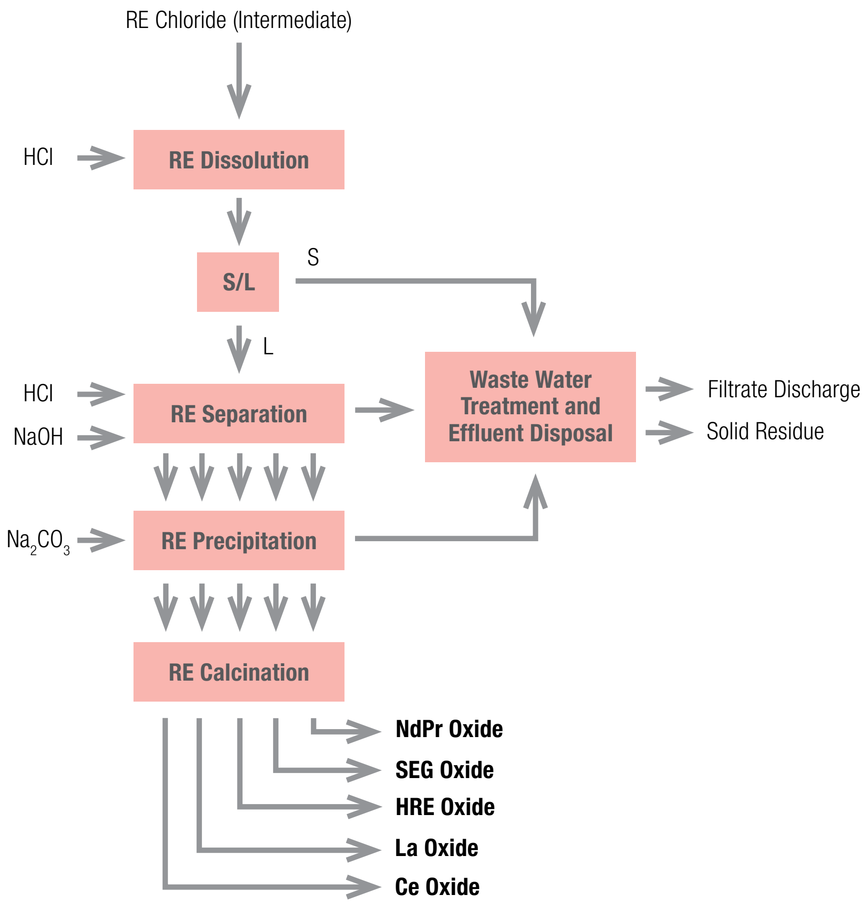
The cerium-rich solid from the hydroxide dissolution is treated to remove the residual thorium as a chemically stable precipitate and this precipitate is sent to the on-site neutralisation RSF. The cerium-rich liquor is precipitated by the addition of sodium carbonate to produce a cerium carbonate product.

6.6 CHEMICAL PRECINCT

6.6.1 INTRODUCTION

The basic RE separation flowsheet is shown in **Figure 6.5**.

Figure 6.5: RE Separation Flowsheet



Initial processing of the RE intermediate feed at the RE Separation Plant involves dissolution and filtering of the feed material in preparation for the separation processes. This high REO-grade feed material contains approximately 93% RE chloride with calcium chloride contributing the majority of the balance. The effectiveness of the impurity removal processes adopted in the RE extraction flowsheet limits the other impurities to less than 0.5%. These impurities are removed in the separation processes. Only a small amount of solid residue containing these impurities is generated at the RE Separation Plant, and requires local disposal.

The RE separation process also generates modest amounts of brine waste water from the neutralisation treatment processes.

The Company will produce five REO products at the RE Separation Plant:

- NdPr (or Didymium) Oxide (as $Nd_2O_3+Pr_6O_{11}$);
- SEG Oxide (as $Sm_2O_3+Eu_2O_3+Gd_2O_3$);
- HRE Oxide (as $Tb_4O_7+Dy_2O_3+Ho_2O_3+Er_2O_3+Tm_2O_3+Yb_2O_3+Lu_2O_3+Y_2O_3$);
- Lanthanum Oxide (as La_2O_3); and
- Cerium Oxide (as CeO_2).

This separation is initially achieved via multiple solvent extraction ("SX") circuits and REO production by subsequent precipitation and calcination processes prior to final product packaging and dispatch to customers.

6.6.2 PROCESS DESCRIPTION

Rare Earth Chloride Receipt and Storage

Rare earth chloride intermediate arrives at the facility in bulk bags within standard shipping containers. The bags are unloaded at the inbound warehouse and discharged into the RE chloride unloading station for transfer to storage bins.

Rare Earth Dissolution

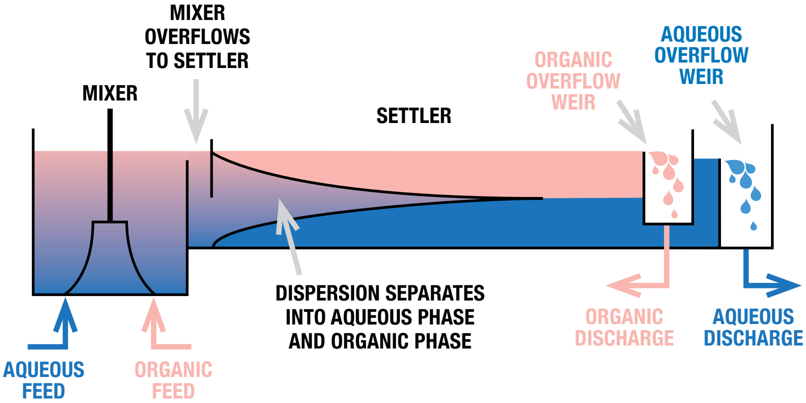
An RE chloride solution is produced by dissolving the RE chloride in water. Minor impurities in the RE chloride solubilises during this process.

Rare Earth Separation

This section of the RE Separation Plant separates the mixed RE chloride solution into five separate RE product streams shown in **Figure 6.5**. The separation of REs into individual products is achieved using a sequence of SX operations. The extractant reagent used in this process is 2-ethylhexyl phosphonic acid mono-2-ethylhexyl ester, sold commercially under various trade names and identifiers such as P507 or Ionquest 801. This extractant is blended with an organic diluent to form the organic phase for the SX processes.

The basic building block for an SX circuit is the mixer-settler (**Figure 6.6**). Multiple mixer settlers are used, with the organic and aqueous flows running counter-current to one another.

Figure 6.6: Solvent Extraction Mixer-Settler Schematic



There are multiple SX circuits for extraction and recovery of the five RE products. The SX process is analogous to the distillation processes used in the oil and other chemical industries to effect separation of chemically similar elements and compounds. There is a differential separation of the REs between the aqueous and organic phases due to modest variations in solubility of the individual REs between these two phases. This differential varies with the RE in question and more significantly, with the pH of the system. The pH of the circuits is controlled using additions of hydrochloric acid and sodium hydroxide solution, as required. The loaded organic phases are then contacted with aqueous hydrochloric acid solutions to strip the selected REs back into an aqueous phase. The stripped organic, in the acid form after contact with hydrochloric acid, is subsequently saponified prior to re-use.

The basic sequence of each SX circuit is as follows:

1. The aqueous RE chloride solution is contacted with the organic liquid in a series of mixer-settler units to extract the target REs. Some of the untargeted REs and other impurities will also extract;
2. The loaded organic is contacted with a dilute hydrochloric acid solution in a second series of mixer-settler units, to scrub the unwanted REs back into the aqueous phase. The aqueous scrub solution is mixed with the feed solution to extraction;
3. The scrubbed loaded organic is then contacted with a strong solution of hydrochloric acid in a third series of mixer-settler units to strip the targeted REs back into the aqueous phase for further processing; and
4. The stripped organic is saponified prior to being recycled to the extraction stage of the process.

Rare Earth Precipitation and Calcination

Sodium carbonate is used to precipitate the REs from the strip solutions as RE carbonate. The RE carbonate precipitates are filtered and washed, with the solids being calcined in order to convert these carbonates to final REO products.

The waste waters from RE separation contain predominantly sodium chloride, with a minor excess of sodium carbonate from the precipitation of REO products.

6.7 PROCESS RECOVERIES

The largest proportion of revenue from the Nolans Project is generated by the NdPr product stream (see Figure 10.3) and, in common with all other processes, the efficiency of recovery of the principal products is of prime importance. The processing route selected for the Nolans Project maximises recovery of the light REs ("LREs"), which includes NdPr (Table 6.1).

▲ Table 6.1: Nolans Process Recoveries – Concentrate to Final REO Product

Rare Earth Group	Recovery
LRE	92%
SEG	78%
HRE	38%
Y	18%
TOTAL[1]	**90%**

[1]Weighted average

6.8 PROCESS OPTIMISATION

The Nolans flowsheet is based on extensive testwork completed by the Company over many years and is both technically and economically viable. Arafura is in the process of completing flowsheet validation and optimisation using specialist RE laboratory facilities in China and at selected laboratories in Australia.

This program includes work in the following areas:

- Beneficiation;
- Optimisation of RE products;
- Variability test programs; and
- Integrated piloting of the complete process and development of engineering data.

The results of this work will be included in the DFS.

6.9 RADIONUCLIDE DEPORTMENT

The Nolans Bore deposit hosts a number of RE-bearing minerals that also contain elevated concentrations of thorium and uranium. Radioactivity at the Nolans Site is naturally occurring and currently presents no exposure-based access restrictions for personnel or livestock. Nonetheless, mining and processing of Nolans ore requires an appropriate level of management vigilance and rigour and, in this respect, the *As Low As Reasonably Achievable* ("ALARA") principal will be applied to all activities at the Company's operating sites.

In 2011, the Company commissioned the country's foremost nuclear science experts at the Australian Nuclear Science Technology Organisation ("ANSTO"), with input from other industry experts, to conduct a detailed study on the deportment of radionuclides in the Nolans process flowsheet (ANSTO, 2011e). This work dealt not only with the physical upgrade and chemical processing of ore and concentrate from Nolans Bore, but also considered the materials handling and processing of ore, intermediate and final products, and process residues from an EHS and regulatory perspective. The findings of this work will be used to guide the design, construction and operational protocols for the Project.

This study has been used as the basis for the updated radionuclide deportment modelling for the SAPL-DSP flowsheet. The key findings are listed below:

- Inhalation and ingestion remain the principal risks associated with the Nolans Site and dust mitigation/suppression measures have been identified;
- Gamma ray emission awareness and exposure management are cornerstones of the longer term management plan for Nolans;
- The deportment of radionuclides is an integral part of the mass and energy balance models and the theoretical models have been validated and modified by data obtained from multiple testwork programs conducted by the Company;
- The level of radioactivity in each process stream is clearly modelled, including the forward growth and decay curves where decay chains have been chemically cleaved. This modifies the radioactivity profile with respect to time; and
- Specific radionuclides have been identified and studied closely because of their known chemical predisposition to associate with certain REs. This association requires close attention during purification and separation.

As with most chemical processes dealing with processing naturally occurring radioactive material ("NORM"), the head of chain radionuclides are of prime importance at the front end of the process, but each radionuclide exhibits behaviour based on its chemistry rather than its radioactivity or decay chain progenies. Arafura has successfully identified points in the process where decay chains are cleaved and the deportment of each significant contributor between the in-process phases.

The Company has assembled a significant knowledge base in radionuclide deportment and radiation management that will be further developed and implemented as the Project moves through execution and into operations.

6.10 TAILINGS AND PROCESS RESIDUES STORAGE FACILITIES

6.10.1 INTRODUCTION

The Nolans Site infrastructure engineering study incorporates tailings and residues storage facilities ("TSFs" and "RSFs") (Knight Piésold, 2014). They include:

- A flotation TSF adjacent to the Concentrator at the Mine Site; and
- Separate water leach, neutralisation and phosphate RSFs, and evaporation ponds adjacent to the RE Intermediate Plant at the Processing Site.

6.10.2 DESIGN OBJECTIVE

A brief design summary of each of the TSFs and RSFs is provided below.

The principal design objective of TSFs/RSFs is to minimise the environmental impact of the permanent and secure containment of waste residues and fluids generated by processing. A number of characteristics and parameters are considered in order to meet the design objective:

- Leachate collection and minimisation of seepage;
- Cost effective construction;
- Maximisation of tailings and process residue densities using the most appropriate deposition strategy;
- Ease of operation; and
- Rapid and effective rehabilitation.

6.10.3 STORAGE CAPACITY AND AREA REQUIREMENTS

The required storage capacity and footprint of each TSF/RSF is shown in **Table 6.2**.

Table 6.2: TSF/RSF Capacity and Area

Type	Storage Capacity Mt	Area ha	Number of cells	Design life per cell Years
Flotation Tails	9.0	20	2	10
Water Leach Residue	7.2	25	2	10
Neutralisation Residue	11.9	33	2	10
Phosphate Residue	2.9	12	2	10
Evaporation Ponds	-	60	6	20

6.10.4 DESCRIPTIONS

Flotation TSF

A TSF for flotation tails is proposed at the Concentrator.

The flotation TSF will comprise two cells, with the second cell replacing the first after a period of approximately ten years. Each facility requires a low permeability soil liner and the embankments will be constructed mainly from mine waste rock. Each cell will have a surface area of 20 hectares and the final embankment height will be 25 metres.

Water Leach, Neutralisation and Phosphate RSFs

Water leach residue is a slow settling-type material and contains elevated levels of radioactive material. This RSF will be constructed using a high density polyethylene ("HDPE")/low permeability soil liner system, combined with basin drainage and a leakage collection and recovery system.

The configuration and construction methods for both the neutralisation and phosphate RSFs are similar to that described for the water leach RSF.

Excess Process Liquor Evaporation Ponds

Six evaporation ponds, each 10 hectares in area and 2.5 metres deep, are required to concentrate the excess process liquor. All ponds will be lined with an HDPE liner. Flow from the process plant will be directed to one of the ponds for a period of several months, after which the flow will be directed to the next pond in sequence.

After approximately 20 months, during which time the liquor concentrates through evaporation, the remaining brine in the cell is pumped to the neutralisation RSF in order to limit the accumulation of precipitate in the evaporation ponds. The cell is then available to re-enter the production cycle and receive excess process liquor.

6.10.5 TSF AND RSF MANAGEMENT

A monitoring program for each TSF and RSF will be developed to monitor performance and integrity during operation. Monitoring will include:

Monitoring Bores

TSF/RSF design incorporates a number of measures to reduce potential seepage from each facility and to mitigate impact on the downstream environment. Groundwater monitoring stations are proposed to be installed at the flotation TSF and at the Processing Site RSFs to ensure early detection of groundwater level changes and/or quality, both during the life of the operation and following decommissioning.

Embankment Piezometers

Pore water pressures will be monitored within the embankments using piezometers at several locations on each TSF/RSF to ensure that stability is not compromised.

Embankment Survey Pins

Survey pins will be installed at regular intervals along the downstream side of all TSF/RSF embankment crests in order to monitor embankment movements.

Radioactivity Monitoring

The chemical fixing of the radionuclides within the process residues has been studied during various phases of development and testwork and the mobility of the radionuclides understood. Under normal environmental conditions the radionuclides will remain immobile indefinitely. Nonetheless these residues will require the application of ALARA-based principles of radiation management during operation to ensure the operational safety of personnel. They will be deposited using sub-aqueous deposition in order to minimise the exposure potential for personnel. Sub-aqueous deposition also reduces the risk of ingestion or inhalation by minimising dust, spray emissions and surface emmisions. RSFs will be covered with a layer of benign stable rock at closure to reduce radioactive shine, limit natural erosion, and provide long-term protection.

6.11 RAMP-UP

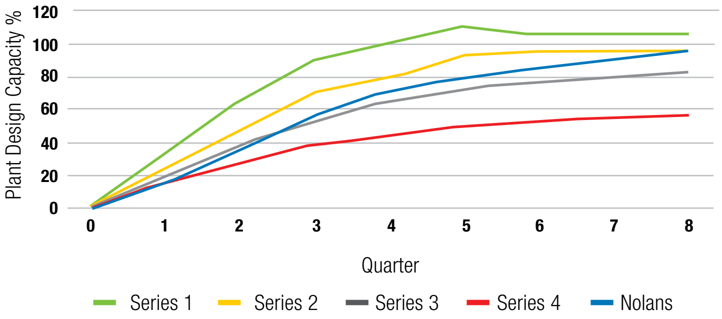
Plant ramp-up from the onset of commissioning to full beneficial production is one of the most critical stages in the success of a project. The Nolans Project is technically complex and good planning and management of the ramp-up phase will be critical to its success. Most of the operational readiness activities are being carried out during the design and execution phases of the Project.

Ramp-up and ultimate production levels achieved for complex processing projects are well documented. McNulty (1998) postulates that ramp-up could on average be divided into four groups or series, based on the complexity of the process and the level to which this process had been developed:

- Series 1
  - Mature technology;
  - Processes similar to earlier successful projects adopted; and
  - Licensed technology or many prior licenses of the technology exist.
- Series 2
  - First plant of a licenced technology;
  - Pilot-scale testwork was incomplete or may have been completed on non-representative samples;
  - Prototype equipment for a unit operation; and
  - Process conditions in key unit operations are unusually severe, such as high temperatures or conditions that are highly corrosive.
- Series 3
  - As for Series 2;
  - Very limited pilot-scale testing that failed to address some important process steps;
  - Feed characteristics such as mineralogy are not fully understood; and
  - Insufficient attention paid to product quality during process development.
- Series 4
  - Any pilot-scale testwork was conducted for generation of product, not for confirming process parameters; and
  - Process flowsheets are unusually complex with prototype equipment in two or more critical unit operations.

Figure 6.7 shows the approximate projected performance on a quarter-by-quarter basis for the different McNulty series and the Company's ramp-up projection for the Nolans Project.

Figure 6.7: Ramp-Up Profiles



From the McNulty series descriptors outlined above, the Nolans Project is assessed as most closely aligned to Series 2, because:

- It is not a licenced technology but it does use aspects of mature technologies;
- Pilot-scale testwork has been conducted and an integrated pilot plant ("IPP") is planned;
- Process conditions are not generally severe with respect to temperature and pressure but some do present corrosive conditions associated with multiple inorganic acids;
- Standard established RE process steps are used in the process employing proven equipment types;
- Process design is supported by extensive testing; and
- Ore and gangue mineralogy is understood in some detail.

The Project's projected start-up curve is realistic and conservative. The early months of ramp-up closely approximate a McNulty Series 4-type project, but the curve subsequently rises above the Series 3 trend by the end of the third quarter, and matches the Series 2 profile by the eighth quarter of ramp-up.

6.12 SUMMARY

An extensive amount of process and engineering development work has been completed by the Company during the development of the Nolans Project. This work incorporates detailed mass and energy balances, process design criteria, optimised flowsheets and equipment selection. It has established a solid foundation for the DFS.

Ancillary plants and other infrastructure requirements for the Nolans Site are well defined and use standard third party proprietary processes and equipment. These same requirements for the RE Separation Plant are defined on the basis of a provisional Gulf Coast USA location.

Radiation management aspects of the Project are well understood, and preliminary designs for the tailings and residue storage facilities have been completed.

7 PROCUREMENT, TRANSPORT AND LOGISTICS

KEY FEATURES

- New site locations offer sizeable reductions in transport and logistics capital and operating costs.
- Simplification of logistics owing to reduced total volumes and significant reduction in hazardous and dangerous goods movements.
- Excellent existing infrastructure for rail and road close to Nolans Site.
- Short-listed RE Separation sites offer excellent logistics infrastructure.

7.1 INTRODUCTION

The positive impact on both the Nolans Project transport and logistics complexity and overall cost was a major consideration in the Company's decision to relocate the RE Intermediate Plant to the Nolans Site in the Northern Territory and to develop the opportunity of an offshore RE Separation Plant.

These decisions have led to significant cost improvements in Project logistics due to:

- Elimination of the need for a haul road and rail siding for concentrate haulage;
- Elimination of the need for dedicated rolling stock and specialised containers for concentrate transport;
- Elimination of the need for loading, unloading and washing systems for concentrate and residue containers; and
- Reduction in the capital requirement for rail and port infrastructure at the RE Intermediate Plant.

These improvements are partly offset by additional ISO tank container requirements and movements for the supply of reagents to the Nolans Site, but this constitutes an overall logistics model that is now considerably simpler and cost effective. Outline details of the logistics materials movements and geography are illustrated in **Figure 7.1**.

7.2 NOLANS SITE

The close proximity of rail facilities to the Nolans Site offers significant logistical advantages for the Nolans Project, with the existing capacity of the Darwin to Adelaide rail line being sufficient to support the total rail transport requirements of the Project. This rail corridor provides direct linkage to the Port of Darwin, which is approximately 1,400 kilometres north of Nolans. Port Adelaide offers an alternative back up port facility with very good infrastructure and a similar haul distance, thereby substantially enhancing the security of the supply chain.

Arafura is working with the owner and operator of the Darwin to Adelaide rail line to investigate options to access the rail line. The operator also operates the Adelaide rail terminal and the Company will look into the viability of an end-to-end solution for the Australian land based operations.

7.2.1 IN-BOUND REAGENT SUPPLY

Detailed logistics modelling indicates that the Project will have annual movements of approximately 350,000 tonnes of in-bound raw materials to the Nolans Site, and these will predominantly be in the form of standard intermodal cargo. Arafura has engaged with the major operators and service providers to assess and ensure access to the required infrastructure and to incorporate the most efficient solutions for cargo movements.

The Company has developed a detailed knowledge of the supply and demand fundamentals for the Nolans Project through discussions with many raw materials suppliers, and multiple supply options are available for the Project needs. Where security of supply is identified as critical, a multiple sourcing strategy will be implemented in the most cost effective manner.

The logistical arrangements required to deliver all of the necessary reagents to the Nolans Site have been extensively modelled. The regulatory requirements and constraints and opportunities are fully considered in the modelling.

7.2.1.1 SULPHUR AND SULPHURIC ACID

The RE Intermediate Plant demand for sulphuric acid will be serviced by an on-site sulphur burning acid plant. Inbound sulphur will be procured on the international sulphur market and it is proposed that bulk shipments be containerised in Darwin for ease of transport by rail and road to Nolans via Alice Springs. Historically, the Port of Darwin has handled solid sulphur shipments and the Company is working with the Port Authority and port operators to finalise the optimal location for a transfer facility.

The Company has established relationships with the key suppliers in each of the main sulphur supply regions of the world. Long term supply agreements will be established with key suppliers at an appropriate time within the project development and execution phase. Arafura has in-house experience and has access to consultants with additional experience in procuring and transporting significant volumes of sulphur and establishing solids or liquids reagent supply chains.

Sulphur, like most other commodities, has returned to a more typical long term pricing band following the anomalous events of circa 2008, and the Company does not believe there to be any foreseeable supply shortfall or significant market movements which would be likely to influence the longer-term supply and demand pricing dynamics within the timescale of project development and several years of production.

Sulphuric acid will be required both for the start-up of the acid plant and during the initial stages of ramp-up until consumption rates justify the commencement of on-site acid production. To this end, Arafura is working with the owners and the operators of the bulk tank facility at the Port of Darwin to facilitate handling of internationally sourced concentrated sulphuric acid via existing infrastructure. Where transport volumes justify the investment, the Company will work with the owners and operators of existing bulk handling installations to facilitate investment in additional capacity. Expansion has already been assessed as practical and feasible.

7.2.1.2 CALCIUM CARBONATE

Arafura has identified several potentially sizeable carbonate (marble and calcrete) sources at surface within 20 kilometres of Nolans on land over which it maintains exploration and development rights. Based on reconnaissance sampling and initial testwork, the Company believes that these sources have the potential to provide the life of mine supply requirements for carbonate within the RE extraction process. Bulk carbonate samples will be acquired and tested to confirm the suitability of these sources. During operations, movement of these materials to the RE Intermediate Plant will be by road train.

7.2.1.3 CAUSTIC SODA AND HYDROCHLORIC ACID

The caustic soda international supply market for Australia is generally well developed and very active. Arafura has engaged with key organisations in this supply chain in order to define an optimal supply solution for the Project.

Regional sourcing possibilities for hydrochloric acid are well understood by the Company and some substantial suppliers are showing great interest in the Project. This represents a modification to the standard approach of hydrochloric acid supply to market within the region.

Caustic soda will be procured on the international market and delivered in bulk to Darwin for subsequent transfer to ISO tank containers. Hydrochloric acid will either be delivered in bulk to Darwin for subsequent transfer to ISO tank containers, or direct from suppliers in ISO tank containers. This dedicated fleet of ISO tank containers will be transported on standard rail and road intermodal services between Darwin and the Nolans Site.

7.2.1.4 OTHER RAW MATERIALS AND REAGENTS

Other inbound raw materials and reagents will also be containerised and transported using the aforementioned intermodal services. This maximises the use of standard services while maintaining flexibility and minimising cost. Sourcing of other critical raw materials will include a matrix of local, regional, national and international suppliers in order to manage the supply related risk.

Key relationships have been established with major suppliers of soda ash from North America, as well as specialist chemical suppliers from China. Where feasible and practical, the Company has established relationships with potential local suppliers of lime and other minor reagents.

7.2.2 OUT-BOUND CARGO

Out-bound rare earth product cargos from Nolans will utilise existing road and rail capacity in addition to the Port of Darwin infrastructure. The products from the RE Intermediate Plant will be packed in bulk bags and transported in standard shipping containers via Darwin and international shipping routes. The RE intermediate product will be shipped via standard existing container freight routes to the offshore RE Separation Plant. The cerium carbonate product will be shipped to customers by similar means.

7.2.3 LOGISTICS INFRASTRUCTURE

7.2.3.1 ROAD TRANSPORT BETWEEN NOLANS AND ALICE SPRINGS

Arafura has completed detailed modelling of intermodal movements between all points in the supply chain. Major on-road and off-road transport operators have been engaged to provide the most effective solutions for the Project. The fundamental principal of the transport and logistics strategy is to use, wherever reasonable, standardised equipment and to optimise performance within the regulatory framework. Road transport between Alice Springs and Nolans offers one such opportunity, as Northern Territory regulations permit the use of “unique combinations” of road trains, thus reducing haul costs.

Nolans’ proximity to Alice Springs, provides an opportunity to base significant maintenance and operations infrastructure associated with the road transport operation in Alice Springs as opposed to the Nolans Site. These potential development benefits to the community, as well as the impact of the road transport operation, will be included in the ongoing community consultation and transport studies.

7.2.3.2 DEDICATED CONTAINERS

The Company has used detailed modelling to define the optimal numbers of intermodal containers and ISO tanks required for the transportation needs of the Project. The existing availability and flows of the respective types of containers, combined with a review of the specialised requirements of certain containers, has resulted in a matrix model using standardised, long term lease and dedicated purpose-built units.

7.2.3.3 CONTAINER HANDLING EQUIPMENT AND HARDSTAND AREAS

The Company has used detailed modelling to define the required hardstand areas at every transfer point in the supply chain, as well as the container handling equipment required at these points. Where terminals exist, Arafura is in ongoing discussions with the terminal operators regarding the provision of a hardstand area and general terminal management and operational services.

The Company will provide for the investment to either upgrade existing facilities or construct new ones where access to public terminals is not possible or where it has has been assessed as uneconomical or restricted.

7.3 CHEMICAL PRECINCT

The selection criteria for the location of the RE Separation Plant are strongly weighted by cost and availability of strategic raw materials and reagents required for processing within the plant. All shortlisted sites are located within or adjacent to world-scale chemical precincts offering supplies of major raw materials and other services, and are near significant port facilities with well-established road and rail networks, providing robust land-based transport options.

7.3.1 IN-BOUND REAGENT SUPPLY

Locating the RE Separation Plant within a large chemical precinct offers significant supply logistics advantages through sourcing major raw materials locally. The good international port, road and rail facilities of the short-listed sites will also facilitate easier functioning of the integrated supply chain. The major liquid raw materials are expected to be supplied by pipeline networks from facilities within the chemical precinct. The relatively modest quantities of RE intermediate feedstock and other raw materials will be delivered as intermodal cargo.

7.3.2 OUT-BOUND CARGO

The outbound cargoes of separated REO products for dispatch to customers worldwide will be containerised and transported on standard intermodal cargo routes.

7.4 TRANSPORT REGULATIONS

The Nolans Project will involve movement of hazardous and dangerous goods that have clearly defined transport requirements. Arafura's logistics model encompasses materials classification and the Project's transport methodologies will comply with best practice and applicable regulatory requirements.

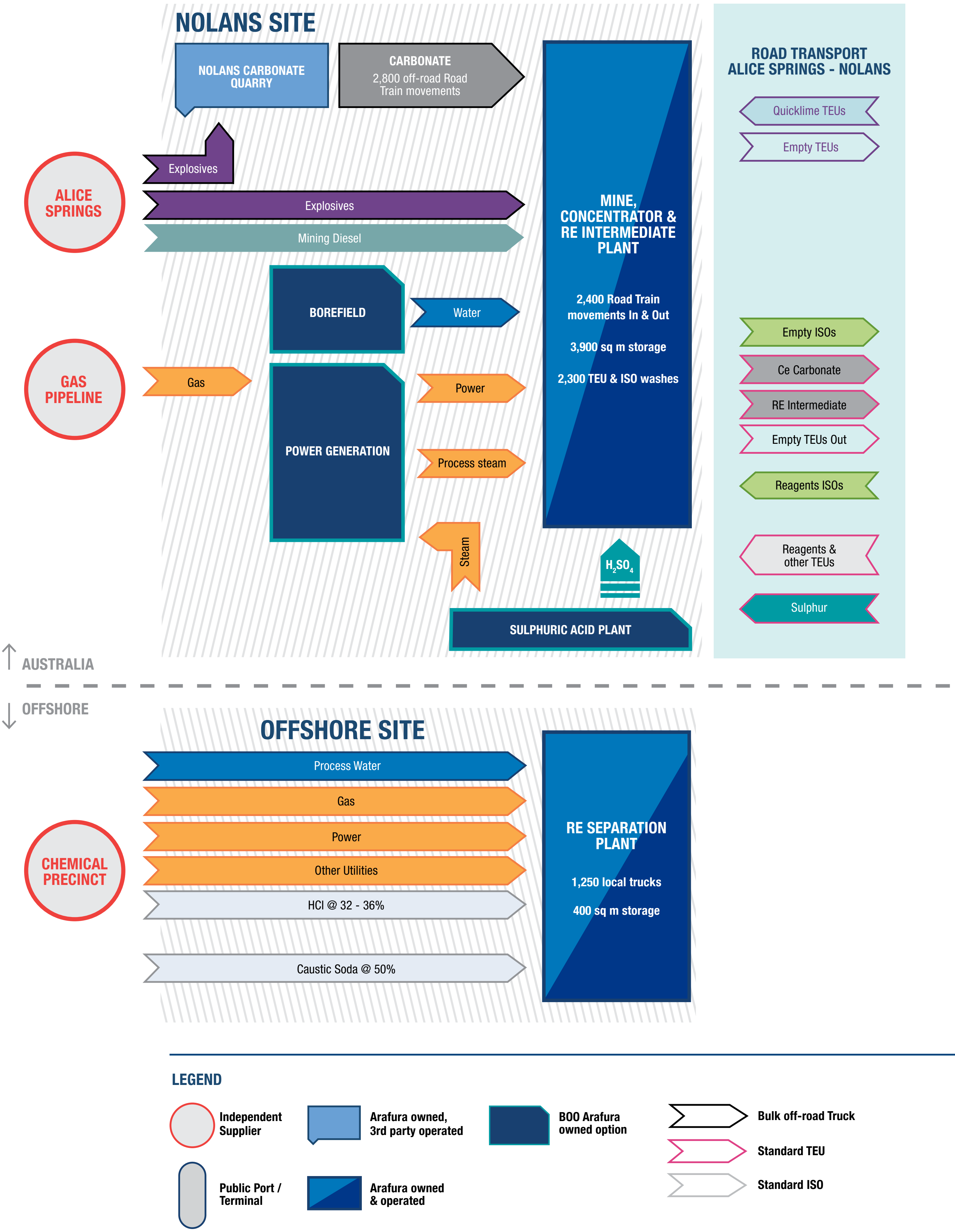
All ports, road and rail corridors that are to be utilised for the Project's logistics needs can accommodate all classes of dangerous and hazardous goods required for the Project.

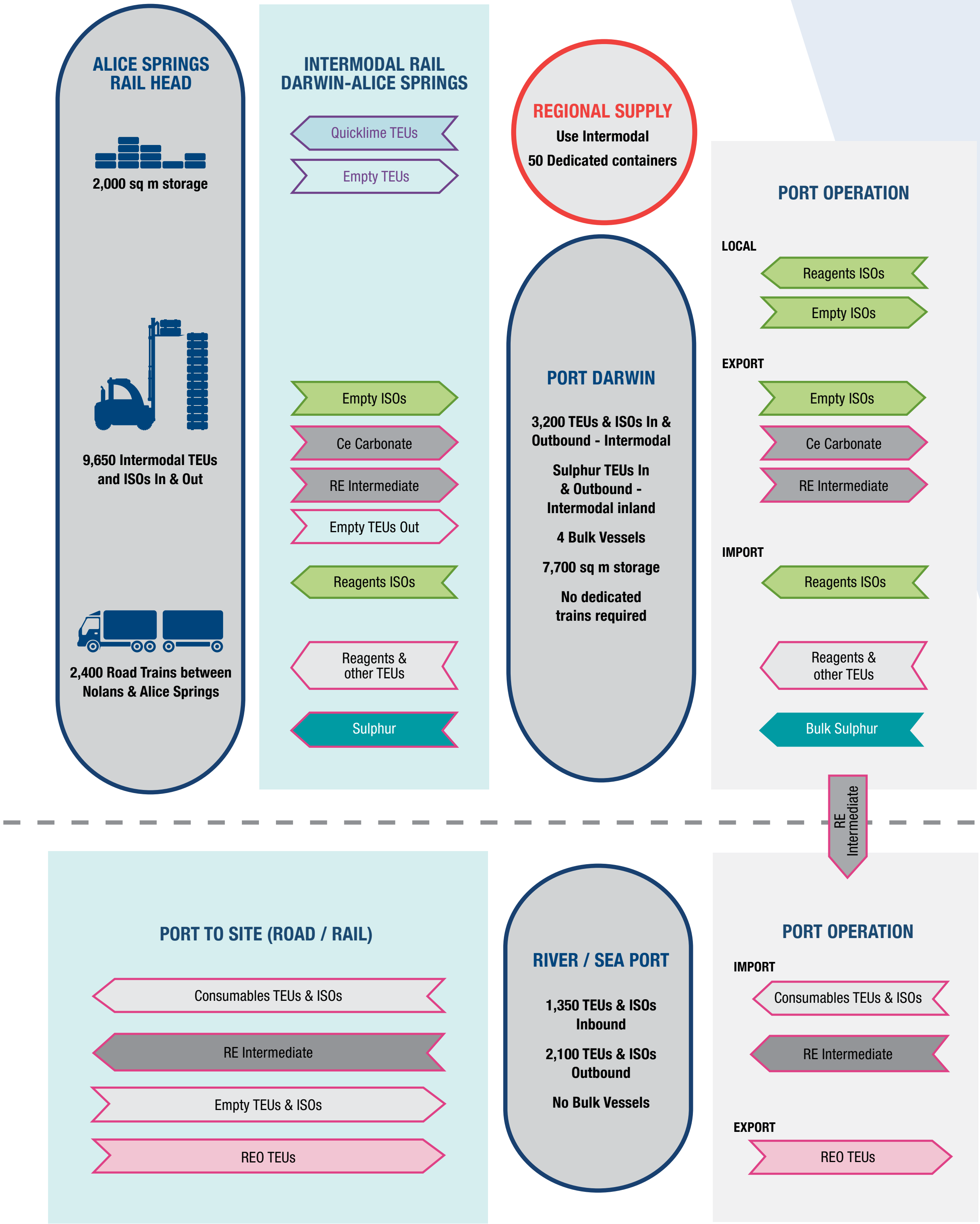
7.5 OUTSOURCING OF INFRASTRUCTURE

Arafura continues to explore opportunities to outsource non-core infrastructure and services, especially where these functions are core business to specialist service providers. This relatively common practice is particularly relevant for the ancillary plants at the Nolans Site, which include sulphuric acid production, power generation and water treatment, as well as accommodation camp requirements. The cost of these facilities are included in the capital cost estimate for the Nolans Project, but the Company will pursue and evaluate opportunities to structure the design, construction and operation of these facilities on an alternative basis such as build, own and operate ("BOO").

Figure 7.1: Logistics Flowsheet

Annual volumes and movements indicated





Arafura dedicated TEU

Arafura dedicated ISO

TEU : Twenty Foot Equivalent Unit

ISO : Intermodal Chemical Tank

8 INFRASTRUCTURE, POWER AND WATER

KEY FEATURES

- Ease of access to the transnational Stuart Highway.
- Proximity to a newly discovered groundwater resource.
- Proximity and access to a major high pressure natural gas pipeline.
- Flat topography of the area.
- Cogeneration of power from sulphuric acid plant supplemented with gas fired generation.
- Existing infrastructure to accommodate pre-construction personnel.

8.1 NOLANS SITE

8.1.1 LOCATION OVERVIEW

The Nolans Site (**Figure 8.1**) has excellent access to public infrastructure, services and utilities.

The Nolans Mine Site is located ten kilometres west of the sealed, all-weather Stuart Highway and 65 kilometres from the Darwin to Adelaide rail line.

The town of Alice Springs, with a population of 24,000, is 135 kilometres south-southeast of the Nolans Site along the Stuart Highway. The town is well served by modern road, rail and telecommunications infrastructure. Daily flights between Alice Springs and most Australian capital cities eliminates the requirement for a dedicated airstrip and associated infrastructure at Nolans.

The Amadeus Basin to Darwin Gas Pipeline passes through the Nolans Processing Site and within five kilometres of the Nolans Mine Site. Natural gas will be used for direct and indirect firing of process equipment and to generate power for the Nolans Site.

The location of the Concentrator has been fixed near the Mine and a site for the RE Intermediate Plant has been selected nearby. Access roads to and around the Nolans Site have been positioned and site buildings have been specified. A conceptual design for the accommodation village has been completed.

The Company has identified sustainable groundwater resources about 25 kilometres southwest of the Processing Site to service the Project's operational needs. Power demand has been estimated, and this will be serviced by cogeneration from a sulphuric acid plant and gas fired on-site generation.

TSFs and RSFs have been specified in Section 6 (PROCESSING) of this Development Report.

8.1.2 INFRASTRUCTURE OVERVIEW

The general layout of the Nolans Site is shown in **Figure 8.2**. The infrastructure required to support the Nolans Site has been investigated over a number of years, including by GHD (2007), Lycopodium (2010), Lycopodium (2013), Lycopodium (2014a) and Arafura (2014b). It includes:

- Site access roads, comprising:
  - Access road from the Stuart Highway;
  - Access road and service corridor between the Processing Site and the Mine Site;
  - Access road and service corridor to the accommodation village; and
  - Access track and service corridor to the borefield.
- Site buildings, comprising:
  - Administration building;
  - Concentrator control rooms and operations centre;
  - Concentrator maintenance workshop and warehouse;
  - Concentrator reagents store;
  - Dangerous goods storage;
  - RE Intermediate Plant control room and operations centre;
  - RE Intermediate Plant maintenance workshop and warehouse;
  - RE Intermediate Plant reagents and product warehouse;
  - Laboratory;
  - Security building;
  - Medical and emergency services centre; and
  - Heavy and light vehicle wash station and weighbridge.
- Borefield and raw water supply pipeline to the Processing Site and Mine Site;
- Potable water supply and sewerage treatment;
- Accommodation village (based on a 400 person requirement);
- Concentrate slurry, filtrate return and water pipelines and pumps between Concentrator and RE Intermediate Plant;
- Power supply from gas and steam turbine-generators;
- Power distribution including overhead lines, HV switch-gear and transformers from the RE Intermediate Plant to the Concentrator, accommodation village and borefield; and
- TSFs and RSFs as described in Section 6 (PROCESSING) of this Development Report.

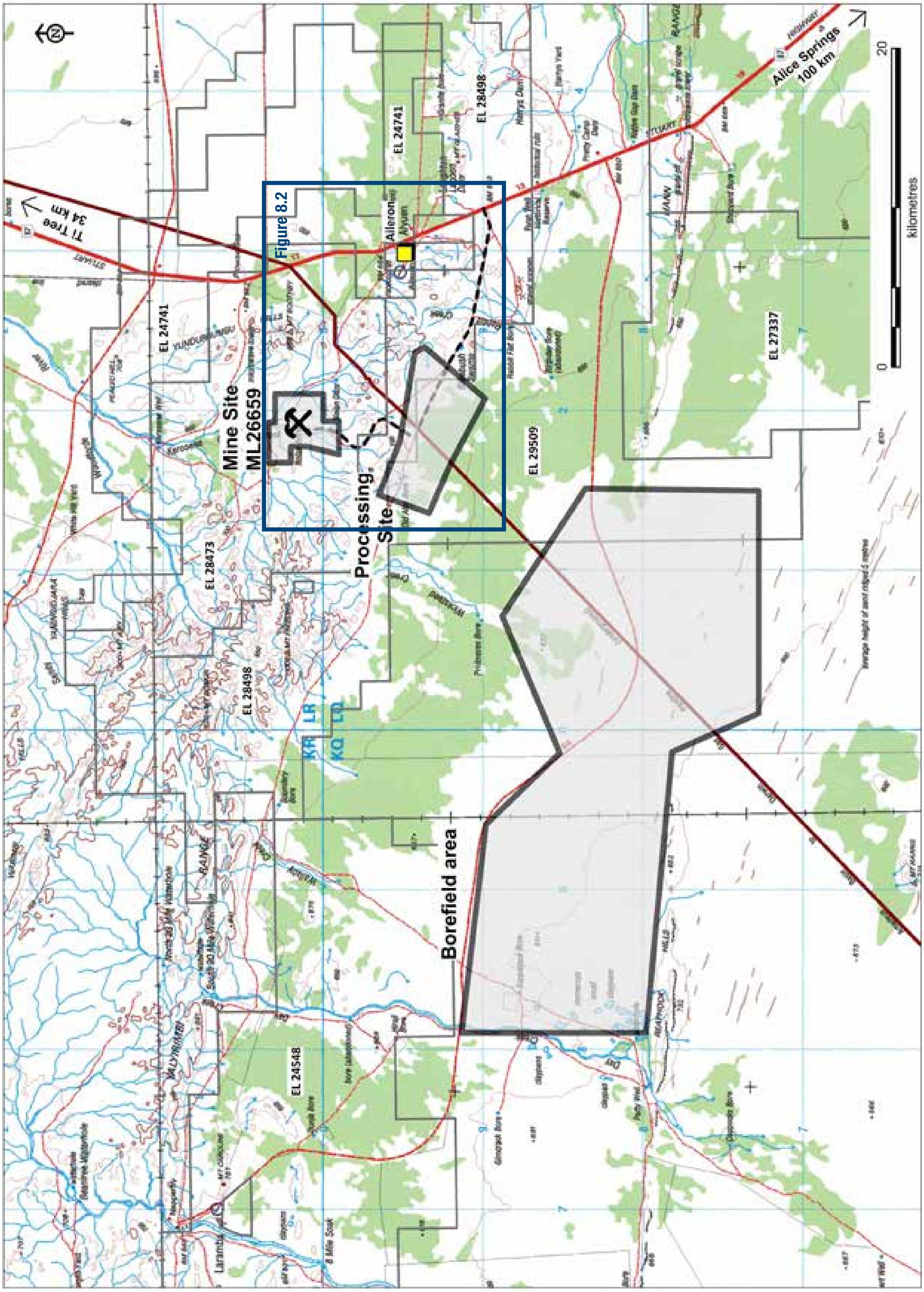
8.1.3 ROADS

Access roads for the Nolans Site include a site access road from the Stuart Highway to the Processing Site, and an access road from the Processing Site to the Mine Site. Preliminary road designs have been prepared using appropriate parameters based on their intended use and routes selected to avoid or minimise disruption to topographic features or Aboriginal heritage sites.

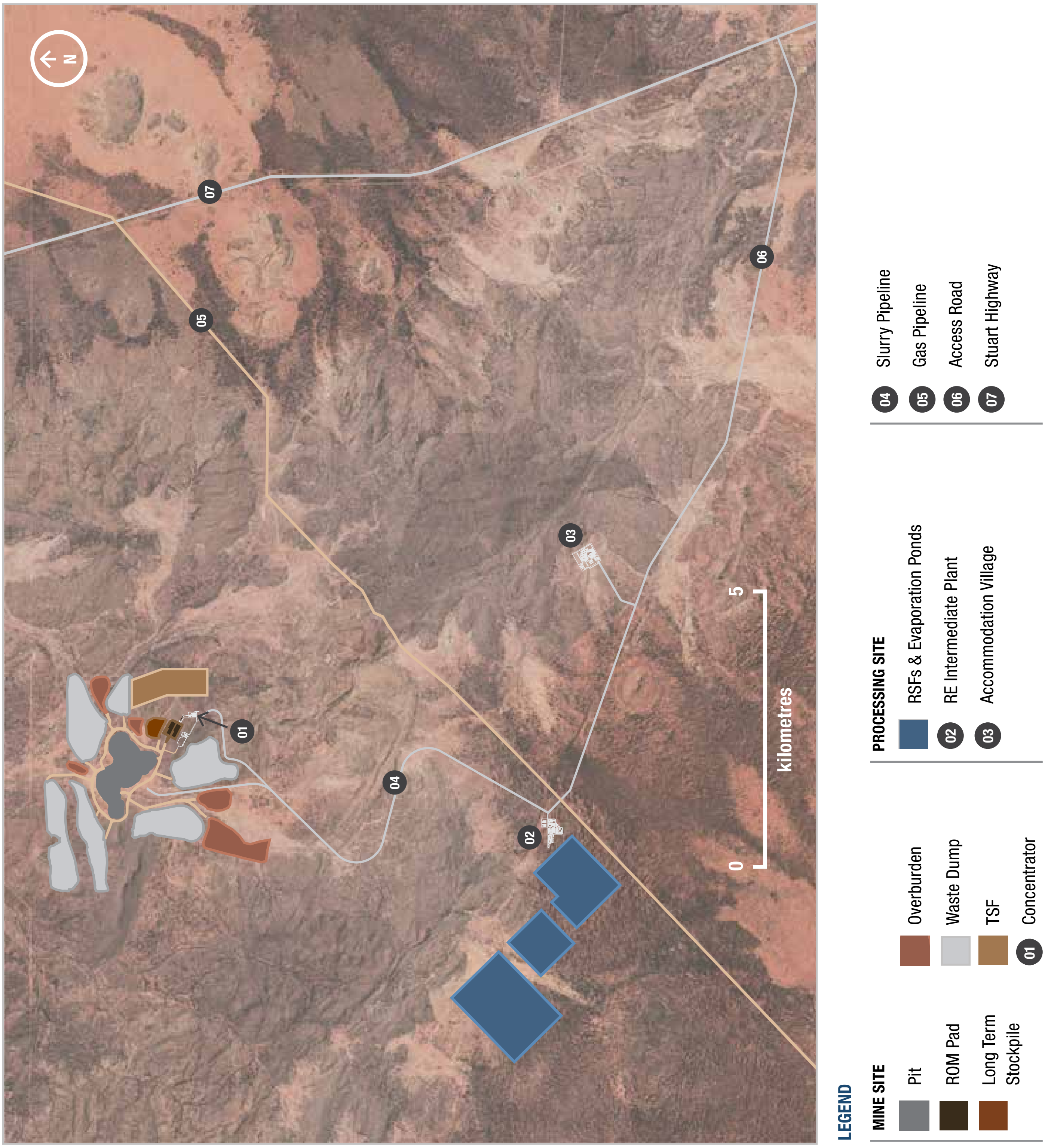
With the exception of certain sections of the concentrate slurry pipeline, all services including power, water, sewerage and communication will run within the access road corridors.

Access to the raw and potable water borefield will be by defined and established 4WD track corridors so as to minimise environmental interference. The borefield service corridor to the raw water collection pond will include a HV overhead power line in addition to raw and potable water pipelines.

Figure 8.1: Nolans Site



▼ Figure 8.2: Nolans Site General Layout



8.1.4 CONCENTRATOR BUILDINGS AND FACILITIES

All buildings and facilities will be constructed in accordance with relevant Northern Territory building regulations and codes applicable to the Nolans Site.

Concentrator plant area buildings will comprise a mix of site erected steel framed and clad buildings and transportable modular buildings. Where practicable, the buildings will be of a modular type construction that can be manufactured off site and transported to the site. Some of the larger buildings may be formed by multiples of these transportable modules or constructed on site as required.

Concentrator buildings will include:

- Plant control room;
- Crusher control room;
- Plant workshop and warehouse;
- Plant crib room, change room and First Aid facility;
- Plant ablution block; and
- Reagents storage warehouse.

8.1.5 RARE EARTH INTERMEDIATE PLANT BUILDINGS AND FACILITIES

RE Intermediate Plant area buildings will, in general, be of similar construction style to the Concentrator plant area buildings, and will include:

- Administration building;
- Emergency services facility;
- Operations centre complex;
- Laboratory;
- Maintenance workshop and stores;
- Product warehouse; and
- Reagents storage warehouse.

8.1.6 ACCOMMODATION VILLAGE

The proximity of the Nolans Site to both Alice Springs and Ti Tree (55 kilometres to the north-northeast along the Stuart Highway) facilitates a bus-in bus-out transport philosophy. The on-site personnel needs of the Mine, Concentrator and RE Intermediate Plant have been estimated using a 400-person accommodation village. Overflow accommodation needs are likely to be met by the nearby Aileron Roadhouse.

The accommodation buildings have been set back to the rear of the site and the central facility buildings and utilities have been located at the front where they will be easily accessible for delivery vehicles. A light vehicle parking area will be located in front of the facility, as will bus drop off and pick up areas.

The Nolans Site is distant from labour and trades personnel, and this dictates that the most practical construction system for the village will be prefabricated transportable buildings. Similar to the plant building, these buildings are mostly of a modular type construction with larger buildings being multi-module style. They will use a range of noise and thermal insulation techniques to provide comfort and minimise operating costs.

The central facility buildings will include the following:

- Kitchen dining building complete with freezer and cool room storage for food. The kitchen will have capacity to comfortably cater for up to 400 people at up to 100 percent occupancy;
- Village administration building, office and shop; and
- Recreation building that provides a range of functions including inductions during construction, meeting hall and general assembly building.

Accommodation buildings will generally be provided as single module structures with a number of accommodation units per building. Each unit will comprise a small bed sit room and an ensuite bathroom with shower, toilet and basin. A small number of larger size rooms will be provided and these rooms will have separate bed and sitting rooms with facilities to allow personnel to use the accommodation as office space. Two accommodation rooms for disabled persons have also been included in the building design. A gymnasium and lap swimming pool have been included for recreation.

Utilities services to be provided to the village include:

- Potable water;
- Fire systems;
- Sewerage;
- Power; and
- Communications.

Power will be generated at the RE Intermediate Plant site and transmitted to the village by overhead high voltage (11 kV) conductors. At the village there will be a kiosk substation from where power will be distributed below ground at low voltage (415 V). While the process plant is under construction, power will be generated at the village using diesel or gas generator sets which will also provide longer term emergency power for the village.

An additional 500-room temporary camp will be leased over the Project's construction period.

8.1.7 WATER SUPPLY

8.1.7.1 OVERVIEW

The Company's investigative work in the Southern basins area south-west of the Nolans Processing Site (see Section 3.4: HYDROGEOLOGY) has defined a sizeable, high-yielding, slightly brackish groundwater system that has the capacity to service the life of the operation. The Southern basins offer a viable sustainable alternative and preferred supply to the Ti Tree Water Control District (located north-east of the Nolans Site – see **Figure 3.5**) for the following key reasons:

- Standard regulatory requirements cover this area;
- Limited competing resource users, and none from the horticultural sector;
- No dependent community relying on this area for water supply; and
- No known groundwater dependent ecosystems within this northern part of the Southern basins.

The demand for raw water for the Nolans Site lies in an expected range of 4.0 to 6.2 Gl per annum, and this includes a minor demand for potable water. The Company expects that this supply will be drawn from a number of borefields located up to circa 35 kilometres from the Processing Site as shown in **Figure 8.1**.

8.1.7.2 RAW WATER SUPPLY

The raw water demand for Nolans will be supplied from a number of active bores within the borefield area. The Company intends that the bores will be distributed spatially across the borefield area to ensure the aquifer system is managed sustainably. The bores will pump to a centrally located collection point and then water will be pumped in a main pipeline to the RE Intermediate Plant.

The bore pumps will each be located within a fenced compound containing the head works, manifold, power and control equipment and power supply. Bores will be remotely monitored by the telemetry system.

A staged pumping system with an intermediate pond and transfer pumping facility has been selected. This system and the associated network of bores will be controlled remotely from the RE Intermediate Plant.. The transfer pipeline from the intermediate pumping station to the RE Intermediate Plant will run within the access track and overhead power line corridor.

8.1.7.3 POTABLE WATER SUPPLY AND TREATMENT

The Company anticipates that the raw water demand for potable uses can be supplied from the northern part of the borefield area via a dedicated transfer pipeline to a treatment facility at the RE Intermediate Plant. An alternative option of using the main raw water supply is also available.

The raw water will be treated by a filtration and treatment system rated at approximately 250 m^3 per day.

8.1.7.4 WASTEWATER TREATMENT AND DISPOSAL

Wastewater from the accommodation village and non-process wastewater from the Processing Site and the Mine Site will be pumped to a common sewage treatment plant located adjacent to the RE Intermediate Plant. The pipelines will be located within defined road service corridors.

The sewage treatment plant will be a package type unit providing the appropriate level of treatment.

8.1.8 CONCENTRATE PUMPING

The optimum approach to transferring concentrate from the Concentrator to the RE Intermediate Plant is by means of a relatively simple single pumping stage slurry pipeline (Lycopodium, 2013). The normal design parameters of mass transfer rates, solids loading, sedimentation rates and re-suspension conditions have been considered in the definition of this pumping system.

8.1.9 GAS SUPPLY

The high pressure gas pipeline from the Amadeus Basin to Darwin passes through the Nolans Site. The Company's engagement with the pipeline operator and a number of existing and prospective producers injecting into the system provides it with confidence that a long-term gas supply opportunity can be established for Nolans.

The close proximity of the Nolans Site to the gas pipeline eliminates the need for a significant offtake connection pipeline. The supply capacity and capability easily exceed the Project's process gas demands, predominantly for sulphation and drying duties, and power generation demands.

8.1.10 POWER

8.1.10.1 POWER DEMAND

The power demand for the Nolans Site is summarised in **Table 8.1** and has been estimated from detailed load lists for the various areas of the plant in a consistent and integrated manner.

Table 8.1: Nolans Site Power Demand Estimate

Area	Operating Load MW
Mine and Concentrator	9.0
RE Intermediate Plant	8.0
Infrastructure assets including accommodation village and water supply	1.5
TOTAL	**18.5**

Acid plant vendor-supplied information indicates that the sulphuric acid plant should deliver a net power output of approximately 6 MW over and above its internal consumption requirements.

8.1.10.2 POWER SUPPLY AND GENERATION

There is no local grid supply opportunity in the Nolans region. The sulphuric acid plant associated with the RE Intermediate Plant will generate power via a steam turbine from the steam arising from burning sulphur. This is a common feature of sulphuric acid plant design. The Nolans Site will require additional power over and above that available from the sulphuric acid plant and it is planned that this will be generated by a gas turbine facility. In addition, this facility will also maintain site operating capability during acid plant or steam turbine/generator outages.

The aforementioned load and generating capacity from the waste heat of the sulphuric acid plant leaves a normal operating natural gas fired generation requirement of approximately 12.5 MW, which is planned to be supplied by a single combined cycle gas turbine based generator set. This is expected to provide the optimum steam/power demand flexibility for the site.

In addition, emergency diesel generators will be located at each of the three principal Nolans Site areas (Mine and Concentrator, RE Intermediate Plant and the accommodation village) to maintain safety emergency power requirements for personnel, and safety critical drives in the event of a major power outage. RE Intermediate Plant emergency generators will also provide black start capability.

8.1.10.3 POWER DISTRIBUTION

The power plant will be located at the RE Intermediate Plant site adjacent to the sulphuric acid plant. The site layout requires power to be distributed to the Mine and Concentrator area (approximately 10 kilometres north of the proposed generation facility), the raw water collection pond (approximately 13 kilometres south west of the proposed generation facility) and the accommodation village (approximately 5 kilometres east of the proposed generation facility).

The power will be transmitted by HV overhead lines from the RE Intermediate Plant to the site users via kiosk substations. In total there will be approximately 30 kilometres of overhead lines.

8.1.11 COMMUNICATIONS

The Nolans Site communications networks will comprise multiple systems designed for the required functionality, security and integrity. These systems include:

- Nolans Site-wide control system network including telemetry links for remote control and monitoring;
- Wide area network linking national network and corporate functions;
- Local area network (business);
- Telephony and VOIP;
- Radio system;
- Mobile phone network; and
- Village entertainment network.

The cable infrastructure for these systems will use defined access and infrastructure corridors. Other radio/microwave transmission and receiving structures will be mounted wherever possible on other multi-use structures.

8.2 CHEMICAL PRECINCT

8.2.1 LOCATION OVERVIEW

The development of an RE Separation Plant within an established offshore chemical precinct is an integral part of the Nolans Project. The high purity and modest quantity of RE chloride feedstock from the RE Intermediate Plant reduces the complexity and processing requirements of the RE Separation Plant and the supply chain is simplified by processing the feedstock close to raw materials supply sources.

The Company has identified and investigated locations for the RE Separation Plant in Asia, the USA, the Middle East and Western Europe (Arafura, 2013m). Each location offers substantial capital and operating cost savings compared with an Australian-domiciled scenario. As a prerequisite for consideration, all of the shortlisted sites offer excellent infrastructure opportunities with established road, rail and port facilities in the immediate area. The chemical precincts under consideration offer significant synergies with respect to established distribution infrastructure for major raw materials and utilities. The selection of a world-scale chemical precinct eliminates the need for Arafura to construct and operate dedicated chlor-alkali and hydrochloric acid production facilities by leveraging existing local production and distribution capabilities for the liquid bulk materials.

8.2.2 INFRASTRUCTURE OVERVIEW

The shortlisted locations are in areas of substantial chemical plant development and the infrastructure requirements are considerably different to the Nolans Site development in Central Australia. The infrastructure required to support the RE Separation Plant is detailed in Lycopodium (2014b).

The RE Separation Plant buildings comprise the following:

- Administration building;
- Operations centre including laboratory;
- Maintenance workshop and stores;
- In-bound warehouse;
- Product warehouse;
- Dangerous goods storage; and
- Site security and weighbridge.

8.2.3 SITE SERVICES

The selection of a location within an established chemical precinct minimises the requirement for dedicated infrastructure for general site services. All potential sites offer multiple services and supplies, such as treated water from utility suppliers and third party waste water treatment facilities.

Power demand for the RE Separation Plant is relatively modest (**Table 8.2**) and has been estimated in a manner consistent with the demand estimate for the Nolans Site. Power will be supplied to the RE Separation Plant by a third party utility supplier or via the local grid, with on-site generation requirement limited to emergency power needs (circa 150 kW).

The close proximity of several chemical processing facilities offers synergy of supply of principal reagents via a multiple user distribution pipeline network. Natural gas is distributed via pipeline in the locations under consideration.

Communications and transport infrastructure are well established in all shortlisted locations.

▲ Table 8.2: RE Separation Plant Utilities Demand

Service / Utility	Requirement
Power running load	0.8 MW
Treated water	500,000 m^3 pa
Waste water treatment	538,000 m^3 pa

8.3 SUMMARY

The infrastructure requirements for the Nolans Project are well defined. Studies on roads, buildings, communications, TSFs and RSFs, and water and power supply have been completed.

Further refinement and detailed definition will be included in the DFS, and the site specific requirements of the RE Separation Plant will be defined when its precise location is finalised.

9 ENVIRONMENT, HEALTH, SAFETY AND COMMUNITY

KEY FEATURES

- The Nolans Project will operate under well-defined regulatory frameworks, both within the Northern Territory at the Nolans Site, and in an offshore location where the Company intends to build and operate an RE Separation Plant.
- The Northern Territory is a jurisdiction familiar with mining and mineral processing operations similar to Nolans. The current Project configuration will minimise transport and simplify management of waste residues.
- Arafura has developed a comprehensive knowledge of the environmental and community setting around the Project. No significant issues that could adversely impact on the Project's regulatory approval have been identified.
- The Company has completed a number of baseline environmental studies at the Nolans Mine Site to an advanced stage. The balance of studies for other aspects of the approvals process has been scoped in readiness for implementation.
- Framework discussions aimed at formalising the Project's Indigenous Land Use Agreement are ongoing and the Company's relationship with the traditional native title custodians and their representatives remains sound.
- Community relations, engagement and acceptance of the Nolans Project have been very positive.

9.1 INTRODUCTION

Arafura has carefully considered and committed significant resources to investigating the impact of the Nolans Project on the local and broader environment, and on the communities within which the Project will operate. The Project has undergone a number of scope and configuration changes since conception and this has affected the focus and continuity of its environmental and community engagement programs. Substantial work to feasibility-level standard has been completed at the Nolans Site since 2006 and the essence of this work is captured below in Table 9.1.

▲ Table 9.1: Nolans Site Environmental and Community Studies

Date	Work Program	Status	Reference
2006	Nolans Mine Site detailed archaeological survey	Ongoing	Gunn (2006)
	Flora and fauna surveys of the Nolans Mine Site	Ongoing	Low Ecological Services (2006)
	Radiation management plan and manual	Ongoing	Radiation Advice & Solutions (2006a), (2006b)
	Personnel radiation dose monitoring	Ongoing	Radiation Advice & Solutions (2006-2012)
2007	Siting study for disposal and storage of thorium and other process residues from Nolans	Ongoing	Environmental Earth Sciences (2007)
2008	Notice of Intent for Nolans Project	Complete	GHD and Arafura (2008)
	Water supply evaluation – Ti Tree Basin	Complete	GHD (2008)
	Economic and social impact of the Nolans development	Ongoing	ACIL Tasman (2008)
2010	Hydrological open pit dewatering	Ongoing	Environmental Earth Sciences (2011)
	Archaeological survey of the Mine Site and haul road corridor	Ongoing	EarthSea (2010)
2011	Mine Site flora and vegetation assessment	Complete	GHD (2011a)
	Mine Site flora and fauna assessment	Ongoing	GHD (2011b)
	Noise and vibration assessment	Ongoing	GHD (2011c)
	Stygofauna pilot survey	Ongoing	GHD (2011d)
2012	Southern basins groundwater investigation drilling and monitoring – Stage 1	Complete	Centreprise (2013)
2014	Southern basins groundwater investigation drilling and monitoring – Stage 2	Ongoing	-

The Company maintains a "bottom-up" approach to its community engagement strategy. The most important and best informed stakeholders in the Project are the Central Australian communities that live and work closest by. At the same time, the Company's "no surprises" philosophy in its dealings with other important stakeholders, such as the relevant Australian, Northern Territory and local government agencies and statutory authorities, underpins its close working relationship with these groups.

9.2 NOLANS SITE

9.2.1 REGULATORY APPROVALS PROCESSES

The Nolans Site is subject to government approvals processes stipulated by the Australian and Northern Territory ("NT") governments. These governments have determined that the appropriate level of assessment for the Project's environmental approvals at the Nolans Site is an Environmental Impact Statement ("EIS").

The environmental approvals process in the NT (**Figure 9.1**) is well defined and has been rigorously tested by many resource project proponents. Based on Arafura's experience and from discussions with regulators (the NT Government's Environment Protection Authority ("EPA"), Department of Mines and Energy ("DME") and Department of the Chief Minister ("DCM"), and the Australian Government's Department of the Environment) the approvals process for the Nolans Project is expected to take 12-18 months to complete. This timeframe includes the EIS assessment process under both the NT's *Environmental Assessment Act* and the Australian Government's requirements under the *Environment Protection and Biodiversity Conservation Act* ("EPBC Act").

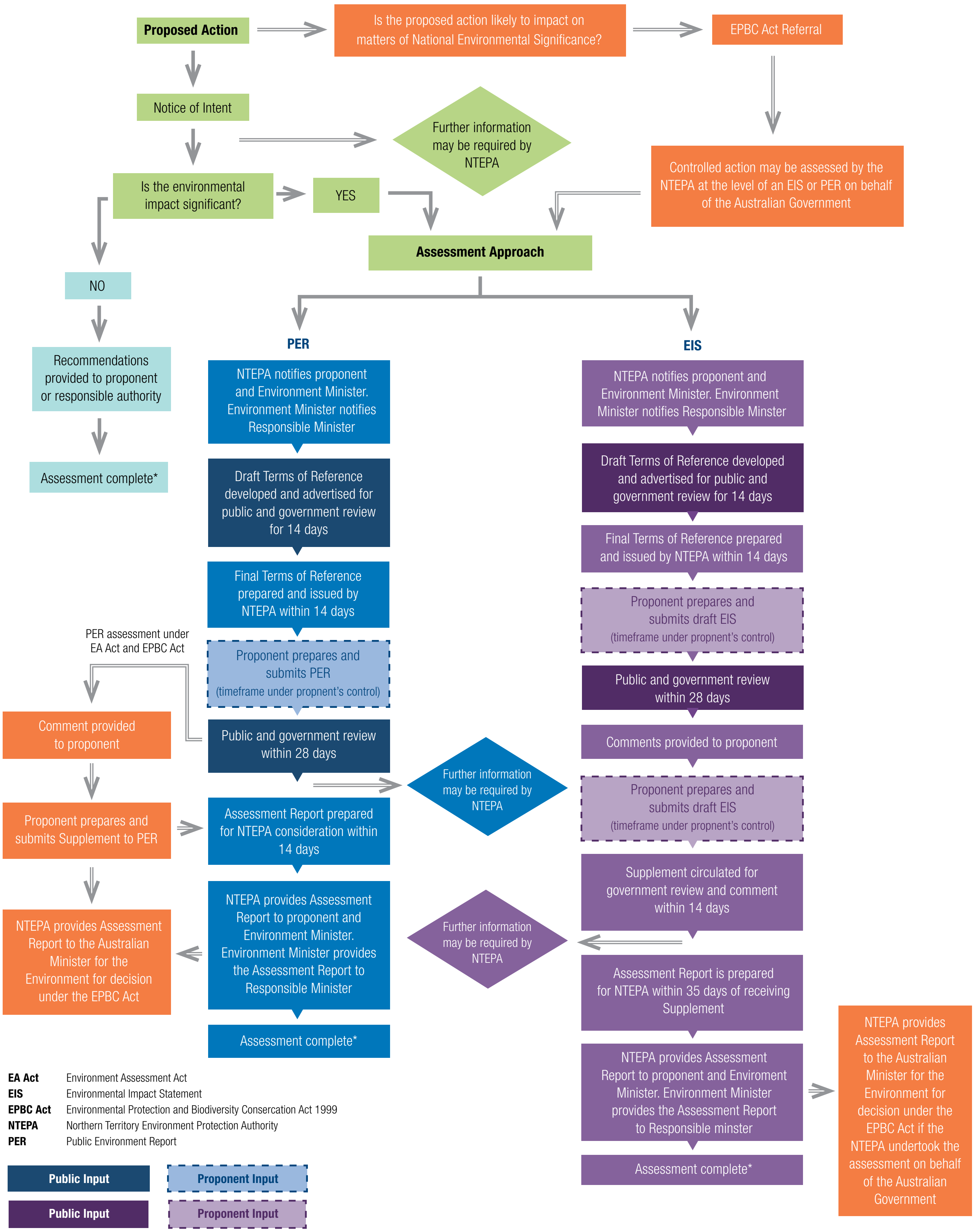
Arafura lodged a referral under the EPBC Act in 2008 to cover the Nolans Mine Site, and a determination was made that the Project was a controlled action because of the presence of radioactive materials uranium and thorium. The Australian Government subsequently made recommendations to the NT Government and its requirements were merged with the NT EIS approval guidelines. These guidelines were issued in November 2008, and were subsequently revalidated until December 2014.

The EPA has indicated that the existing guidelines will require review and potentially minor amendment to ensure that, in addition to the Mine Site, the EIS addresses all impact aspects for the Nolans Processing Site, workers camp, borefield, and all access corridors to the Nolans Site and borefield. In response, the Company is preparing an amendment document to facilitate a guideline review by the EPA, leading to the reissue of guidelines that will extend the EIS submission date by two years to December 2016.

The Nolans Project has been awarded Major Project status by the DCM. This affords the Nolans Project a designated case officer who has carriage of coordinating a whole-of-government streamlined response to the approvals process.

Figure 9.1: Northern Territory Environmental Impact Assessment Flow Chart.

Figure courtesy of the Northern Territory Environment Protection Authority.



*The decision in accordance with the EAAP (Environmental Assessment Administrative Procedures) is subject to clause 14A and 15 of the EAAP.

The NT regulatory framework also requires compliance with a number of prescribed Australian Government codes and standards, and this ensures a uniform national approach to specific management processes. One such code that is directly relevant to the Nolans Project covers the transportation and management of radioactive materials. The NT has several mature mining operations that operate effectively under these regulatory frameworks. They include the Ranger Uranium Mine.

The regulatory environment authorising access to groundwater in the Northern Territory is the sole responsibility of the NT Government. Current mining legislation enables "as of right" access to water for mining and mineral processing. The Company considers that approval to access and abstract a sustainable water supply from the Southern basins will be relatively straightforward. Applications have been made to the relevant NT regulators to secure groundwater resources from the Southern basins to meet the Project's anticipated water supply requirements.

9.2.2 SCOPE OF EIS ASSESSMENT WORK

The current environmental assessment guidelines for the Nolans Mine Site broadly characterise baseline environmental information and assesses impacts on the Nolans Mine Site and adjoining areas. The guidelines specify a comprehensive list of requirements that cover all the environmental and community aspects of the Project that must be addressed. They include:

1. Hydrology;
2. Air Quality;
3. Noise and Vibration;
4. Waste Rock and Residue Management;
5. Radiation;
6. Indigenous Foods and Trophic Transfer;
7. Flora;
8. Fauna;
9. Groundwater Fauna;
10. Archaeology;
11. Greenhouse Gas;
12. Sustainability and Climate Change;
13. Social and Impact Assessment including Risk;
14. Economic Impacts; and
15. Mine Rehabilitation and Closure.

As the Project has now been reconfigured with expanded operations near the Mine Site, the guidelines will now be broadened to include:

- The Nolans Processing Site;
- The logistics access corridor from the Nolans Mine Site to the Processing Site then to a rail head via the Stuart Highway;
- The water supply borefield located southwest of the Processing Site in the Southern basins;
- A carbonate quarry to provide some of the raw material for processing at the RE Intermediate Plant; and
- The general region included within scope for specific studies (such as social impact assessments), including communities at Aileron, Alyuen, Ti Tree and Alice Springs.

9.2.3 NOLANS MINE SITE

Arafura engaged environmental consultants in 2008 to scope, define and compile the Nolans Mine Site EIS. These studies encompassed fifteen technical studies, ten of which require baseline characterisation field programs or data collation. **Table 9.1** provides a summary of these and other EIS-related studies undertaken at the Nolans Site since that time.

Field work, data collection and collation for baseline characterisation studies have been largely completed with longer-term baseline data collection ongoing. This includes climate data (**Figure 9.2**), emissions data from dust deposition gauges, and standing water level and water quality data from selected groundwater bores downstream of the Nolans Mine Site within the Ti Tree Basin.

▼ Figure 9.2: Weather Station at Nolans Mine Site

The main outcomes of some of the key studies are outlined below.

Hydrology: The development of the Nolans Mine will require dewatering of the local aquifer. Studies completed on this aspect of the Project show that the ore body is highly porous and transmissive and that the Nolans aquifer is limited in its lateral extent and, in effect, is constrained to the ore body (EES, 2010). Accordingly, dewatering of this groundwater system to enable the mining process will be relatively straightforward and can be achieved using production bores or a simple 'in pit' pump system. Additionally, because this aquifer is constrained, there will be no downstream impact on the Ti Tree Basin, some 25 kilometres to the north, due to pit dewatering.

The Nolans Mine Site lies in the headwaters of the Woodforde River drainage system that flows across the western extension of the Ti Tree Basin. For this reason, the Mine Site will be designated a non-release site and the Company must demonstrate that its activities will not impact the basin. Studies have been implemented to investigate the quality and quantity of water falling on and shedding off the Mine Site area to support the development of appropriate catchment strategies into the mine design.

The ephemeral Kerosene Camp Creek transects the north-western part of the Nolans open pit development and will require a diversion. Work is continuing to determine the best location for this diversion. To aid in its design and that of the Mine Site water management system, the Company is acquiring data from a series of seventeen monitoring stations and water samplers that it has installed within the Mine Site drainage system (**Figure 9.3**). Once constructed and flows are redirected, the diversion is anticipated to impact a small downstream section of riparian vegetation. Data collection is ongoing well downstream of the Mine Site and within the Ti Tree Basin itself to ensure that the pre-development hydrological environment is recorded and understood.

Figure 9.3: Water Monitoring Station in Kerosene Camp Creek

Air Quality: No issues regarding air quality are anticipated. The nearest receptor to the Mine Site is located at Aileron Roadhouse, about 12 kilometres to the east, placing it upwind of the prevailing (85% of the time) south-easterly wind. The nearest major downwind receptor of the Nolans Site is the small Laramba community about 50 kilometres to the west. Considering the substantial distance to this community, dust will not present any concerns.

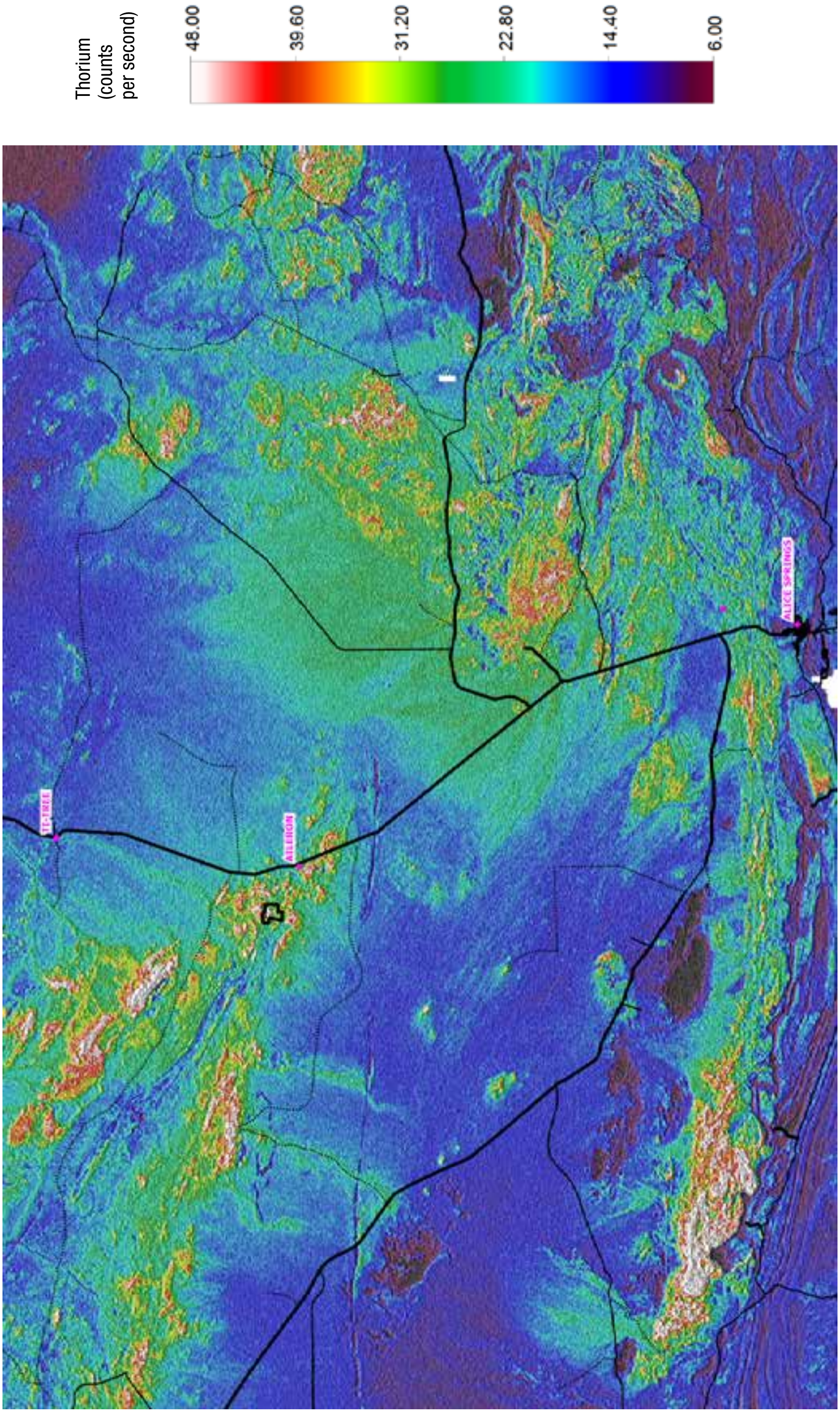
The only issue raised by stakeholders to date has been the radioelement content of dust from the mining operation. The Company has reviewed studies from other sites where the mining process generates radioelement-bearing dust. These studies show that the plume generated during mining is confined to a halo around the open pit with a bias in the downwind direction primarily because of the specific gravity of the dust particles. They also show that the radioelements are almost undetectable downwind beyond 500 metres of the pit edge, and that, as the open pit deepens, the halo retreats towards the pit edge.

Noise and Vibration: Measurements have been taken at the nearest receptor at Aileron Roadhouse to determine background noise levels. Considering the distances involved, the Company is confident there will be no discernable noise from mining or processing operations. Work has also been undertaken on the potential for vibration at this receptor. Vibration impacts from the operations are not expected due to the distance from the Nolans Site, the local geological environment, and the nature of the ore and waste rock (GHD, 2011c).

Radiation: The level of natural radiation over the Nolans Bore deposit is an order of magnitude greater than the average background radiation level across Australia, but not unusually high when placed in the context of the local region (**Figure 9.4**).

Figure 9.4: Gamma radiation from naturally occurring sources of Thorium.

Detector mounted in aircraft flying at an average height of 60 metres above the ground.



Radioactive materials management is an important issue that will be addressed in the EIS approvals process. The Company has generated a very substantial baseline dataset for use in monitoring and management of radioelements at the Nolans Site and its corresponding footprint. This dataset includes:

1. High resolution gamma radiometric airborne survey over the Nolans Mine Site and the region more generally. This survey was completed at 50 metre-spaced flight lines at an elevation above ground of 30 metres;
2. Transect-based systematic soil and radon sampling program across the deposit (Arafura, 2008b);
3. Extensive biogeochemical surveys over the deposit and regionally following selection of representative vegetation types. These surveys accurately delineate the deposit footprint and will assist in monitoring and quantifying potential future impacts resulting from the Nolans development. The biogeochemical data set also provides an excellent resource to understand and quantify any potential food chain assertions that stakeholders may raise;
4. The Company has rigorously documented and quantified worker exposure to radioactivity over consecutive exploration campaigns at Nolans Bore during 2005-2012 (RAS, 2006-2012). This data will be used to extrapolate likely effective doses across a range of future activities and professions at the Mine, Concentrator and RE Intermediate Plant, and assist in implementing appropriate management strategies from an occupational health and safety ("OH&S") perspective;
5. Work completed on the chemical composition and stability of waste rock material types in the natural environment indicates that they present a minor and manageable risk. The next phase of work is to characterise and delineate waste rock on the basis of radioactivity levels (see Section 3.3.2: WASTE ROCK). Following this phase of work, the stability of the material types will be investigated, leading into waste rock dump design. The Australian Government's Australian Radiation Protection and Nuclear Safety Agency ("ARPANSA") guidelines on radiation protection and radioactive waste management in mining and mineral processing (ARPANSA, 2005) will be used as a basis for management protocols during design and operations.

Flora: There are no species of significance identified, located or assessed within the area of the Nolans Mine Site or along the designated access corridors.

Fauna: Surveys by Low (2006) and GHD (2011b) have identified two classified vulnerable fauna species, the Black Footed Rock Wallaby and the Australian Bustard (**Figure 9.5**). Despite being relatively abundant in the local region, both species are limited to a very small part of the proposed development area: the rock wallaby to the rocky hills around the perimeter of the Mine Site, and the bustard in the sand plains along the former haul road route east of the Stuart Highway. The Project configuration has now changed, resulting in the removal of the haul road, so that it is now very unlikely that any habitat of the bustard will be impacted by the Nolans development, and no further work related to this species is planned. Investigations into, and assessment of, favourable habitat for the rock wallaby are ongoing in light of the planned placement of waste rock dumps in close proximity to hills adjacent to the Mine Site.

Figure 9.5: Black Footed Rock Wallaby and Australian Bustard

Groundwater Fauna Background surveys have been completed on the Nolans aquifer to determine the presence of stygofauna (GHD, 2011). No species were detected during the survey. Further surveys may be required on shallow calcrete aquifers located two kilometres southwest of Nolans Bore as these represent more favourable habitat.

Archaeology: A number of Aboriginal heritage sites were recorded during field surveys of the Mine Site area by Gunn (2006) and EarthSea (2011). The sites of greatest significance will be quarantined from Arafura's planned development activities but others, for example those within or immediately adjacent to the Nolans open pit, will be destroyed or relocated following due regulatory process and in collaboration with local traditional native title custodians. In addition to these surveys the NT Government's Aboriginal Areas Protection Authority ("AAPA") and the Central Land Council ("CLC") have completed heritage surveys over the Mine Site area.

Other: Work that has been completed on the remaining five environmental and community aspects of the Project requiring assessment under the EIS guidelines will be expanded to take account of the scope and scale change of the Project. No significant issues are expected in relation to any of these studies.

9.2.4 NOLANS PROCESSING SITE

The Nolans Processing Site comprises a large-scale chemical processing facility (the RE Intermediate Plant), a number of ancillary plants (such as a sulphuric acid plant, water supply, tailings storage and a power plant), and other infrastructure. The Company does not expect that the Processing Site will be designated a major hazard facility. Some of the general studies required for the Mine Site EIS are being expanded to include the Processing Site and others require more detailed site specific work.

Hydrology: The preferred location of the Nolans Processing Site is in the Southern basins catchment at the headwaters of that drainage system. This location removes the risk of adverse impact on distant horticultural and pastoral activity in the Ti Tree Basin catchment and water control district.

The Processing Site is positioned on shallow basement rocks, and this location results in a much higher level of safeguard against potential leachate escape. Furthermore, drilling by the Company indicates that the likelihood of groundwater below the Processing Site is remote.

Water sampling stations have been established in a number of poorly developed drainages downstream of the Processing Site to provide pre-development surface water quality and flow data.

Air Quality: A detailed study to characterise and quantify potential emissions from the RE Intermediate and ancillary plants is required to demonstrate that appropriate management processes are included in the design of the plants to manage and mitigate potential impacts of these emissions on air quality.

Residue Management: The RE Intermediate Plant will generate significant quantities of process residues, some radioactive, and it is intended that these residues will be managed for disposal and long-term storage at the Processing Site. Arafura's extensive beneficiation and RE extraction testwork programs (see Section 5.2: BENEFICIATION TESTWORK and Section 5.3: RE EXTRACTION TESTWORK) have enabled the Company to develop a sound understanding of the composition and chemical and physical stability of these residues. A key study is required to characterise their long-term behaviour in the natural environment to ensure that RSFs are engineered and managed appropriately during and post operations. It is likely that, subject to the results of ongoing studies, all process (including radioactive) residues will be disposed into RSFs using sub-aqueous deposition. This practice eliminates dust emissions and minimises radioactive shine. At closure, standard and accepted practice in the mining industry is to cover TSFs/RSFs with a layer of benign stable rock to reduce radioactive shine and limit erosion (EES, 2007; GHD, 2012).

Fauna and Flora: Baseline surveys for fauna and flora at the Processing Site will commence soon. However, based on local knowledge and observations at the site, the vegetation types are well represented both locally and regionally (**Figure 9.6**) and are unlikely to contain unique species. In regard to fauna, the wildlife habitat in the area is also likely to be well represented both locally and regionally. Consequently, the Company believes that the Processing Site is very unlikely to host fauna or flora species that are designated vulnerable or threatened.

Figure 9.6: Typical Landscapes at the Nolans Site

Top: Nolans Mine Site, looking west from the location of the Concentrator

Bottom: Nolans Processing Site, looking south-east from the location of the RE Intermediate Plant

Archaeology: Heritage surveys will be completed for the areas corresponding to the Processing Site, accommodation camp and borefield, and the access corridors between the Mine Site and the Processing Site, and between the Stuart Highway, Processing Site and the borefield (**Figure 8.1**). The Company has a clearance certificate from the AAPA covering all of these areas. This clearance certificate identifies ten Aboriginal heritage sites, all of which will be avoided by the Project's infrastructure development activities.

Transport: An additional area of study will be the transport and logistics impact on roads, facilities and communities, considering the significant number of reagent and freight movements necessary to meet the Project's requirements (see Section 7: PROCUREMENT, TRANSPORT AND LOGISTICS).

9.3 CHEMICAL PRECINCT

All short-listed offshore locations for the Project's RE Separation Plant are within substantial, mature operating chemical precincts, and in jurisdictions that have, and continue to expand, approve and regulate, significant chemical processing facilities. Each of these jurisdictions has well established regulatory frameworks and management processes that function effectively. The Company is satisfied that the proposed development will comply with all local, regional and national regulatory requirements, and operate in accordance with widely accepted chemical industry management practices and standards.

Once a preferred location is confirmed the Company will implement the required regulatory approvals process for the proposed development.

9.4 HEALTH AND SAFETY

The Nolans Project, when constructed and operational, will comply with the NT legislative framework of the *Work Health and Safety (National Uniform Legislation) Act*. The Company intends to operate the Project under a comprehensive integrated management system that complies with the requirements of International Management Standards ISO 9001 for Quality, ISO 14001 for Environmental and OHSAS 18001 for OH&S.

The key OH&S operational issue for the Project will be the management of radioactive materials and the potential for workforce exposure. The Company identified this issue early in the life of the Project and has, as a consequence, operated its exploration, metallurgical and process development activities in accordance with its radiation management plan and manual, first prepared in 2006 and since refined by expert radiation safety management consultants Radiation Advice & Solutions Pty. Ltd. (RAS, 2006a; RAS, 2006b). As part of this, (see Section 9.2.3 NOLANS MINE SITE), the Company has assembled a baseline radiation exposure dataset to guide plant design and support the development of appropriate management systems that will ensure the safety and well-being of all personnel. The Company will refer to the ARPANSA Radiation Protection Series guidelines and the advice of RAS in the formulation of its operations protocols.

9.5 STAKEHOLDER ENGAGEMENT AND AGREEMENTS

Arafura is committed to open and transparent engagement and consultation with the community as a core organisational value. Communication and engagement strategies have been tailored to the local communities in which the Company operates, and it has achieved great success in engaging with interested stakeholder groups and the broader community. As well as being strongly committed to its values, Arafura is often highlighted within these communities as a leading example of a proponent committed to consultation.

At a local level, regular information exchange meetings are held with the Nolans Site's traditional native title custodians and their representatives in the CLC (**Figure 9.7**), with which Arafura maintains sound relationships. This builds on a longstanding exploration agreement between the parties (see Section 2.1: NOLANS SITE) that covers, amongst other things, protection of heritage sites and protection of the environment. Negotiations have commenced on an ILUA for the Nolans Project which includes a community benefits package and a formal mining agreement.

▼ Figure 9.7: Briefing at the Nolans Mine Site with Traditional Native Title Custodians

A high level of engagement and consultation continues with other local stakeholders, including pastoralists, business people, local government (Central Desert Regional Council and Alice Springs Town Council), non-government organisations, and the Alice Springs and Ti Tree communities. In 2007 the Company commissioned a scoping study-level assessment of the potential economic and socio-economic impact of the Nolans Project on the local, NT and Australian economy (ACIL Tasman, 2008). This work will be updated in due course to take account of the major change in Project scope since that time.

As the Project advances and the level, quantity and complexity of available information increases, the intensity of engagement activities will escalate accordingly so that the Company keeps attuned to the concerns of affected stakeholders. Towards the completion of the Nolans EIS, Arafura will establish a small representative office in Alice Springs to facilitate much of the on-ground engagement and provide a local conduit for feedback.

The Company's values of open consultation and engagement and the experience gained through working with its Australian stakeholders will extend to the location of the proposed RE Separation Plant once site selection has been finalised.

10 SALES AND MARKETING

KEY FEATURES

- The Nolans Project will derive most of its revenue from rare earth products whose target markets have the most value and best growth prospects.
- NdPr Oxide is a critical rare earth for high performance permanent magnets in the automotive sector and wind turbines and is a high value and growth product contributing to 77% of Arafura's projected sales revenue.
- Strong growth in catalyst, battery, ceramics and phosphor market segments will support the sale of Arafura's other rare earth products.
- The successful evaluation of Arafura's five REO products by key target customers has removed barriers to product validation and established Arafura's authenticity as a future supplier.
- Discussions with prospective customers in key regional markets are progressing well and should secure future supply chain diversification of Arafura's products.
- Global rare earths demand is underpinned by strong forward growth in the renewable energy, automotive and electronic sectors.
- Supply will be constrained for most rare earths due to Chinese industry consolidation, future changes to export restrictions and long development times for rare earth projects to enter the supply chain.

10.1 SALES AND MARKETING STRATEGY

Arafura's marketing strategy is to create and sustain value through market positioning of high quality REO products to target customers in key growth platforms such as automotive, clean energy technology and electronics. Arafura's sales plan targets customers across the entire RE supply chain where visibility, security and stability of supply are becoming increasingly important for operators in the renewable energy and automotive sectors.

Arafura's NdPr Oxide for use by advanced magnet customers in the automotive sector and wind turbines is a leadership product for the Company. Attractive global markets in energy storage, transportation emissions and energy saving devices will drive demand for Arafura's La Oxide, Ce Oxide, SEG Oxide, and HRE Oxide products. Other structurally attractive markets include the regional market of North America, which uses La Oxide for refining catalysts in fluid cracking of oil.

To position Arafura strongly in established regional markets of Europe, Japan, South Korea and the North America, a combination of direct sales to end users and partnering with strategic distributors is important for global reach and access to customers. Arafura has forged long-term relationships with key end users and strategic trading partners involved in key markets where the Company plans to place its products.

10.2 PRODUCTS AND CUSTOMERS

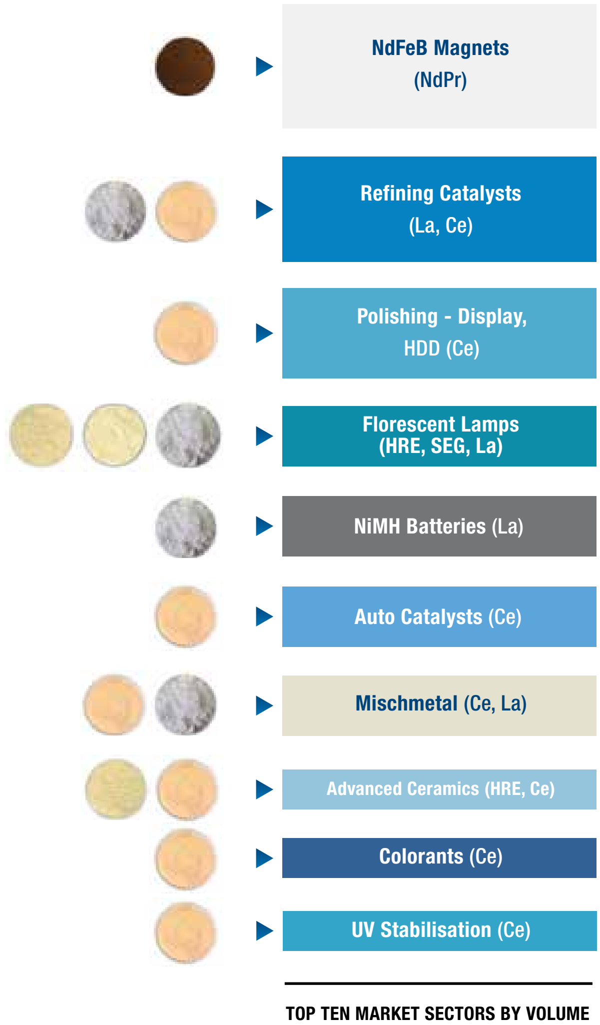
Arafura has made available samples of its five high quality REO products (Figure 10.1) for pre-qualification testing by key customers in the regional markets of Japan, South Korea, Europe and North America where the Company intends to place its product upon commercialisation of the Nolans Project.

Arafura's product mix is well positioned to supply target customers in leading growth sectors of the RE market (**Figure 10.2**). The use of Neodymium-Iron-Boron ("NdFeB") permanent magnets is the largest market for NdPr Oxide, and leading magnet and magnet alloy producers in Japan have tested Arafura's product as an initial step towards product qualification. **Table 10.1** summarises Arafura's customer evaluation program for the entire product range. SEG Oxide and HRE Oxide product samples have been tested and discussions continue with key partners in order to realise the value of the RE phosphor elements europium, terbium and yttrium, and dysprosium for use in permanent magnets.

The evaluation process for Arafura's products by a number of key customers has achieved favourable results, bringing the Company one step closer to market as an approved source of high quality REO products. The pre-qualification testing de-risks Arafura's future material qualification process with leading customers and sends a clear message regarding Arafura's capability and REO product quality. Furthermore, the Company is pursuing unity of specification and purchasing arrangements with key customers and partners.

▼ **Figure 10.1: Arafura Final REO Product Samples**

▼ **Figure 10.2: Arafura positioned to supply Key Markets**



10.3 CUSTOMERS AND MARKETS

Table 10.1: Arafura's Customer Qualification Program

Arafura Product	Application	Region	Customers	Quality Confirmed
NdPr Oxide 	NdFeB Magnets	Japan	Magnet producer; Magnet alloy producer	✓
SEG Oxide 	Phosphors	Japan/ Europe/ South Korea	Trading company; Separation company	✓
HRE Oxide 	NdFeB Magnets	Japan/ Europe/ South Korea	Magnet producer; Trading company	✓
La Oxide 	Refining Catalysts	North America	Catalyst producer	✓
Ce Oxide 	LCD & Optical Polishing	Europe	Polishing producer	✓

Arafura will sell its products directly to end users and through distribution channels with strong local networks to RE customers to deliver product to key markets. The Company has a robust sales plan that targets the highly attractive magnet segment through the sale of NdPr Oxide, which will contribute approximately 77% of the sales revenue (Figure 10.3).

The NdFeB magnet market is the largest market by value (Visiongain, 2010; BCC Research, 2009) and by 2018 the permanent magnet sector is forecast to be worth US$18.8 billion (MarketsandMarkets, 2013). Changes are occurring across the RE supply chain, with final end users in the automotive and wind turbine sectors reducing their supply risk by directly controlling critical raw material supply. Consequently, Arafura is targeting these groups, in addition to the more traditional NdFeB magnet and alloy producers, for the sale of its NdPr Oxide product.

The primary value outlet for Arafura's NdPr and its other RE products is shown in **Figure 10.4**.

Figure 10.3: Projected Sales of Arafura RE Products into Key End Markets

Stacked columns from L to R are as follows:

- **Nolans RE Mix**: weight averaged in-situ RE composition for Total Resources from **Table 3.5**
- **Value by Market Segment**: data from 2013. Segment colour accords with dominant RE product (e.g. dominant RE product in Phosphors market is SEG)
- **Revenue Contribution**: potential revenue contribution by Arafura's RE products. Ce revenue (3%) includes contribution by Ce Carbonate
- **Sales by Value**: projected sales (by value) of Arafura's RE products into key markets (e.g. sales of NdPr product into the Automotive market accounts for 18% of total revenue)

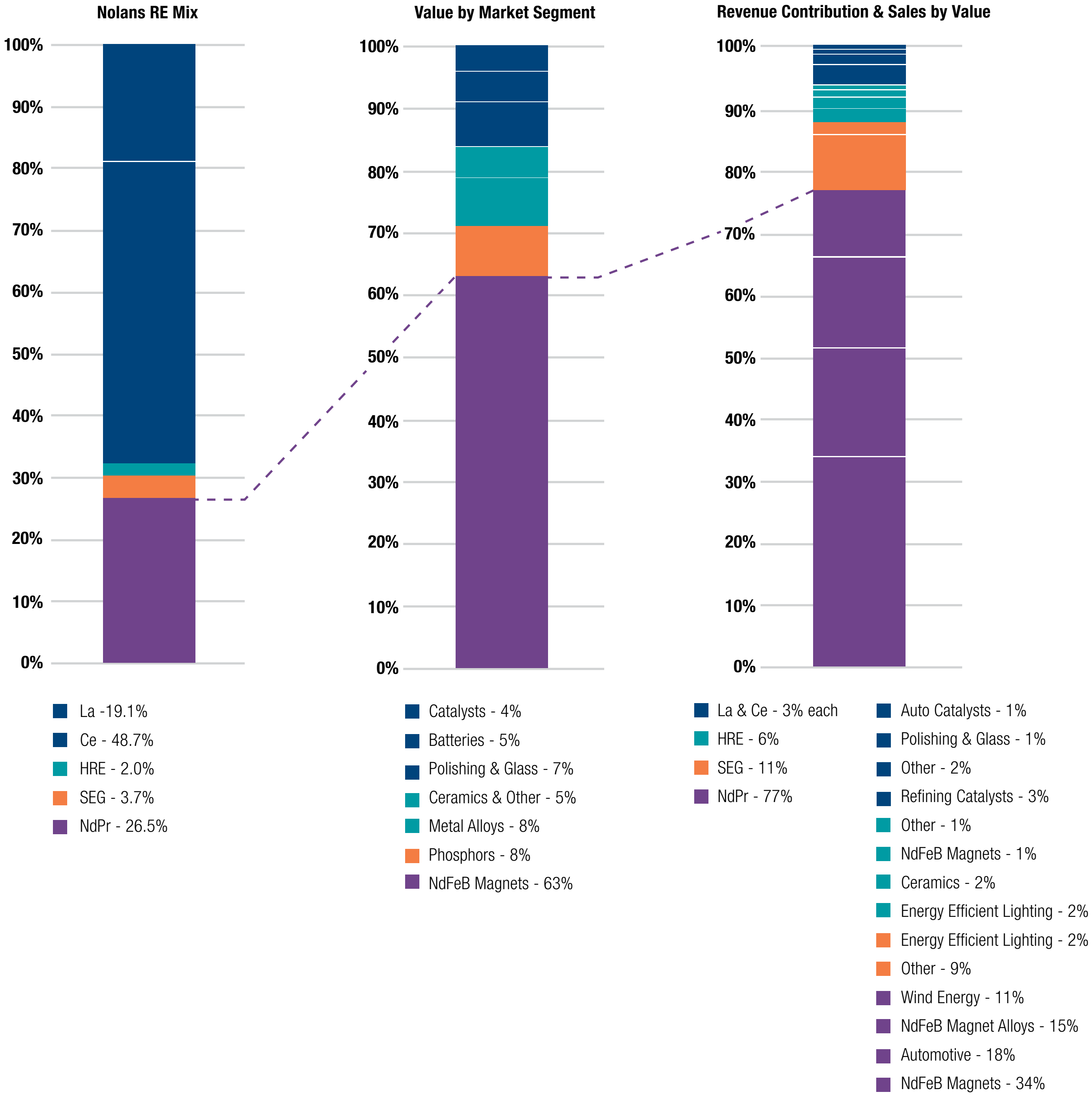


Table 10.2: Primary Value Outlet for Arafura Products

Arafura Product	Rare Earth Segment	Growth Platform	Target Region
NdPr Oxide	NdFeB Magnets	Automotive - Wind Energy	Europe, Japan, South Korea
SEG Oxide	Phosphors, Auto Catalysts, Optics	Energy Efficient Lighting - Emissions Reduction	Europe, Japan
HRE Oxide	Phosphors, Auto Catalysts, NdFeB Magnets	Energy Efficient Lighting - Emissions Reduction - Automotive	Europe, Japan
La Oxide	Refining Catalysts, Batteries, Optics	Energy Efficiency - Energy Storage - Electronics	North America, Japan, Europe
Ce Oxide	Polishing, Auto Catalysts	Electronics - Emissions Reduction	Japan, Europe, South Korea

Arafura is seeking to further improve its product mix and continues active dialogue with potential partners to separate its mixed REO products (SEG Oxide and HRE Oxide) and to refine products to a higher purity. This will assist the Company to expand and capture target markets in energy efficient lighting, optical glass, magnets and other niche applications.

The Company has a Letter of Intent ("LOI") with ThyssenKrupp Metallurgical Products ("ThyssenKrupp") to develop an exclusive, long-term commercial agreement for the annual sale of approximately 3,000 tonnes of REO products into the German market. This supply arrangement is maturing into a more appropriate offtake arrangement, which is in active negotiation. ThyssenKrupp has exposure to and global reach in the automotive sector and will be a pivotal partner in the supply of Arafura's products. German automotive customers are strengthening industrial value creation through supply chain security of critical REs such as NdPr Oxide. Industry is turning to ThyssenKrupp as an important link in the value chain from producer to market.

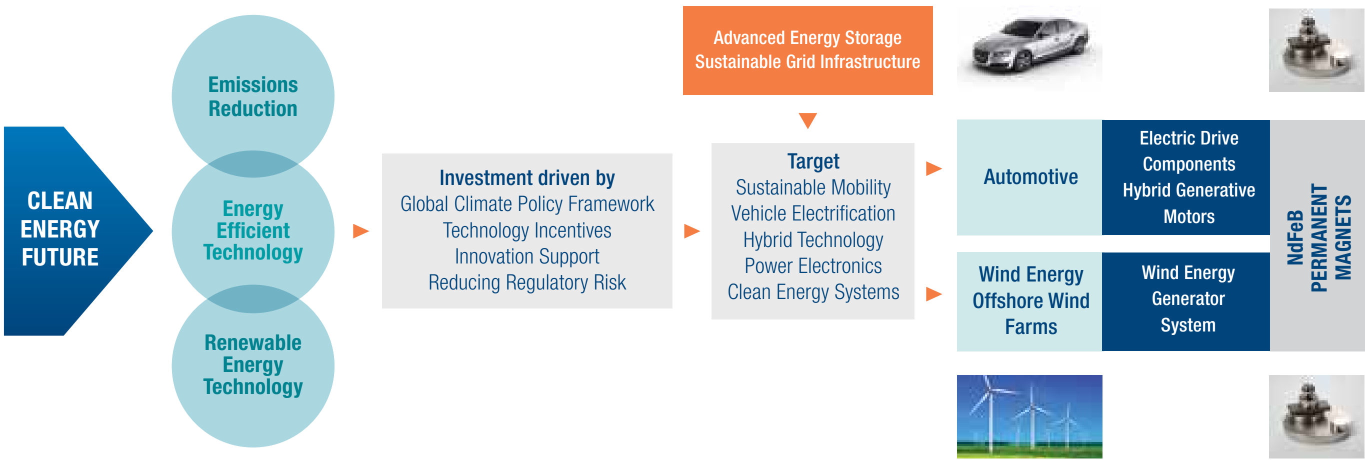
Arafura has executed a non-binding Memorandum of Understanding ("MOU") with a major Korean multinational organisation to cooperate on the future sales of 3,000 tonnes per annum of RE products to the South Korean market. The Korean organisation expects there to be significant consumption of NdPr Oxide and Ce Oxide in the future, primarily to support the growth in high performance magnet motors for automakers and for use in liquid-crystal display ("LCD") glass polishing.

The Company considers that its Ce Carbonate product from the RE Intermediate Plant could be used to supply a growing catalyst market in China and is in discussions with a prospective Chinese customer in this regard.

▲ **Table 10.3: Rare Earth Growth Markets to 2020**

Growth Sectors		Rare Earth Markets	Industry Outlook to 2020
Clean Energy Technology	Wind Energy	Magnet Generator	10% annual market growth driven by China, USA and Europe. Large NdPr Oxide magnets for offshore wind power plants.
Automotive Technology	HEV/EV	Magnet EV Motor NiMH Battery	Government policy support and a decrease in battery pack prices expected to accelerate EV sales towards 7% of the total light vehicle market in 2020. CAGR of 10% for NdPr Oxide magnets and 7% for La batteries.
	Emissions Control	Auto Catalyst	New global regulations to cut emissions drive catalysts market to grow at 5% CAGR. Strong demand for Ce, Nd, Pr and Y.
	Electrical Drives	Magnet Motor Drives	Increase in light vehicle sales, replacement demand for fuel efficient vehicles to grow NdPr Oxide magnet drives in electric power steering, sensor, ABS, etc.
Electronics & Communications	Computing Consumer Electronics & Applications Fibre Optics	LCD/Optical Glass Glass Polishing Advanced Ceramics Magnetic Drives	6% CAGR for Y, Tb, Eu, La, Nd, Pr and Gd used in electronic applications - global TV sales, smartphone technology, tablets and digital storage devices to grow significantly to 2020.
Oil Refining		Refining Catalysts	Strong outlook for La in refining catalysts growing at 3-5% CAGR to 2020.
Healthcare	Medical Equipment (MRI, X-Ray)	Magnets Phosphors	Strong growth in the medical devices market to 2020 due to growing markets in Asia and increasing awareness to focus on early detection. NdPr Oxide magnets and Gd, Y, and La for rare earth phosphors.
Lighting	Energy Efficient Lighting	Phosphors	Eu, Tb, and Y demand growing at 4% CAGR. Ongoing advances in light-emitting diodes (LEDs) could eliminate the need for Tb, and reduce Eu and Y.
Industrial Aerospace Defence		Rare Earth-based Super Alloys	The superalloy market is projected to grow by 5% CAGR. Strong growth for Nd, Pr, La and Y.

▼ **Figure 10.4: NdFeB Permanent Magnets vital to a Clean Energy Future**



10.4 MARKETS AND GROWTH DRIVERS

Rare earths are critical materials and essential to many important final end products, driven by several future growth trends stemming from innovation and development in renewable energy concepts and electronic technology, continued evolution in automotive technology, and trends within the automotive industry (US Department of Energy, 2011).

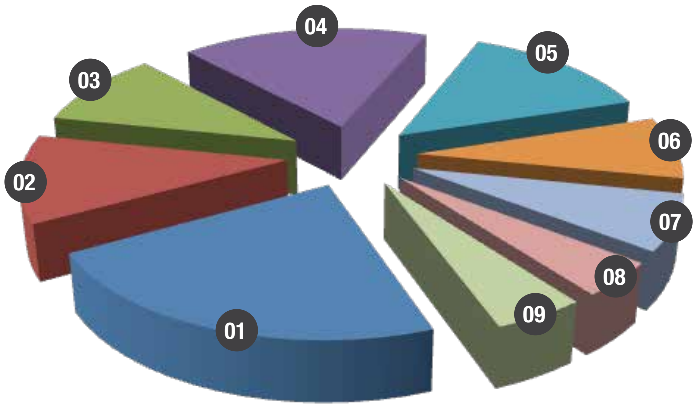
Rare earths enable and facilitate magnetic, optical, catalytic and electronic applications in key growth markets such as clean energy technology, automotive technology and electronics, and communications (Roskill, 2011). Other key sectors that are forecast to drive global RE demand through to 2020 and beyond include the oil refining, healthcare, lighting, industrial and aerospace sectors as shown in **Figure 10.5** (Roskill, 2011; GWEC, 2013; Freedonia Group, 2013; CREIC, 2014a-2014d; IEA, 2013).

Strong investment in renewable energy such as wind, and sustainable mobility through vehicle electrification and hybrid technology of the automotive industry are of the utmost importance to rare earth growth. Studies indicate that the demand by the hybrid vehicle sector could potentially increase the demand for lanthanum and neodymium by 15-30% (Curtin-IMCOA, 2014). The use of NdPr Oxide in NdFeB magnets in electric drives and generators are indispensable if a clean energy future is to be achieved (**Figure 10.4**).

Electronics is by far the largest growth market for NdFeB magnets and numerous RE-bearing products. Consumer electronics, including next-generation laptop computing, smart phone technology, home appliances, and communications and entertainment devices, are in strong demand. Increasing technological innovation has enabled the world consumer electronics market to grow at around 7% per annum and growth is expected to continue at this level into the future (RNCOS, 2013).

Rare earth market segments by application are shown in **Figure 10.5**. Magnets are by far the largest application, predominately using NdPr Oxide for high performance magnetic devices, and focused on wind energy, consumer electronics, automotive components and the emerging electric vehicle market. Catalysts form the second largest application and include La Oxide in refining catalysts for crude oil refining and Ce Oxide in automotive emissions catalysts. RE batteries, metallurgical applications and glass polishing remain important applications for a number of REO products.

Figure 10.5: REO Market Segments by Application (2013)[1]



01 Magnets - 23%
02 Metal Alloys - 11%
03 Batteries - 10%
04 Catalysts - 18%
05 Polishing - 14%
06 Glass - 8%
07 Phosphors - 7%
08 Ceramics - 4%
09 Other - 5%

[1] Arafura interpretation combining other available market information

10.5 DEMAND

Demand for REs in 2013 was stable for some products and remained weak for others due to structural demand changes, innovation, slower global growth for "high-tech" goods and lower investment in renewable energy.

The continued elimination, reduction and recycling of REs in certain applications also contributed to lower demand; however, a growth outlook through to 2020 of approximately 6-7% per annum (Table 8.2) shows that global demand overall is expected to drive strong growth in demand for RE products.[2]

▲ Table 10.4: Growth by Market Sector to 2020

REO Market	CAGR
Magnets	10%
Batteries	7%
Metal Alloys	6%
Catalysts	5%
Polishing	5%
Ceramics	5%
Phosphors	4%
Glass	3%
Other	7%
TOTAL	**6-7%**

Cerium demand for glass polishing has declined through re-use and modest growth is expected in the polishing sector due to growth in consumer electronics and automotive applications. Cerium is finding strong forward growth for its use in automotive catalysts due to increasing government restrictions on transportation emissions.

Demand for catalytic materials and energy efficient lighting is driving demand for La Oxide and RE phosphor materials. Global usage of catalytic materials is growing and consumption of fluid cracking catalysts is driving La Oxide demand. Energy storage technologies and demand for NiMH batteries for vehicle electrification is also driving demand for La Oxide. NiMH offers advanced industry a proven reliable product.

Rare earth phosphor materials used in energy efficient lighting are showing modest future growth due to alternative competing energy saving devices.

10.6 SUPPLY

As the world's largest producer of REs, China currently accounts for more than 90 percent of global supply, but international dependence on China's exports of REs has started to decline with the commencement of production from Molycorp and Lynas in 2013. Supply from non-Chinese sources is expected to increase in the future as new developments in Australia, North America, Europe and Africa emerge over the next decade. However, long development lead times will constrain supply for some critical REs in the future.

The supply of REs in 2013 showed sustainable demand with exports amounting to 50% of the Chinese government quota. Overcapacity in China's entire RE supply chain has created high stock levels from producers to final end users, but this is expected to slowly deplete over the coming year to normal levels with improvements in domestic manufacturing and continued Chinese Government consolidation of the RE industry.

China's national RE policy and its management by the Chinese Government are pivotal for future supply fundamentals and a number of initiatives are being pursued including:

- Chinese Government consolidation of the RE industry, challenging illegal mining, production and trading along with enforcement of environmental regulations on mining and processing of REs; and
- Rationalisation of the RE industry through the creation of six major RE groups, including the Inner Mongolia RE franchise combining several major producers, and the Guangdong and Guangxi provinces in the south of China to strengthen the heavy REs ("HRE") industry.

Other initiatives include:

- Strategic materials stockpiling of REs targeting critical REs that support clean energy technology; and
- Establishment of an exchange aimed at strengthening integration and price stabilisation.

These measures along with further consolidation and preferred exportation of value added products will place further long term pressure on China's exports of RE products.

The use of export quotas and tariffs as an industrial policy tool to restrict global supply has been successfully challenged by the World Trade Organisation, which ruled against China in 2013. While the role of export quotas on supply might not be clear, export quotas for less critical REs may decline in importance in the foreseeable future.

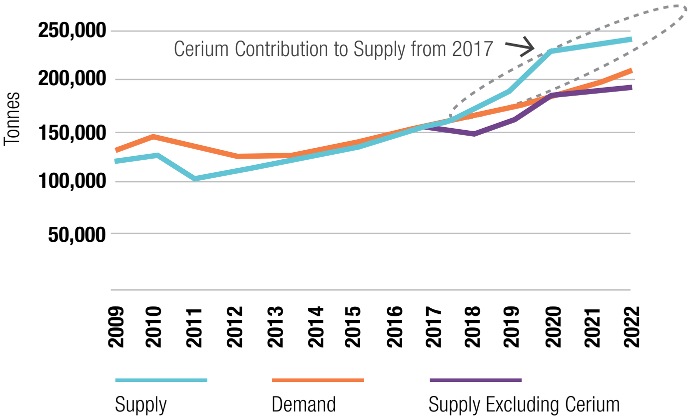
[2] Demand estimates from internal analysis, customer engagement and industry consultants

10.7 SUPPLY AND DEMAND BALANCE

The Company's demand estimates are based on a forecast that global demand for REs will grow at a compound annual growth rate ("CAGR") of 6-7%. However, Curtin-IMCOA (2014) forecasts demand to be as high as 8-12% subject to availability of alternative non-Chinese supply from the middle of the decade.

This leads to a total global RE market of approximately 180,000 tonnes in 2020, which includes Chinese consumption of 144,000 tonnes. Total supply through to 2020 is forecast to grow at a CAGR of 5-6%, with a dependency on China's continued production and advancement of non-Chinese projects (**Figure 10.6**).

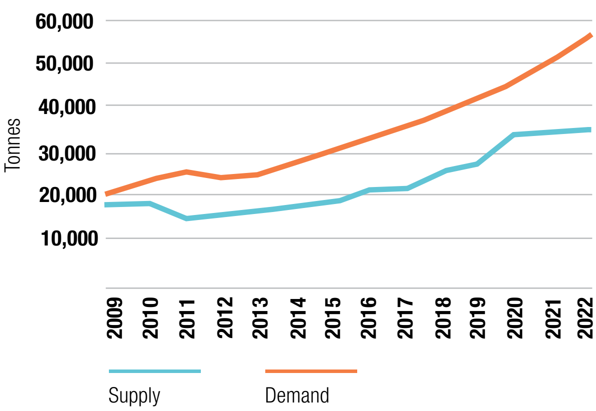
▼ Figure 10.6: Rare Earths Supply and Demand



New and increased production of light REs ("LREs") and structural shifts in total market demand are expected to contribute to an oversupply of cerium. Cerium, lanthanum and some other REs are expected to sustain industry sectors in the metal alloy, catalyst, battery and glass polishing applications.

A shortage of the key magnet-feed RE neodymium is expected for the foreseeable future (US Department of Energy, 2011), and this is brought into sharp focus in Arafura's supply-demand analysis for Nd Oxide as shown in **Figure 10.7**.

▼ Figure 10.7: Nd Oxide Supply and Demand



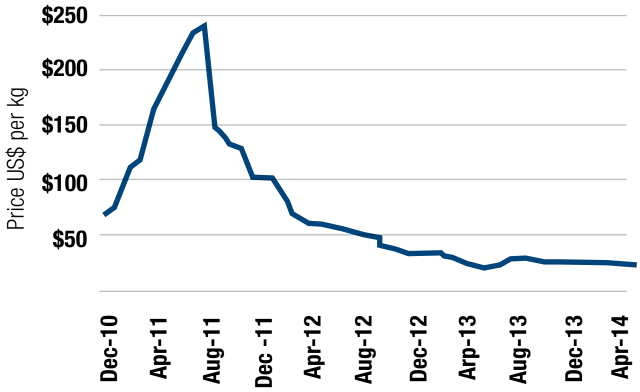
Similarly, shortfalls in the middle and HREs are predicted, with europium and dysprosium forecast to be in significant demand in the future despite innovations in efficient lighting and attempts to reduce high temperature magnet application dependence on dysprosium.

10.8 PRICING

An increase in Chinese export quotas in 2010 and strong global demand significantly increased REO export prices in 2011, resulting in average REO export prices in 2011 up to five times higher than those seen in 2010, before falling by almost 70% on average in 2012. In the first half of 2013, REO prices continued to fall due to a slowing global economy and lacklustre purchasing of RE products across the supply chain. Prices recovered by 30% from July 2013 due to stockpiling of REs by the Chinese industry and an increase in the sales volumes of buyers of critical REs.

Prices in 2014 have stabilised and continue to show resistance to further decline (**Figure 10.8**), although Chinese industry consolidation will place supply restrictions on some critical REs, creating upward pressure on prices in the future.

▼ Figure 10.8: Nolans Rare Earth Basket Price



Weighted average month end REO prices (FOB China) from *Metal-Pages*

Access to reliable sustainable supply for use in critical technologies remains a concern for permanent magnet manufacturers and final end technologies. Users increasingly require a stable and ideally a diversified supply of raw materials to maintain competitive prices and forward growth in the sector. Sustainable pricing that meets the expectation of producer and user is expected to promote further development in key sectors of the market.

An internal pricing model has been used by Arafura as the primary price forecasting tool. Pricing projections adopt market supply and demand fundamentals with an understanding of key market drivers as the basis for pricing assumptions.

Arafura has developed a price forecast from 2014 to 2023 for six RE products that it intends to market. The weighted average price of Arafura's RE products for 2013 is calculated using actual individual REO prices in US$/kg FOB China from the trade website Metal-Pages. The price forecast commences at a 2013 weighted average Nolans basket price of US$33/kg FOB China on an individual REO basis. Arafura has forecast a price growth of 5.8% per annum to the Nolans basket price after 2014.

A price CAGR of 7.6% in real terms is applied to NdPr Oxide over the forecast period and remains constant thereafter in real terms. NdPr Oxide is expected to be undersupplied with an increase in the production of magnets for use in the automotive sector and wind turbines. NdPr Oxide is the preferred raw material and the price premium for Nd Oxide over NdPr Oxide for use in magnets is narrowing.

No price growth in real terms has been applied over the forecast period for lanthanum, cerium, samarium, europium, gadolinium, terbium, dysprosium and yttrium on an oxide basis from 2014 prices. However price growth upside in dysprosium remains positive due to use in high end magnet applications and limited new supply entering the market.

Cerium carbonate has been marketed at a 50% discount to the FOB China Ce Oxide price and no price growth in real terms has been applied over the forecast period.

The forecast basket price for Nolans RE products in 2019 is US$44/kg on a FOB basis. Arafura will not be separating all of the REOs in this basket and has discounted the basket price to arrive at an average Nolans RE product price of US$36.64/kg for the first year of production in 2019 as the starting point for the pricing forecast.

These discounts have been calculated from a number of sources, including Metal-Pages for NdPr Oxide and discussions with end users for all other RE products that the Company intends to market.

The Company can leverage the comparatively high proportion of neodymium (20.6%) and praseodymium (5.9%) in the Nolans Bore resource. NdPr Oxide has a highly attractive supply-demand balance and is expected to generate 77% of the revenue from the Nolans Project over the forecast period (**Figure 10.3**).

11 CAPITAL AND OPERATING COSTS

KEY FEATURES

- Significant reductions in capital and operating costs of the Nolans Project have been achieved
  - Relocation of the RE Intermediate and RE Separation plants
  - Material improvements and simplification of the process configuration
- Total capital cost has been estimated at A$1,408 million (US$1,263 million), which includes:
  - Direct costs of A$889 million
  - Indirect costs of A$252 million
  - Owner's costs of A$70 million
  - A contingency of A$197 million
- Capital costs will be estimated to +/-15% accuracy by completion of DFS.
- Total operating cost has been estimated at A$312 million per annum, or A$15.67/kg (US$14.06/kg) REO equivalent.
- Breakdown of operating costs are:
  - Mine A$2.64/kg
  - Concentrator A$1.86/kg
  - RE Intermediate Plant A$7.84/kg
  - RE Separation Plant A$1.79/kg
  - Transport and Logistics A$1.54/kg

11.1 BASIS OF CAPITAL AND OPERATING COST ESTIMATES

Total capital costs of the Nolans Project have been estimated from engineering cost estimates developed as discrete but inter-related packages, by its consultants Lycopodium and AMEC, and further supplemented and refined by the Company.

The principal areas estimated include:

- Mine and Concentrator;
- RE Intermediate Plant;
- RE separation Plant;
- Nolans Site Infrastructure; and
- Transport and Logistics.

Arafura has compiled a capital cost estimate for the Nolans Project based on these estimates, which have been developed using the rationale of conventional non-modular construction techniques, local procurement with global supply, and local design as the basis for costs:

- The Mine and Concentrator estimate has been generated by Lycopodium (2010) and subsequently updated and adjusted by Lycopodium (2014a) to reflect processing and other changes;
- The Nolans Site Infrastructure estimate has been generated by Lycopodium (2014a);
- The RE Intermediate Plant estimate has been derived from estimates provided by AMEC (2012b) and AMEC (2012c) for the RE Intermediate and RE Separation plants which, in addition to corresponding infrastructure, were previously combined as the RE Complex on a single site in Whyalla, South Australia, some 1,200 kilometres south of the Nolans Site;
- The RE Separation Plant estimate has been generated by Lycopodium (2014b) and for costing purposes is based on the plant being located within or near a chemical precinct in the Gulf Coast region of the USA;
- The Transport and Logistics estimate generated by Arafura (2014c) is based on detailed modelling by the Company and both road and rail service providers, using completed project benchmark costs and incorporating engineering and equipment inputs.
- The capital cost estimate is supported by the following information:
- Process flowsheets, detailed mass balances, equipment lists and engineering drawings produced with sufficient detail to permit the assessment of the engineering quantities for earthworks, concrete, steelwork, mechanical and electrical equipment within the process plants and associated infrastructure;
- Equipment costs based on budget quotes received from vendors for major plant items and a substantial proportion of the minor plant items, supplemented where necessary with recent historical engineering contractor cost database information;
- Technology supplier estimates for certain turnkey packages such as the sulphuric acid plant at the Nolans Processing Site;
- Completion of detailed modelling of logistics flows and a full assessment of related capital costs of ancillary equipment; and
- Updates where appropriate to reflect enhanced detail and market movements.

Consistent with the capital cost estimates, operating cost estimates have been prepared by the Company's engineering consultants Lycopodium, AMC and AMEC. Arafura has completed additional detailed work to refine these estimates, taking account of revised market pricing information for raw materials and services, and revisions in the process consumption requirements from detailed mass balance data.

Operating costs were broken into the following principal areas for estimation:

- Mine operating costs have been prepared by Lycopodium (2010) with subsequent additional definition and updating by AMC Consultants (2013a) to reflect the re-defined mine plan and optimisation work;
- Concentrator operating costs are based on Lycopodium (2010) and updated to reflect flowsheet changes and additional updated cost information;
- RE Intermediate Plant costs are based on work done by AMEC (2012d) and AMEC (2012e) amended to reflect the placement of the RE Intermediate Plant at the Nolans Site and the flowsheet change to SAPL-DSP. This work includes reagent cost estimates based on detailed mass balance modelling of the process flowsheet, supported by extensive testwork and unit prices provided by leading suppliers with the capability to satisfy the Company's requirements, and labour rates based on current relevant industry survey benchmark data;
- The RE Separation Plant estimate has been provided by Lycopodium (2014b) and for costing purposes is based on the plant being located within or near a chemical precinct in the Gulf Coast region of the USA;
- The Transport and Logistics estimate is based on detailed material movement modelling, information from prospective service providers, and prevailing market rates; and
- Total operating costs include general and administration, maintenance materials and contractors, consumables and other support costs.

![Arafura Resources Limited]

11.2 CAPITAL COST ESTIMATES

11.2.1 OVERVIEW

Total capital cost for the Nolans Project is estimated at A$1,408 million. This estimate comprises direct costs of A$889 million, indirect costs (mainly EPCM costs, specialist consultant costs and site costs) of A$252 million, owner's costs of A$70 million and a contingency of A$197 million (**Table 11.1** and **Figure 11.1**).

▼ Figure 11.1: Nolans Project Capital Costs (A$m)

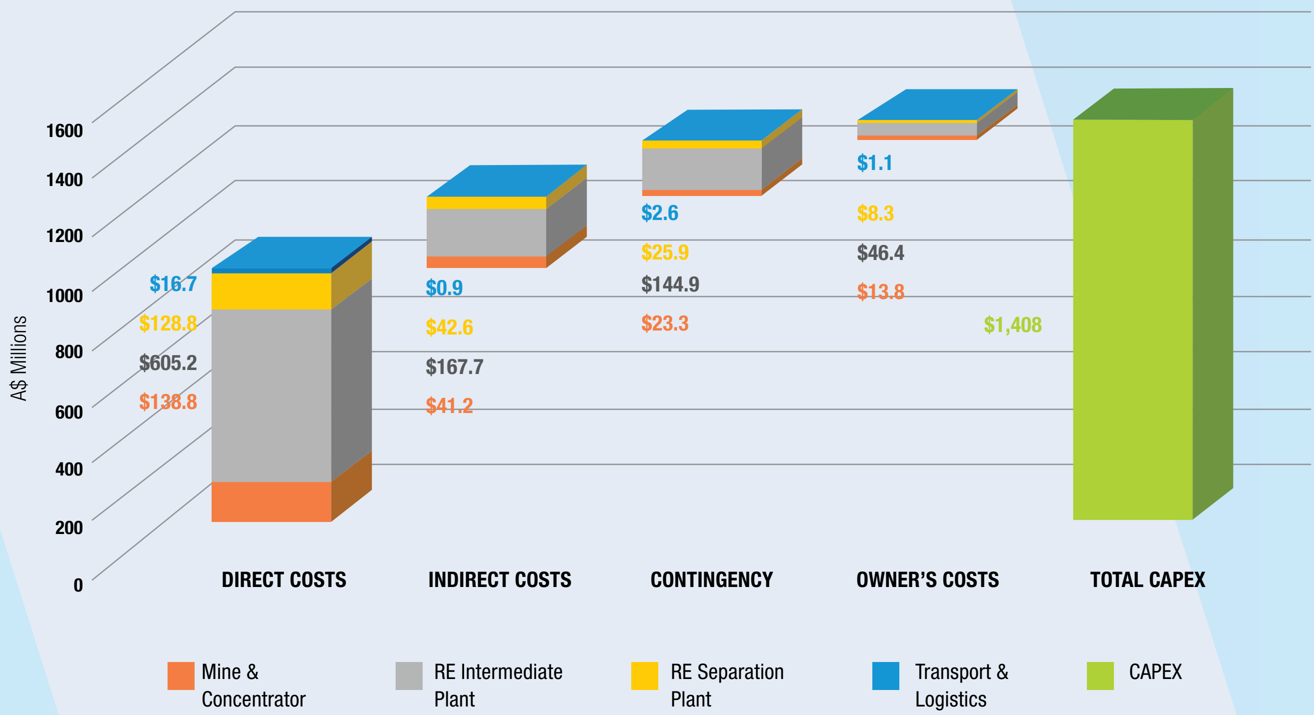


Figure 11.2 breaks down capital costs for the Nolans Project into four main plant areas: the Mine and Concentrator (15% of total costs) and the RE Intermediate Plant (68%) at the Nolans Site in the Northern Territory, the RE Separation Plant (15%) at an offshore chemical precinct, and Transport & Logistics (2%).

The capital estimates include the costs necessary to construct and commission the Nolans Project ready to operate.

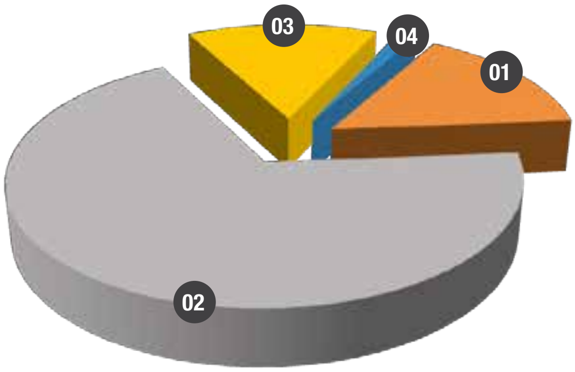
The extensive work program undertaken by Arafura and its consultants has positioned the Company to confidently estimate the direct costs associated with the equipment and assets necessary in each of the four main plant areas. As per industry norms, direct costs include those for the supply of equipment and associated freight and construction. Indirect costs are those costs that are not a fixed asset item of the plant and, in keeping with the aforementioned industry norms, these include temporary construction facilities, engineering, procurement and construction management ("EPCM"), and commissioning costs, for which values have been defined using industry standards.

Owner's costs include Arafura's costs and expenses during project execution leading to start up, and these include items such as land costs, legal costs, permitting and development approvals. Contingencies included in the estimate are based on the individual estimate accuracies and these will be further refined through subsequent stages of the development process.

▲ Table 11.1: Capital Costs Breakdown (A$m)

NOLANS SITE	A$m
MINE & CONCENTRATOR	
Mine	6.6
Concentrator	132.2
TOTAL DIRECT COSTS	**138.8**
TOTAL INDIRECT COSTS	41.2
Owner's Costs	13.8
Contingency	23.3
TOTAL MINE & CONCENTRATOR	**217.1**
RE INTERMEDIATE PLANT	
Process Plant	243.6
Process Plant Ponds and Co-Products	64.7
Process Plant Infrastructure	114.4
Ancillaries	182.5
TOTAL DIRECT COSTS	**605.2**
TOTAL INDIRECT COSTS	167.7
Owner's Costs	46.4
Contingency	144.9
TOTAL RE INTERMEDIATE PLANT	**964.2**
TOTAL NOLANS SITE	**1,181.3**
CHEMICAL PRECINCT	
RE SEPARATION PLANT	
Process Plant	102.1
Process Plant Ponds and Co-Products	1.0
Process Plant Infrastructure	23.1
Ancillaries	2.6
TOTAL DIRECT COSTS	**128.8**
TOTAL INDIRECT COSTS	42.6
Owner's Costs	8.3
Contingency	25.9
TOTAL RE SEPARATION PLANT	**205.6**
TRANSPORT & LOGISTICS	
TOTAL DIRECT COSTS	**16.7**
TOTAL INDIRECT COSTS	0.9
Owner's Costs	1.1
Contingency	2.6
TOTAL TRANSPORT & LOGISTICS	**21.3**
TOTAL CAPEX	**1,408**

▼ Figure 11.2: Capital Costs Breakdown



01 Mine & Concentrator – 15%
02 RE Intermediate Plant – 68%
03 RE Separation Plant – 15%
04 Transport & Logistics – 2%

11.2.2 MINE AND CONCENTRATOR

Mine and Concentrator capital costs were first estimated by Lycopodium (2010) as part of a draft DFS. This cost estimate formed the basis of the August 2012 Base Case with direct costs (including Nolans Mine and Concentrator infrastructure) contributing A$230 million.

This estimate was updated by Lycopodium (2014a) and Arafura (2014d) to take account of recent pricing updates, flowsheet adjustments, and infrastructure common to the Mine Site and Processing Site as a result of re-locating intermediate chemical processing from Whyalla to Nolans. The revised total capital cost estimate of A$217.1 million for the Mine and Concentrator (**Table 11.1**) includes direct costs of A$138.8 million and represents approximately 15% of the total capital cost of the Project (**Figure 11.2**). Direct mining costs include miscellaneous assets that fall outside the battery limits of the mining contractor's supplied items. Concentrator direct costs include all of the equipment in the beneficiation flowsheet, relevant buildings and associated storage facilities.

The Concentrator is sized to process approximately 780,000 tpa of ROM material and a provision has been made for material type-driven flowsheet modifications and expansion of its capacity over the life of the Project.

11.2.3 RARE EARTH INTERMEDIATE PLANT

Previous estimates of the combined RE Complex comprising the RE Intermediate Plant, RE Separation Plant and corresponding infrastructure (including the logistics component) were estimated by AMEC (2012b) and AMEC (2012c) as part of an engineering study. The estimate was constructed in such a manner that facilitated the separation of costs associated with the individual plants, and the Company has subsequently:

- Refined the flowsheets for the RE Intermediate Plant based on extensive metallurgical testwork (see Section 5 METALLURGICAL TESTWORK);
- Undertaken process modelling for the RE Intermediate Plant (see Section 6 PROCESSING);

- Refined the detailed equipment list (Arafura, 2013);
- Utilised recent and additional engineering contractor cost database information and factoring for further estimate definition; and
- Used technology supplier estimates for certain ancillary and infrastructure packages at the Nolans Processing Site.

The relocation of the RE Intermediate Plant to the Nolans Site has a considerable impact on the site's infrastructure requirements. An engineering cost estimate for the infrastructure necessary to support the Mine and Concentrator, and the RE Intermediate Plant at the Nolans Site has been prepared (Lycopodium, 2014a). The scope of this work includes:

- Accommodation village;
- HV power distribution;
- Pipelines;
- Residue and evaporation ponds;
- Roads;
- TSFs (Knight Piésold, 2014); and
- Water with associated bore fields and treatment.

The estimated total cost of the RE Intermediate Plant of A$964.2 million (**Table 11.1**) represents 68% of the total capital costs of the Project (**Figure 11.2**). Direct costs total A$605.2 million and these include the processing facility, TSF/RSFs, infrastructure and ancillaries, with the sulphuric acid plant being the single largest cost contributor to ancillaries.

The RE Intermediate Plant has been designed to process in excess of 300,000 tpa of concentrated slurry from the Concentrator.

11.2.4 RARE EARTH SEPARATION PLANT

The reconfiguration of the Nolans Project re-positions intermediate chemical processing to the Nolans Site and also defines an offshore RE Separation Plant within the proximity of an established chemical precinct.

Lycopodium (2014b) has prepared a capital cost estimate for the RE Separation Plant based on engineering design information supplied by Arafura. The geographical location used as the basis of this estimate is the Gulf Coast of the USA for which benchmark comparative cost data is readily available. This aids further comparative cost studies associated with the final location selection.

The total cost estimated for this facility is A$205.4 million (**Table 11.1**) which represents 15% of the total capital cost (**Figure 11.2**). Direct costs include all of the processing unit operations, reagent handling, waste water treatment, and general infrastructure such as administration buildings, maintenance workshop and roads.

The RE Separation Plant has been designed to separate in excess of 30,000 tpa of mixed RE chloride intermediate from Nolans (with scope for expansion at a later date), and produce five separated REO products (see Section 6 PROCESSING).

11.2.5 TRANSPORT AND LOGISTICS

Relocating the RE Intermediate Plant from Whyalla to the Nolans Site has simplified and concentrated the Transport and Logistics infrastructure and equipment requirements of the Project in a much smaller and more manageable area. The elimination of a dedicated haul road, rail siding and substantial loading and unloading facilities reduces both the capital requirement and the complexity of the logistics map.

Arafura (2014c) has prepared a capital cost estimate for the Transport and Logistics components of the Project and this includes:

- Container handling equipment;
- Container washing facility;
- Fleet of dedicated ISO tank containers;
- Minor fleet of dedicated standard 20 ft containers; and
- Hardstand areas in Darwin, Alice Springs and at the Nolans Site.

The estimated Transport and Logistics direct costs of A$16.7 million compare very favourably to the August 2012 Base Case direct costs of A$185.3 million. This translates to a total capital cost for Transport and Logistics of A$21.3 million, or 2% of the total cost estimate (**Figure 11.2**).

11.2.6 CAPITAL COST ESTIMATE SCOPE

The capital cost estimates in **Table 11.1** include costs necessary to design, construct and commission the Nolans Project. They include costs associated with the Mine and Concentrator, the RE Intermediate Plant, Nolans Site and off-site infrastructure in the Northern Territory, and the offshore RE Separation Plant.

The Project will use selective mining practices for approximately the first ten years of operations and will require its plant to be expanded during years seven to ten of operations in order to process more material to maintain its scheduled REO production targets. The capital cost of this expansion is estimated to be A$197 million of plant expansion costs that will be needed for upgrades to the Concentrator and the RE Intermediate Plant (A$115 million) and for incremental lifting and expansion of the TSFs/RSFs and evaporation ponds (A$82 million).

These plant expansion costs will come out of Project cash flows and are fully accounted in the Project's financial evaluation (see Section 12 FINANCIAL EVALUATION) of this Development Report.

11.3 OPERATING COST ESTIMATES

11.3.1 OVERVIEW

Operating costs for the Nolans Project have been estimated on an A$/kg REO equivalent (20,000 tpa) basis, and are summarised below in **Table 11.2**.

▲ **Table 11.2: Summary of Operating Costs**

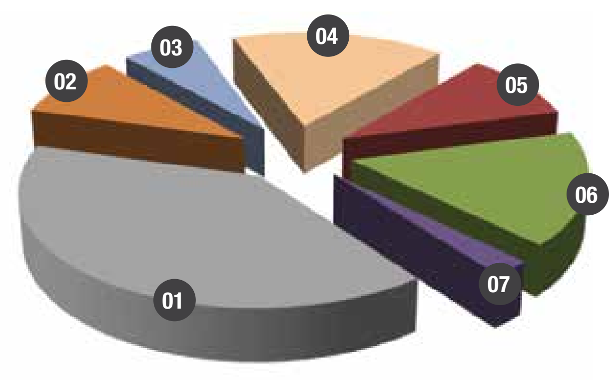
Plant	Australian cost component A$/kg REO	USA cost component US$/kg REO	Total A$/kg REO	Total US$/kg REO	Total A$m pa
Mine	2.64	-	2.64	2.37	52.5
Concentrator	1.86	-	1.86	1.67	37.1
RE Intermediate Plant	4.75	2.77	7.84	7.03	156.1
RE Separation Plant	-	1.61	1.79	1.61	35.6
Transport & Logistics	1.44	0.09	1.54	1.38	30.7
TOTAL	**10.69**	**4.47**	**15.67**	**14.06**	**312.0**

Costs converted using A$1 = US$0.897

Operating costs comprise an Australian cost element of A$10.69/kg REO and a US cost element of US$4.47/kg REO, equating to A$15.67/kg REO. The US cost element relates mainly to RE Separation Plant costs being based on a US Gulf Coast location. In addition, globally traded commodities such as sulphur for use at the RE Intermediate Plant, are quoted on a US$ based pricing structure.

Figure 11.3 shows that reagents and consumables together represent the largest single contributor (40%) to operating costs for the Project, followed by mining (17%) and labour costs (16%).

▼ **Figure 11.3: Operating Costs Breakdown**



01 Reagents & Consumables – 40%
02 Maintenance – 9%
03 G&A – 6%
04 Mining – 17%
05 Transport – 10%
06 Labour – 16%
07 Power – 2%

11.3.2 MINE AND CONCENTRATOR

Mining operating costs are reported in Section 4.4 (MINING: CAPITAL AND OPERATING COSTS) of this Development Report.

Average mine operating cost is calculated at A$5.78/t material moved, or A$58.30/t of ore mined based on an average of 900,000 tpa of ore feed. This equates to A$52.5 million per annum, or A$2.64/kg of REO produced based on 20,000 tpa REO equivalent.

These costs are reliable long term averages and the Nolans financial model takes into account the varying mining and feed rates associated with commissioning, ramp up and grade variations.

Concentrator operating costs are estimated by Lycopodium (2010) and further refined by the Company to reflect recent developments in Project configuration and selective mining strategies. Costs are estimated at A$37.1 million per annum or approximately A$1.86/kg of total equivalent REO production.

Table 11.3 is a high level summary for the Concentrator operating cost estimate.

▲ **Table 11.3: Concentrator Operating Cost Estimate Summary**

Category	A$m pa	A$/kg REO
Labour	6.7	0.34
Power	7.0	0.35
Reagents and Consumables	10.1	0.51
Maintenance Materials	6.4	0.32
General and Administration	6.9	0.34
TOTAL	**37.1**	**1.86**

11.3.3 RARE EARTH INTERMEDIATE PLANT

The RE Intermediate Plant operating cost is approximately A$156.1 million per annum or A$7.84/kg of REO equivalent produced.

These operating costs were estimated as part of an engineering study (AMEC, 2012d; AMEC, 2012e) when the two component plants (RE Intermediate and RE Separation) were combined as the RE Complex in Whyalla. For the current configuration scenario of the RE Intermediate Plant at the Nolans Site and the RE Separation Plant in an offshore chemical precinct, the Company has:

- Prepared flowsheets for the RE Intermediate Plant based on extensive metallurgical testwork (see Section 5 METALLURGICAL TESTWORK);
- Undertaken process modelling for the RE Intermediate Plant (see Section 6 PROCESSING);
- Completed SysCAD modelling to estimate raw material consumptions; and
- Refined the operating cost of the RE Intermediate Plant using updated cost information.

A summary of the operating cost estimate for the RE Intermediate Plant is shown in **Table 11.4**.

▲ Table 11.4: RE Intermediate Plant Operating Cost Estimate Summary

Category	A$m pa	A$/kg REO
Labour	33.2	1.67
Power[1]	0	0
Reagents and Consumables	94.3	4.73
Maintenance Materials	17.9	0.90
General and Administration	10.7	0.54
TOTAL	**156.1**	**7.84**

[1]Net power generation costs are attributed to the Concentrator operating costs with the RE Intermediate Plant gaining the benefit of power and steam generated by the sulphuric acid plant.

Lycopodium (2014a) prepared an engineering cost report for the on-site infrastructure requirements of the Concentrator and the RE Intermediate Plant. These have been included in the RE Intermediate Plant operating costs.

11.3.4 RARE EARTH SEPARATION PLANT

An operating cost estimate for the RE Separation Plant has been prepared by Lycopodium (2014b) in parallel with the capital cost estimate. The total RE Separation Plant operating cost is approximately A$35.6 million per annum or A$1.79/kg of REO equivalent produced. **Table 11.5** shows the high level summary for the operating cost estimate.

▲ Table 11.5: RE Separation Plant Operating Cost Estimate Summary

Category	A$m pa	A$/kg REO
Labour	11.2	0.56
Power	0.3	0.01
Reagents and Consumables	19.7	0.99
Maintenance Materials	3.0	0.15
General and Administration	1.4	0.07
TOTAL	**35.6**	**1.79**

11.3.5 TRANSPORT AND LOGISTICS

An operating cost estimate for the Transport and Logistics components of the Project has been prepared by Arafura (2014c) and is summarised in **Table 11.6**. This estimate includes all road, rail and port handling costs as required for inbound and outbound cargo for both Nolans and the RE Separation Plant sites. Where reagents are sourced internationally, reagent costs are included in the individual plant operating costs (**Tables 11.3-11.5**) and also include the sea freight component for these items.

▲ Table 11.6: Transport & Logistics Operating Cost Estimate Summary

Category	A$m pa	A$/kg REO
Australian Logistics	28.7	1.44
Offshore Logistics	2.0	0.10
TOTAL	**30.7**	**1.54**

11.4 SUMMARY

Engineering capital cost estimates have been prepared by reputable engineering consultants for the Mine and Concentrator, the RE Intermediate Plant, all infrastructure requirements, and the RE Separation Plant. The Company has estimated the total capital cost of the Project to be A$1,408 million based on these estimates, augmented by additional process engineering refinements and detailed Transport and Logistics estimates.

The total Project capital cost estimate will be refined and further developed to a ±15% level of accuracy as part of the DFS.

Operating cost estimates have been prepared for the Mine and Concentrator, RE Intermediate Plant (including ancillaries), RE Separation Plant and associated infrastructure using reputable engineering consultants and in a synonymous manner to the engineering capital cost estimates. They have been augmented by additional process engineering refinements, revised market pricing information, and detailed Transport and Logistics estimates. An average cost of A$312 million per annum, or A$15.67/kg of REO equivalent, has been estimated.

These costs will be further refined and developed in parallel with the Project's capital costs as part of the DFS.

12 FINANCIAL EVALUATION

KEY FEATURES

- The Nolans Project generates an NPV of A$2,045 million on an after-tax basis with a 10% discount rate.
- The Project generates an IRR of 21% and an after-tax payback of capital in the fifth year of operation.
- The Project maintains a robust NPV and IRR through lower capital and operating expenditure, notwithstanding the use of conservative forecast rare earth prices.
- The life of the Project, based on Measured and Indicated Resources alone, will exceed the twenty years used in the financial evaluation.

12.1 METHODOLOGY AND ASSUMPTIONS

A financial evaluation of the Project has been undertaken using a discounted cash flow ("DCF") analysis in Australian dollars (A$). The evaluation includes cash flows from the Project and does not include potential cash flows from exploration activities or other assets held by the Company. A Net Present Value ("NPV") and Internal Rate of Return ("IRR") for the Project have been calculated over a twenty year operational period to reflect an enterprise value for Arafura on the sole basis of the Project.

The following key production and economic assumptions apply to the Project:

- Production target of 20,000 tonnes of REO equivalent per annum underpinned by Measured and Indicated Resources;
- Construction period of 36 months;
- Production ramp-up over eight quarters;
- Twenty years of operation including the production ramp-up period;
- Capital and operating costs as contained in this Development Report;
- Capital cost escalation of 3.2% per annum during the construction period;
- An annual sustaining capital expenditure allowance of 1.4% of total direct capital costs in addition to an annual allowance of approximately A$7.5 million (in real terms) for tailings and residues storage facilities ("TSFs/ RSFs");
- Selective mining practices during the first ten years of production to target the best performing material types;
- Plant expansion capital expenditure of A$115 million and A$82 million for TSFs/RSFs in years seven to ten of operations;
- Operating costs include general and administration costs;
- An overview of the price assumptions for the sales revenue is outlined in Section 10.8 (PRICING);
- Consumer Price Index ("CPI") escalation of 2.7% per annum applied to sales revenue and operating costs;
- An exchange rate of A$1 = US$0.897 in 2014, gradually reducing to US$0.813 by 2017 and remaining constant thereafter; and
- An after-tax discount rate of 10% has been used for the DCF analysis. The discount rate has been determined by considering:
  - The required cost of equity return to an equity investor;
  - The rates of return for comparable ASX-listed companies; and
  - The debt to equity ratios of comparable ASX-listed companies.

The financial evaluation is based on the Project being funded entirely from equity and does not take account of any uplift that may result from debt raised through a project financing. Arafura intends that the Project will be partly funded through project finance debt facilities.

12.2 PROJECT RESULTS

Based on the above assumptions, the Nolans Project generates an NPV of A$2,045 million and an IRR of 21.4% on an after-tax basis, calculated over twenty years. The payback period to return capital is five years. A summary of results is contained in Table 12.1, and the financial performance of the Project is summarised in Figures 12.1 and 12.2.

Table 12.1: Financial Evaluation Summary

	US$m pa
Sales Revenue	
REO equivalent 20,000 tonnes (less royalty and selling expenses)[1]	638
Total Revenue	**638**
	A$m pa
Total Revenue @ A$1 = US$0.897	**712**
Operating Expenditure	
Mine & Concentrator	(90)
RE Intermediate Plant	(156)
RE Separation Plant	(35)
Transport & Logistics	(31)
Total Operating Expenditure[2]	(312)
Operating Cost (A$/kg REO)	15.67
EBITDA	**400**
Capital Expenditure (A$m) (excluding deferred capital)	1,408
NPV @ 10% after tax and capital payback (A$m)[3]	**2,045**
IRR after tax and capital payback[3]	**21.4%**
After tax payback period	Year 5 of operations

[1] Sales revenue based on the 2019 forecast price of US$36.64/kg (Section 10.8: PRICING).

[2] Operating expenditure based on Section 11.3 (OPERATING COST ESTIMATES) assuming annual production of 20,000 tonnes of REO based on an average of 900,000 tpa of ore feed.

[3] NPV and IRR analysis is based on the disclosed Project assumptions including allowance for construction, indexation, and the varying mining and feed rates associated with commissioning, ramp-up and grade variations.

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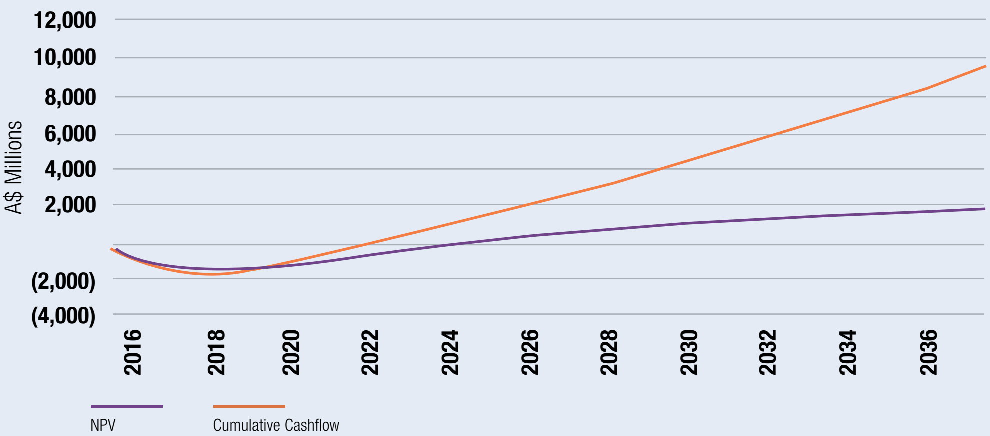
▼ Figure 12.1: Nolans Project Cumulative Net Cashflows and NPV after tax



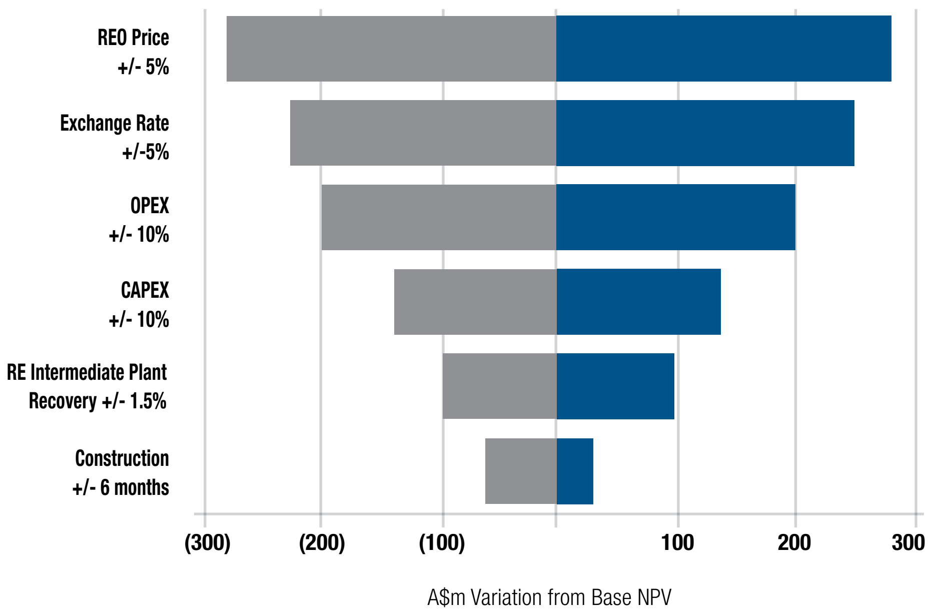
▼ Figure 12.2: Nolans Project Net Annual Cashflows after tax

12.3 SENSITIVITY ANALYSIS

A high level sensitivity analysis has been carried out to determine the impact and sensitivity of the financial results to changes in the key assumptions and variables. The results of this analysis are shown in Figure 12.3 and Tables 12.2 to 12.4.

The analysis shows that the Project is most sensitive to REO prices and exchange rate, and relatively less sensitive to movements in capital expenditure, RE recoveries at the RE Intermediate Plant, and construction delays.

▼ Figure 12.3: NPV Variation for Key Project and Economic Assumptions



▲ Table 12.2: Sensitivity Analysis REO Selling Price

	NPV 20 years A$ billion	IRR 20 Years
+30%	$3.7	28%
+20%	$3.2	26%
+10%	$2.6	24%
Base	**$2.0**	**21%**
-10%	$1.5	19%
-20%	$0.9	16%
-30%	$0.4	12%

▲ Table 12.3: Sensitivity Analysis Operating Expenditure

	NPV 20 years A$ billion	IRR 20 Years
+30%	$1.4	18%
+20%	$1.6	19%
+10%	$1.8	20%
Base	**$2.0**	**21%**
-10%	$2.2	22%
-20%	$2.4	23%
-30%	$2.6	24%

▲ Table 12.4: Sensitivity Analysis Capital Expenditure

	NPV 20 years A$ billion	IRR 20 Years
+30%	$1.6	18%
+20%	$1.8	19%
+10%	$1.9	20%
Base	**$2.0**	**21%**
-10%	$2.2	23%
-20%	$2.3	25%
-30%	$2.5	27%

A detailed sensitivity analysis was completed for key operating costs to determine the impact on the financial results to changes in these costs. The analysis shows that the Project is most sensitive to mining costs and price fluctuations in sulphur and caustic used in RE extraction. The financial outcomes are relatively less sensitive to movements in hydrochloric acid prices.

The summary results of the analysis are shown in **Figure 12.4** and **Tables 12.5** to **12.10**.

Figure 12.4: NPV Variation for Key Operating Costs

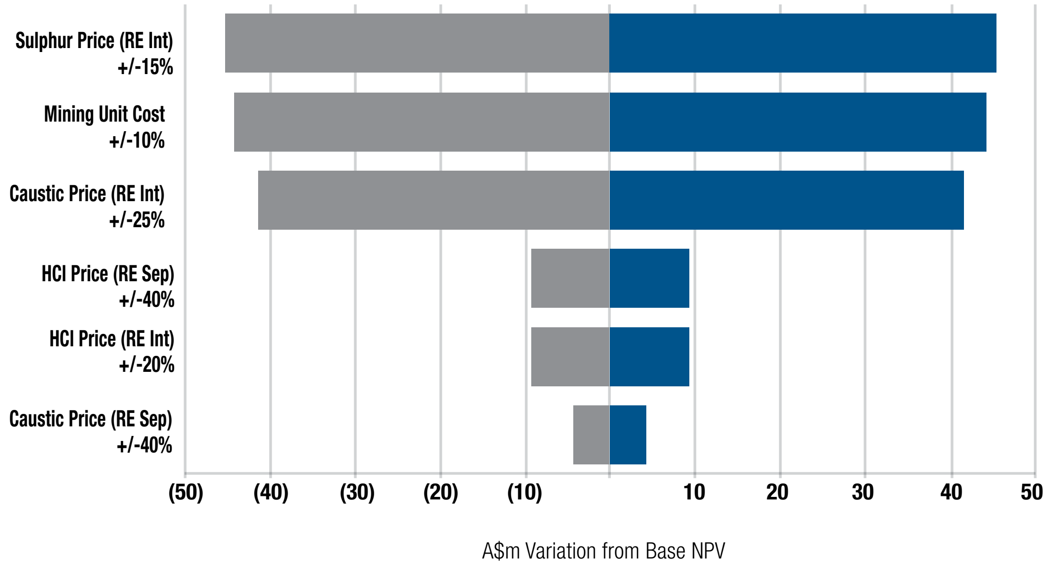


Table 12.5: Sensitivity Analysis Sulphur Price

	NPV 20 years A$ billion	IRR 20 Years
+15%	$2.000	21.2%
Base	**$2.045**	**21.4%**
-15%	$2.091	21.6%

Table 12.6: Sensitivity Analysis Mining Cost

	NPV 20 years A$ billion	IRR 20 Years
+10%	$2.002	21.2%
Base	**$2.045**	**21.4%**
-10%	$2.090	21.6%

Table 12.7: Sensitivity Analysis Caustic Price (RE Intermediate)

	NPV 20 years A$ billion	IRR 20 Years
+25%	$2.004	21.2%
Base	**$2.045**	**21.4%**
-25%	$2.087	21.6%

Table 12.8: Sensitivity Analysis HCl Price (RE Separation)

	NPV 20 years A$ billion	IRR 20 Years
+40%	$2.036	21.4%
Base	**$2.045**	**21.4%**
-40%	$2.055	21.4%

Table 12.9: Sensitivity Analysis HCl Price (RE Intermediate)

	NPV 20 years A$ billion	IRR 20 Years
+20%	$2.040	21.4%
Base	**$2.045**	**21.4%**
-20%	$2.051	21.4%

Table 12.10: Sensitivity Analysis Caustic Price (RE Separation)

	NPV 20 years A$ billion	IRR 20 Years
+40%	$2.041	21.4%
Base	**$2.045**	**21.4%**
-40%	$2.050	21.4%

12.4 CO-PRODUCTS

The current Project configuration has phosphate and uranium reporting to waste streams, and revenue that could be generated from the sale of phosphate and uranium co products is not included in this Development Report. However, the opportunity to commercialise both products is being investigated and by way of example, the financial impact of including a uranium circuit in the RE Intermediate Plant design is summarised below. The key assumptions used in the analysis are shown in Table 12.11.

▲ Table 12.11: Uranium Circuit Financial Model Assumptions

Uranium Price	US$35/lb
Capital Costs	A$19 million
Operating Costs	A$7.1 million pa

This initial analysis is based on a uranium price of US$35/lb and at this price, the incremental NPV impact of including a uranium circuit is not significant. Should the selling price for uranium increase to US$70/lb on a sustainable basis, the Project's NPV would increase by A$53 million. In this event, the opportunity to install a uranium circuit at a later date could gain traction.

12.5 TAXATION

The Project, together with its operations and corporate activities, is based largely in Australia and subject to corporate tax under the *Income Tax Assessment Act* in Australia, *A New Tax System (Goods and Services Tax) Act* ("GST"), customs duties on imported equipment, and royalties on mining operations in the Northern Territory under the *Mineral Royalty Act*.

The RE Separation Plant is to be constructed offshore at a site yet to be determined. For the purposes of the financial model it has been assumed that the offshore jurisdiction will have a similar income tax and indirect tax regime to that in Australia.

13 RISK ASSESSMENT

KEY FEATURES

- Project risk assessed as part of the Company's Corporate Risk Management Policy.
- Formal enterprise risk management system in place.
- Risk mitigation strategies developed and implemented.
- Project funding considered the highest priority risk.

13.1 OVERVIEW

Arafura has developed and formally adopted a Risk Management Policy that sets out the Company's risk profile. The Board is responsible for approving the Company's policies on risk oversight and management, and for satisfying itself that management has developed and implemented a sound system of risk management and internal control.

The Company has an enterprise risk management system in place to identify and mitigate risks associated with the development of the Nolans Project. This system ensures that corporate and project risks are identified on an ongoing basis, and that risk mitigation strategies and actions are developed and implemented.

Risk in this context is defined as anything that can impact on Arafura meeting its Project objectives. These objectives can be financial, technical, community, environmental, OH&S and corporate. Risk is a combination of the likelihood of an event occurring, and the consequence if it did occur. High consequence events, even if low likelihood, are categorised as potentially high risks that require management attention.

As well as having formal risk assessment processes in place, Arafura has appointed two sub committees to help mitigate risk:

- Audit and Risk Committee; and
- Technical Committee.

These committees maintain an overview of Arafura's commercial and technical decision making. Other than reporting through these committees, the Board requires the Company's executive management to report to it at least annually that Project risks are being managed effectively.

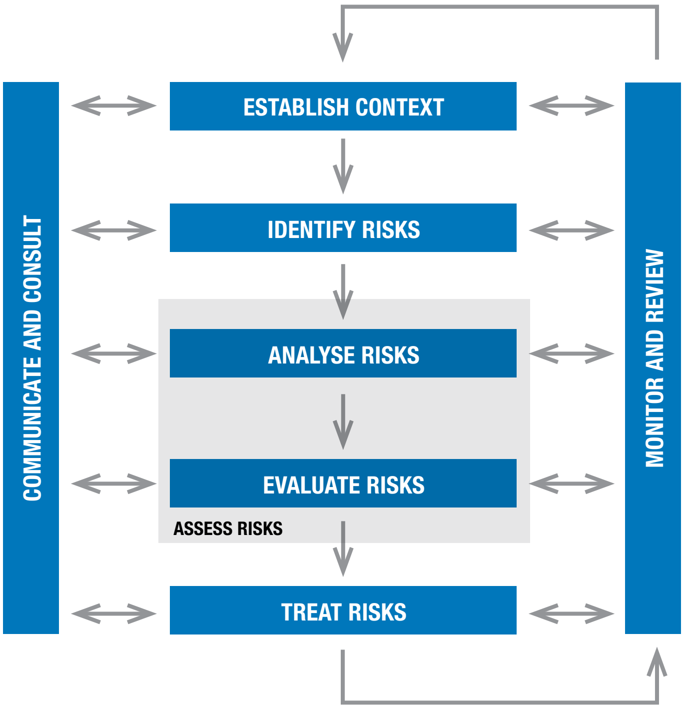
Project risks are regularly assessed throughout the Project's development. The formal enterprise risk management assessment system adopted by the Company documents risk and proposed mitigation strategies (BatteryLimits, 2012; Alberfield, 2014). A project risk assessment review is scheduled on a quarterly basis.

The key issue identified as representing the highest risk to successfully delivering the Nolans Project is project funding. As the Nolans Project proceeds through to completion of the DFS and into detailed design and construction, the Company will monitor this risk, and a number of lower priority risks, on a regular basis, and implement strategies to mitigate these risks. This is consistent with the Company's Risk Management System and Policy.

13.2 AUSTRALIAN STANDARD METHODOLOGY

Arafura has based its risk assessment methodology on the Australian Standard for Risk Management, AS 31000:2009. This methodology is shown in Figure 13.1.

▼ Figure 13.1: Australian Standard Methodology AS 31000:2009 Risk Management



Risks are ranked taking into account the controls and risk mitigation actions that have already been implemented. They are then re-ranked with additional controls, strategies and planned actions to mitigate the risk, and to determine the residual risk rating.

Arafura has classified its risks as:

- 'Priority Action' issues – highest level of risk;
- 'Management Attention' issues – next level of risk;
- 'Moderate' risk; and
- 'Low' risk.

Figure 13.2 shows the position of the risks on the risk matrix in their current likelihood and consequence positions.

Figure 13.3 shows the position of the residual risks on the risk matrix with the additional planned risk mitigation steps in place.

Figure 13.2: Arafura Corporate Risk Profile – Current

LIKELIHOOD	CONSEQUENCE: 1 Insignificant	2 Minor	3 Moderate	4 Major	5 Critical
A Almost Certain					
B Likely			Processing		
C Possible			Product Price Marketing	Cost and Schedule Blowouts Ramp-up	Project Funding
D Unlikely		Native Title Community	Radioactivity Environmental OH&S	Study Funding	
E Rare		Resource	Reagent Supplies		

LOW MODERATE MANAGEMENT ATTENTION PRIORITY ACTION

Figure 13.3: Arafura Corporate Residual Risk Profile with Planned Additional Risk Mitigation In Place

LIKELIHOOD	CONSEQUENCE: 1 Insignificant	2 Minor	3 Moderate	4 Major	5 Critical
A Almost Certain					
B Likely					
C Possible			Product Price		Project Funding
D Unlikely		Study Funding Native Title Community	Marketing Processing Radioactivity Environmental OH&S	Cost and Schedule Blowouts Ramp-up	
E Rare		Resource	Reagent Supplies		

LOW MODERATE MANAGEMENT ATTENTION PRIORITY ACTION

13.3 RISK ASSESSMENT OUTCOMES

13.3.1 PRIORITY ACTION ISSUES

1. Project Funding

Project funding is a priority issue for Arafura Resources. Funding in the current investment market is difficult to source, and the Project has high capital requirements at circa A$1,400 million. Arafura has a proven resource, a well-developed processing flowsheet, a product mix in high demand, and the Project is in a stable political environment. It is also directing a major effort into communicating to the market that it is leading the world's rare earth ("RE") developments.

The Company has developed strong relationships, predominately under confidentiality agreements, with a number of strategic parties that include Chinese RE producers, multinational trading houses, global investment banks, government funding agencies, RE customers and end users. These parties are provided with regular updates on the Project and are at various stages of project assessment.

Expected outcomes include:

- Equity participation at corporate and/or Project level;
- Debt financing;
- Long term offtake;
- Engineering and construction or EPCM;
- Commissioning and ramp-up expedition; and
- Path to market.

With an advanced DFS, Arafura will be in an even stronger position to attract project funding. However, this risk will remain a 'Priority Action' to Arafura until debt and equity funding packages are secured.

13.3.2 MANAGEMENT ATTENTION RISK ISSUES

1. Project Cost and Schedule Blow Outs

During 1997-2012 a number of large Australian mining projects experienced significant over-runs in both capital costs and schedule. In its cost and schedule estimating for the Nolans Project, and in managing project implementation, Arafura will ensure that it learns the lessons from this period. This is not a risk that can be passed to engineering companies, but one that requires close management by Arafura. Among other things, the Company has already appointed a Technical Committee of experienced industry experts to assist it to oversee the management of the Nolans development, including cost control and progress against schedule.

Arafura has also appointed Sheng Kang Ning (Shanghai) Mining Investment Co. Ltd. ("SKN"), a China-based mineral investment and services company, to assist with the management of the Nolans flowsheet optimisation program and the completion of the Nolans DFS. SKN is a 90% owned subsidiary of Shenghe Resources Holdings Co. Ltd. ("Shenghe"), a Shanghai Stock Exchange-listed industry leader in RE production and technology development. Shenghe's operations include China's third largest RE mine, an RE processing plant, and downstream catalysts, molecular sieve and polishing powder manufacturing plants. Shenghe markets specialty RE products to international and China-based customers, and its current allocation of the Chinese RE export quota is approximately 4.5%.

The services being provided by SKN to Arafura include:

- Introducing experienced and well-regarded China-based organisations to complete process testwork for the Nolans Project in support of the DFS;
- Facilitating meetings with China-based organisations and assisting with the review of work, reports and other deliverables produced by China-based contractors and service providers; and
- Assisting with securing opportunities for investment in Arafura and marketing for the Nolans Project.

A key aspect of this engagement is the strategic, technical and operational experience of SKN and Shenghe's Board and executive management team, augmented by support from respected China-based research institutes. The SKN leadership team is proficient in the development and operation of RE processing facilities, with directorships in a number of RE production companies, and is highly regarded within China and the international RE industry.

Project costs and schedule blowout risk will continue to be managed during the DFS as costs and the implementation schedule are being developed further, and then during the implementation period leading into ramp-up. It is expected that Shenghe will assist in this regard.

Prudent risk management is required to ensure that the Company remains sufficiently funded to cover risk events.

2. Ramp-Up

Any large project is particularly cash flow vulnerable during the ramp-up period. Nolans, being a complex large project, is no exception and the Company must ensure that its cash flow funding matches the expected ramp-up profile. In feasibility study work and financial modelling to date, Arafura has paid close attention to this issue.

Ramp-up is currently considered to represent a 'Management Attention' risk to the Project. Arafura recruited an Operations General Manager relatively early in the life of the Project to help mitigate this risk and this manager is charged with overseeing plant design with a view to operability and ramp-up. As the construction phase proceeds, a Commissioning Manager will be appointed and a dedicated commissioning team will support the operations personnel. The operations team will be well trained prior to commissioning.

In addition, an amount of capital will be set aside for use in process modifications and debottlenecking during the commissioning and ramp-up stages. The alliance with Shenghe and its operational experience is also expected to help mitigate commissioning and ramp-up risks.

These steps, in conjunction with integrated piloting of the flowsheet and prudent process design, will help reduce the likelihood of ramp-up risk occurring from 'Possible' to 'Unlikely'.

Arafura is differentiating itself from other non-Chinese RE development companies by aligning itself with strategic organisations that can mitigate operational risk and subsequently financial risk.

3. Study Funding

The Company has adequate cash available to maintain the current progress on Project development. Further funding will be considered throughout the Project development as appropriate. In the current economic climate, this may be difficult and will require significant effort, although Arafura expects to be able to raise these funds given the advanced state of the Project.

This is an ongoing risk.

4. Processing

Extensive testwork has been undertaken by the Company to develop the process flowsheet (see Section 5: METALLURGICAL TESTWORK). The beneficiation flowsheet is well understood and developed, as is the RE separation flowsheet. The RE extraction flowsheet has had extensive development work put into it and will have some areas confirmed through further testwork. A program of work is underway in Australia for this purpose.

Work is also underway in China to confirm the flowsheet developed by Arafura. A further program of work is planned as part of the DFS to pilot the process and conduct variability testing.

This risk requires 'Management Attention', but once this work is complete, the risk will reduce to 'Moderate'.

13.3.3 MODERATE RISKS

1. Product Price

The demand for, and price of, commodities depends on a variety of factors, including the level of forward selling by producers, cost of production, general economic conditions, inflation, interest rates and exchange rates.

It is difficult to put accurate forward estimates onto pricing, but the Company has over many years acquired a vast amount of knowledge of the RE market and believes that it has a good understanding of pricing dynamics.

Securing long-term offtake arrangements will assist Arafura in mitigating this risk in the short term.

Product price risk is rated as 'Moderate' throughout the life of the Project.

2. Marketing

Arafura has put major efforts into understanding and developing its market. It has forged long-term relationships with key end users and strategic trading partners involved in markets where the Company plans to place its product range.

In addition, the Company's product mix includes the highly sought-after NdPr Oxide for use by advanced magnet customers, and it represents a leadership product for the Company. Arafura has produced samples of five REO products to a specification that has been deemed acceptable for use by potential customers. Shenghe has an existing global customer base and can assist Arafura in placing its product range into the most appropriate market at the right price.

Marketing risk is currently ranked as 'Moderate'. Nonetheless, the Company is confident that it will have a market for its products and that, as the Nolans Project is further developed, this risk will reduce in its likelihood from 'Possible' to 'Unlikely' as relationships with potential buyers strengthen and sales agreements finalised.

3. Mining, Transporting, Processing and Storing Radioactive Materials

The Company has built a strong relationship with Northern Territory and Australian government authorities, and is implementing systems, processes and procedures to manage the risks associated with mining, transporting, processing and disposal of radioactive materials, including process residues. It has undertaken extensive and detailed testwork with ANSTO to understand the Project's radionuclide deportment and has enlisted the help of a recognised specialist radiation safety management consultant Radiation Advice & Solutions.

Arafura has significantly reduced the risk associated with the transport of radioactive materials by co-locating the Concentrator and RE Intermediate Plant at the Nolans Site.

The Company's existing radiation management plan will be expanded to incorporate the processing and management of radionuclides. Plant and TSF design has taken into account the radioactive nature of the process residue streams. Despite this risk being rated as 'Moderate', it will require careful on-going vigilance and rigor.

4. Environmental

Arafura's projects and operations are subject to Northern Territory and Australian laws and regulations regarding the environment, including hazards and discharge of hazardous waste and materials and prescribed materials. Arafura is committed to conducting its activities in an environmentally responsible manner and in accordance with applicable laws and regulations.

The Company expects to meet its environmental obligations throughout the implementation and operation of the Project. Given the nature of the Project and the Company's understanding of its environmental setting, this is considered a 'Moderate' risk that requires careful on-going management vigilance.

5. Occupational Health and Safety

Arafura is committed to providing a healthy and safe environment for its personnel, contractors and visitors. It currently provides appropriate instructions and protocols, personal protective equipment, preventative measures, first aid information and training to all stakeholders through its OH&S management systems commensurate with the level of risk. As the Project's activities ramp up, these management systems will be expanded accordingly and rigor increased to meet this increased risk profile. This is considered a 'Moderate' risk to the Project that requires on-going management vigilance.

6. Supply of Reagents

The Nolans Project is dependent on its supply chain of a number of key reagents and in particular sulphur for sulphuric acid production. The Company has undertaken extensive work to understand its supply situation (see Section 7: PROCUREMENT, TRANSPORT AND LOGISTICS), and it is not expected that the supply of key reagents will be a key business risk. This is considered a 'Moderate' risk to the Project.

7. Title and Native Title

The Company appreciates the need to confer with all stakeholders, including the traditional native title custodians of the land on which it plans to develop the Nolans Project. It also confers regularly with the relevant NT and Australian government agencies.

The relationship with the pastoralists and the traditional custodians and their representatives is sound and Arafura is confident in its ability to maintain this relationship throughout the life of the Project. Arafura follows the required processes and procedures with regard to meeting its obligations.

This is considered a 'Moderate' risk to the Project.

8. Community Relationships

Arafura maintains good relationships and has a solid engagement strategy with all Project stakeholders across the general region. This represents a 'Moderate' risk to the Project.

13.3.4 LOW RISKS

1. Resource

The resource is proven to high-confidence JORC standards and is well defined and investigated (see Section 3: GEOLOGY AND RESOURCES and Section 4: MINING). This is a 'Low' risk to the Project.

13.3.5 OTHER RISKS

There are a number of factors that are outside Arafura's control that may adversely impact on the operational performance of the Project. These factors are common with almost all significant business ventures and in particular mining and mineral processing projects.

These factors include:

- Economic factors both in Australia and internationally, such as commodity prices, interest rates, inflation and exchange rates;
- Government policy;
- Taxation; and
- Changes to the regulatory environment.

The Company continues to monitor and take account of these factors by participating in a number of industry, community and government working groups through which it can mitigate their impact on the Project.

13.4 SUMMARY

Arafura has conducted a high level risk assessment of the Nolans Project to identify the key risks and to develop risk mitigation strategies and plans to manage these risks.

Many of the issues that would have previously ranked as 'Priority' or requiring 'Management Attention' have been mitigated by the efforts of the Company in resolving technical and commercial issues relating to the Project. The risk assessment has highlighted the key issues on which Arafura management must continue to focus as it develops the Project.

The next steps for Arafura are to establish a risk register and to monitor identified risks on a regular basis as the Project proceeds through the DFS phase into detailed design and construction. This is in line with the Company's Risk Management System and Policy and ensures that Arafura's management maintains focus and control over the key issues that potentially have the greatest impact on the Nolans Project.

14 PROJECT EXECUTION

KEY FEATURES

- The Nolans Project is technically sound and commercially robust.
- The Company has developed a Project Execution Plan through to scheduled first product from the Nolans Project in the first half of 2019.
- There has been considerable progress since the August 2012 Base Case and the Project's beneficiation and RE extraction flowsheets are in the validation phase.
- There has been a strong focus on de-risking and optimising key areas of the Project.
- Project capital and operating costs have been substantially reduced by reconfiguring and optimising the Project.
- The validation and optimisation program being undertaken in China will be largely finalised over the remainder of 2014.
- The Company's focus is now on completing the DFS in the second half of 2015.
- The Company's fund raising program for the Project is ongoing and will be intensified as the DFS approaches completion.

14.1 OVERVIEW

Arafura has developed a detailed project execution plan ("PEP") for the Nolans Project. It covers the period through to the Company's planned commencement of construction in the second half of 2016 and the planned commencement of Project operations in the first half of 2019. A summary of the main action items and milestones in this detailed schedule is shown in Figure 14.1.

The PEP focuses on the main actions required to be completed before project execution including the remaining testwork validation; work necessary for the Company to complete the definitive feasibility study ("DFS"), including cost estimation, to ±15% accuracy; fund raising activities for the Project; awarding and execution of engineering, procurement and construction management ("EPCM") contracts; and development of the Project.

The scope of this work includes the design, construction and commissioning of suitable facilities to be established in the Northern Territory for mining and processing at the Nolans Site, and inbound logistics requirements.

As demonstrated in this Nolans Development Report, the Company has made significant progress since the August 2012 Base Case and the key milestones from this point on, and the Company's scheduled target dates for achieving these, are set out and discussed in this Section.

14.2 COMPLETION OF FLOWSHEET DESIGN

The flowsheet for the Nolans Project is the result of extensive and systematic testwork undertaken by Arafura and its consultants over a number of years. This has resulted in a process flowsheet that is well tested and technically and commercially suitable for treating Nolans ore. What remains to be done is targeted confirmatory testwork being undertaken in Australia and testwork in China by rare earth ("RE") experts to validate, optimise and confirm the Nolans flowsheet.

China is the dominant producer and supplier of REs to industry globally, and the Company's use of Chinese expertise to validate its flowsheet design and to potentially improve that design, minimises the technical risk of the Nolans flowsheet by accessing the acknowledged expertise of organisations very familiar with processing RE ores. Over the coming months, as each part of the validation process is completed, design parameters will be "locked in" to allow detailed engineering to be undertaken.

An optimised integrated pilot plant ("IPP") will be constructed and operated in the first half of 2015 to further prove up the Nolans flowsheet. The Company plans on commencing detailed engineering design activities in the second half of 2015.

14.3 DETAILED ENGINEERING DESIGN

Detailed engineering design will commence in the second half of 2015 and continue through the early stages of construction, but will be progressed with cost estimation to ±15% accuracy in time for completion of the DFS, which is scheduled on or before the end of the third quarter of 2015. Detailed design will take the current engineering estimates, refined for any flowsheet design improvements and produce them to the required level of accuracy.

The capital costs in this Development Report, as outlined in Section 11 (CAPITAL AND OPERATING COSTS) are estimated on the basis of a standard EPCM approach to Project design and construction. Under this approach to construction, the EPCM engineer will provide detailed design, procurement and construction management services, including appointing appropriate fabricators and contractors for the various parts of the Project and will coordinate all Project construction activities. A cost estimate for the EPCM engineer is included in the Project's capital cost estimates. This philosophy will be closely integrated with third party contractor supplied and operated assets in areas such as mining, and transport and logistics.

The following sub-sections set out in more detail the main features of the three main areas of the Nolans Project, namely the Mine and Concentrator, the RE Intermediate Plant and related infrastructure and ancillary plants, and the RE Separation Plant.

14.3.1 MINE AND CONCENTRATOR

Detailed work initially conducted by Lycopodium (Lycopodium, 2010) and subsequently updated with further refinements, and the re-location of a greater proportion of the processing to the Nolans Site, provides a robust foundation for engineering design and the DFS. Arafura has completed extensive modelling and has a comprehensive understanding of the orebody. The mine development is planned in an uncomplicated manner with the benefit of flat topography and a conventional open-pit design for a relatively modest mining rate.

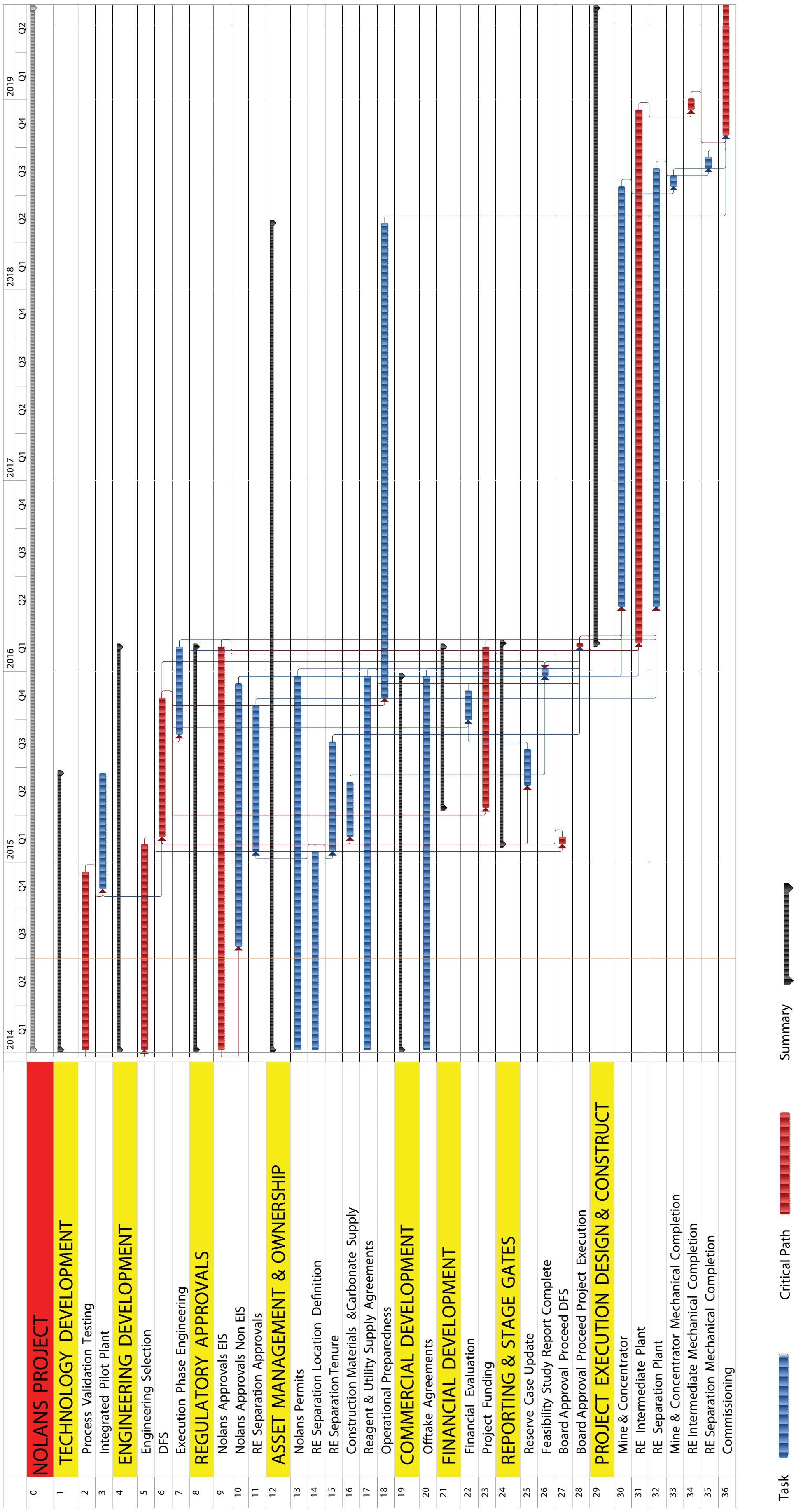
The Concentrator (**Figures 14.2** and **8.2**) is a mid-sized facility with a straightforward flowsheet that features conventional and proven comminution and processing technology, and a slurry transfer pipeline feeding concentrate to the RE Intermediate Plant.

14.3.2 RARE EARTH INTERMEDIATE PLANT, INFRASTRUCTURE AND ANCILLARIES

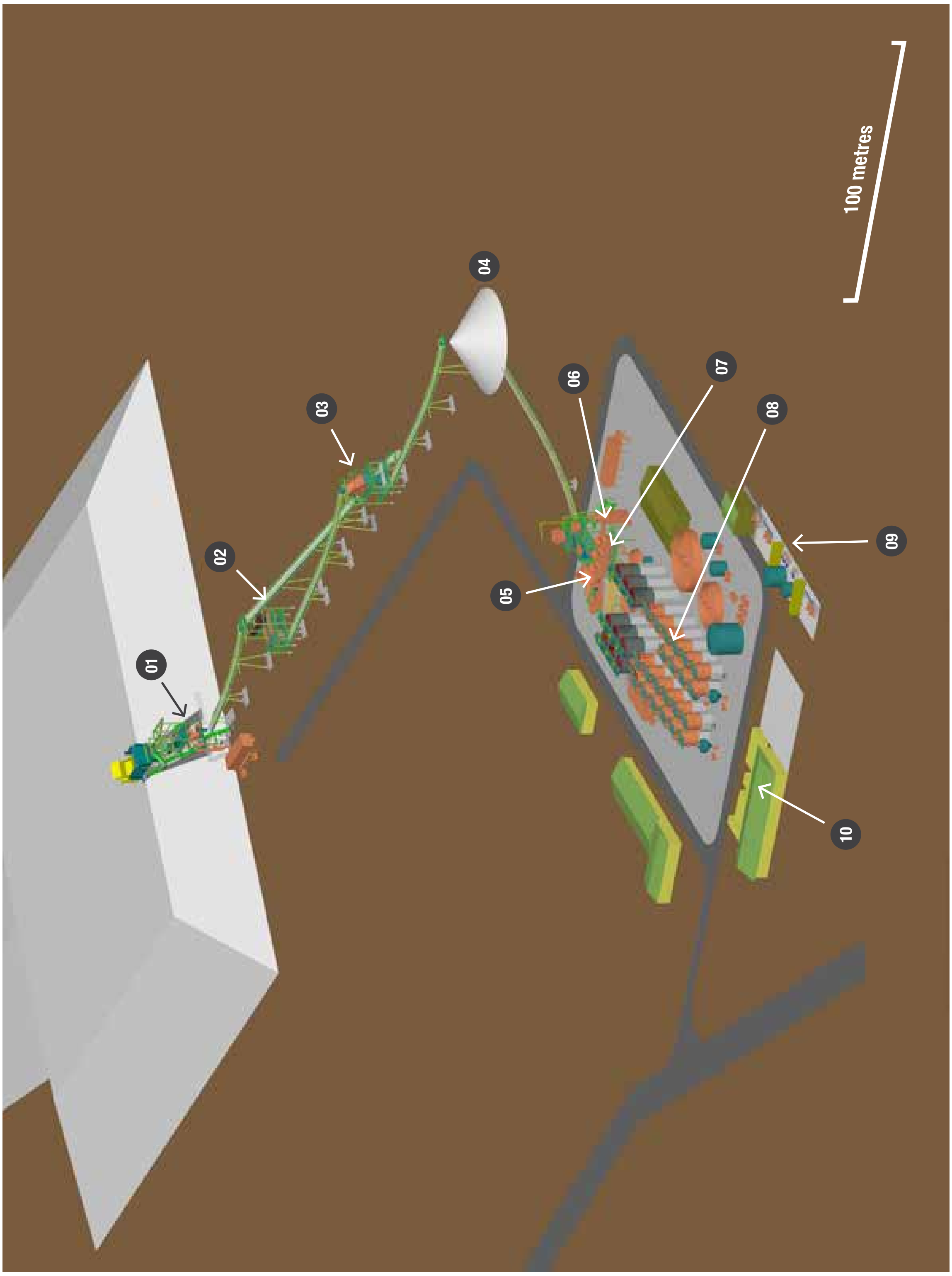
The engineering development work completed for these areas has been substantial, logically being closely linked to recent process developments and the re-location of the RE Intermediate Plant. The RE Intermediate Plant (**Figures 14.3** and **8.2**) is relatively complex featuring multiple discrete, but conventional, unit operations that are not necessarily close-coupled. Most of the process will be in a liquid phase, the plant will generally operate at atmospheric pressure and close to ambient temperature, and corrosion protection measures are known for the nature of the process materials. Acid bake will operate at a modest temperature.

Infrastructure and ancillary requirements will use relatively standard, tried and tested technologies and will include a sulphur burning sulphuric acid plant, natural gas fuelled power generation, water abstraction and transfer, water treatment, and accommodation and other services.

Figure 14.1: Project Execution Plan: Key Activities and Milestones



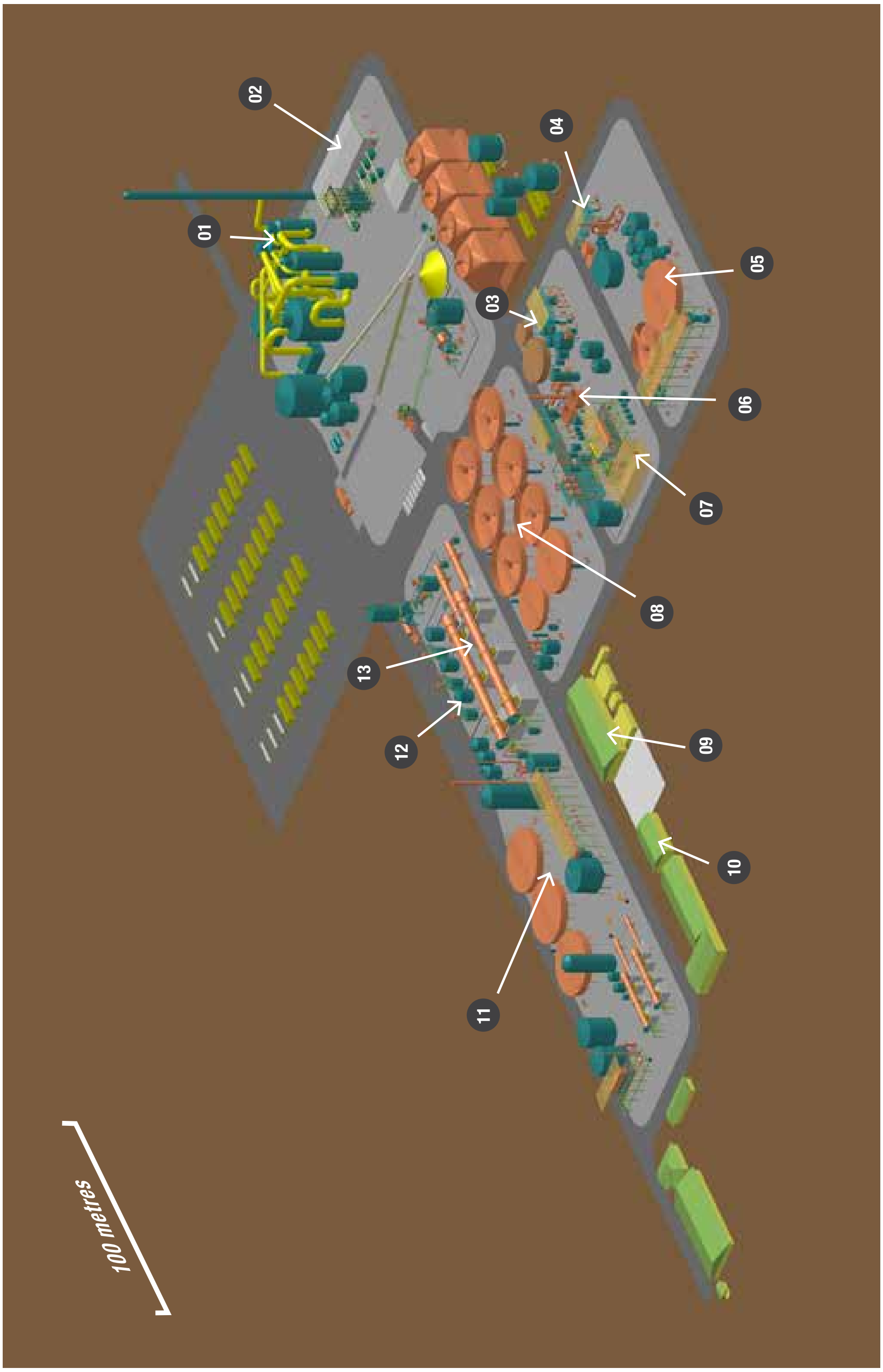
▼ Figure 14.2: 3D Layout of Concentrator (Nolans Mine Site)



LEGEND

- 01 Primary Crusher
- 02 Secondary & Tertiary Crusher
- 03 Screen
- 04 Crushed Ore Stockpile
- 05 Grinding Mill
- 06 Re-grind Mill
- 07 Magnetic Separation
- 08 Flotation
- 09 Reagents
- 10 Workshop

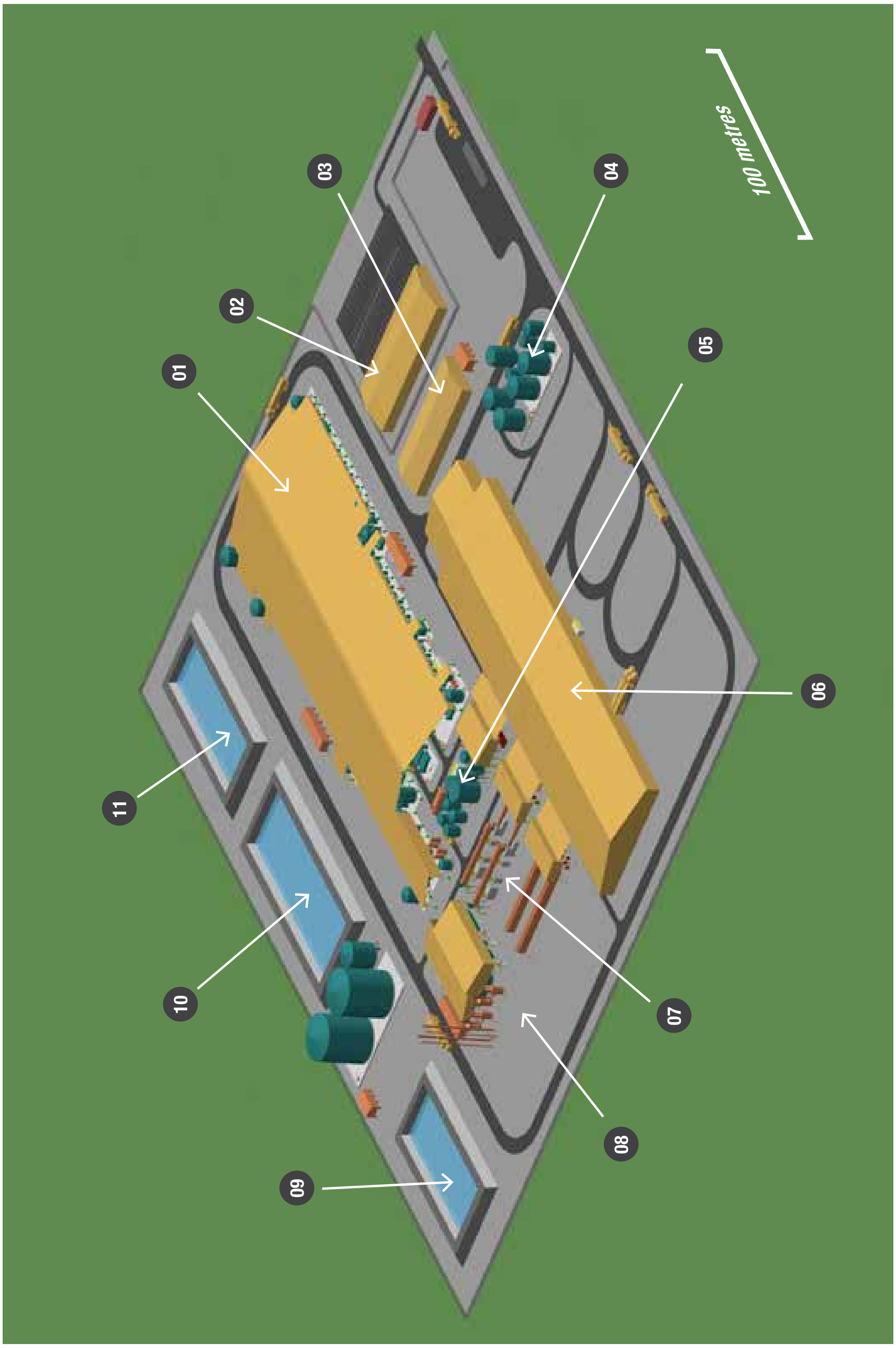
Figure 14.3: 3D Layout of RE Intermediate Plant (Nolans Processing Site)



LEGEND

- 01 Acid Plant
- 02 Power Station
- 03 DSP
- 04 Hydroxide Dissolution
- 05 Impurity Removal
- 06 Hydroxide Conversion
- 07 Product Packing
- 08 Water Leach
- 09 Workshop
- 10 Control Room
- 11 Pre-Leach
- 12 Reagents
- 13 Acid Bake

▼ Figure 14.4: 3D Layout of RE Separation Plant (Offshore Site)



LEGEND

- 01 SX
- 02 Administration
- 03 Operations Centre
- 04 Reagents
- 05 Dissolution
- 06 Warehouse
- 07 Calcination
- 08 Laydown Storage
- 09 Storm Water
- 10 SX Event Pond
- 11 Waste Water

14.3.3 RARE EARTH SEPARATION PLANT

The RE Separation Plant engineering study is underpinned by process design information from detailed testwork and used a generic but geographically identified Gulf Coast USA location as its baseline. The Company will finalise the site for the RE Separation Plant prior to detailed engineering being conducted and prior to completion of the DFS.

The main attributes of the RE Separation Plant (**Figure 14.4**) are summarised as follows:

- Purity of feedstock minimises additional product purification processes;
- Principal processes include SX, precipitation and calcination;
- Cost effective mixer-settler designs have been studied and considered;
- Fire risk is minimised by design and use of higher flash point diluents; and
- The location leverages the local supply of reagents, utilities and services.

14.4 ENGINEERING DEVELOPMENT

The objective of the PEP, at a high level, is to provide the Company with the most cost effective and time efficient approach to Project development. Arafura plans to develop the principal areas of the Nolans Project in parallel. However, the degree of complexity of the installation, lead times of major equipment, access to local fabrication and construction markets, and feedstock supply lead time allows a more relaxed schedule for the RE Separation Plant than for the Nolans Site.

The geographic locations and interdependency of the individual areas of the Project development have some influence on the degree of complexity, the schedule related interdependencies and the process interdependencies, but the various areas of the Nolans Project demonstrate common characteristics such as:

- Multi-discipline nature of design;
- Design development intensive overall process;
- Interrelated schedules with opportunity for specific construction independence;
- Engineering complexity; and
- Modularisation opportunities.

A maximum three year design and construct is included in the PEP to take the Project from approval to hand-over to operations for hot commissioning and ramp-up. The schedule targets construction to commence in the third quarter of 2016.

14.5 DEFINITIVE FEASIBILITY STUDY

Arafura is targeting the third quarter of 2015 to complete the DFS, although much of the necessary work has already been undertaken by the Company and its consultants. In order to bring the Project to a DFS level, confirmatory work in a number of disciplines and a decision on the offshore site for the RE Separation Plant will be important, as well as the timely completion of pilot testwork and the Chinese optimisation program. The Company is confident that it has the knowledge and processes in place to achieve the targets established in the PEP.

The DFS will be managed by Arafura's experienced team in key areas of geology, engineering, financial evaluation and funding requirements, commercial, sales and marketing, sustainability activities and community engagement. Most of these areas are already well advanced towards DFS.

The Company retains personnel from a range of other disciplines and will grow the team as appropriate to manage subsequent phases and requirements for DFS and Project execution purposes. This team will be assembled to provide in-house expertise in project management, controls and administration, process development and evaluation, engineering and mining, procurement and logistics, Environment Health Safety Quality ("EHSQ") and risk, operational readiness and commissioning, legal, and human resources. The Company will also engage external expertise as appropriate for various input into the DFS.

Specific activities that require attention in order to complete the DFS include:

- Detailed mine planning and scheduling for the Nolans Mine and the carbonate quarry;
- Preliminary engineering;
- Securing potential vendors and costs for major equipment packages;
- Evaluating the selected footprint for the RE Intermediate Plant;
- Evaluating the selected RE Separation Plant site;
- Capital and operating cost estimating to ±15%;
- Defining all infrastructure requirements;
- Finalising groundwater availability and abstraction access;
- Requirements and security of principal supply agreements;
- Preparation of a detailed PEP;
- Commercial off-take agreements for products; and
- Funding the Project.

14.6 FUNDING

Arafura will require significant capital investment in the form of both equity and debt to finance the Nolans Project. Although the Company's financial evaluation of the Project shows a good return on investment, a strong capacity to service debt and a long-lived Project, as outlined in Section 12 (FINANCIAL EVALUATION), the aftermath of the Global Financial Crisis has not been a positive environment for small companies with large projects to raise substantial amounts of equity or debt.

The Company has maintained a close watch on, and has associations with, participants in global capital markets and has strategies in place to maximise its ability to attract funds for the Project. In addition, capital markets have shown some improvement recently and greater interest in the Nolans Project. Arafura believes that this interest will appreciate considerably as the DFS for the Nolans Project approaches completion.

Arafura is currently focusing on a number of key areas, including:

- Developing and promoting a clear understanding of each component of the product delivery process, from mine extraction through to delivery of product to customers, and how Project risks will be mitigated;
- Aligning with RE market operators to minimise project technology, commissioning, start up and product quality risks;
- Executing a high level of firm offtakes with credit-worthy customers to underpin repayments of Project debt;
- Early engagement with potential customers to ensure that Nolans RE products meet quality specifications;
- Ensuring that all Project consents and approvals are successfully achieved; and
- Completing a high quality DFS.

In addition, the Company is in varying stages of negotiation with a number of parties which will ultimately determine the basis of its funding structure.

Arafura's fund raising activities for the Nolans Project are ongoing and will escalate as the DFS nears completion.

14.7 CONSTRUCTION

An early works program is scheduled to commence following completion of the DFS and upon obtaining necessary regulatory and other key approvals. This will include:

- Preparation of tender documents for the EPCM contracts;
- Preparation of tender documents for mining, ancillaries and other infrastructure;
- Assessment and provisional approval of EPCM and other contracts;
- Conclusion of the value engineering exercise; and
- Commencement of execution phase engineering.

On Arafura Board approval to proceed, regulatory approvals in place, and with funding for the Project secured, the selected EPCM contractor(s) will be instructed to proceed with the execution phase of the Project. The structure of the Project lends itself to multiple EPCM contracts for distinct packages of work, which could include the Mine and Concentrator, the RE Intermediate Plant, the sulphuric acid plant, the RE Separation Plant, and off-site infrastructure. However, it may also be feasible to engage a single organisation to execute the Project, provided that such an organisation can demonstrate the capability and global reach and experience to cover the geographic spread of the Project. Arafura will carefully consider and evaluate this alternative.

A contract mining organisation will be engaged to prepare for the mining activities to be carried out by the contractor using its expertise, equipment and management.

Third party service providers for a number of transport and logistics services will also be contracted at this stage to ensure that the supply chain infrastructure and capabilities are fully developed and functional during the execution phase of the Project.

Arafura will expand its client team to manage Project execution. This will require additional skills (for example construction management and quantity surveying skills) to supplement those skills already in the Company. A proportion will be early recruitment operational personnel who will initially gain familiarity, input and ownership of the Project as part of the client team prior to moving into the operations team to define, manage and optimise operational readiness and longer term operational activities.

14.8 PROJECT ORGANISATION

Arafura will recruit first class personnel for key Company roles, including key roles within the engineering team, such that ownership and know-how is maintained within the business. Arafura's core engineering team is well credentialed and established and will continue to grow during subsequent phases of the Project. It will be supplemented and supported by additional contract resources with specific skill sets to form the integrated client team for the latter development and implementation phases.

This client team will also be fully integrated with the corporate functions of the Company's business. This will ensure clear common objectives and focus, short lines of communication, and operational flexibility to address issues in a timely manner.

The principal members of the operations team will be recruited early in the Project timeline to ensure that operational input into design is assured and total Project ownership achieved.

14.9 NEXT STEPS

The Company's PEP is well developed, with a focus on achieving the following key objectives:

- Complete flowsheet optimisation testwork and piloting;
- Complete the DFS, including engineering design activities to deliver capital and operating cost estimates to ±15% accuracy;
- Complete the regulatory permitting processes for the Nolans Site and offshore locations;
- Update the Ore Reserves for the Project;
- Secure an appropriate level of product sales and raw materials supply contracts;
- Obtain Arafura Board formal investment decision to proceed;
- Execute the Project funding plan; and
- Develop and construct the Nolans Project.

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GLOSSARY

Term	Definition
AAPA	Aboriginal Areas Protection Authority (Northern Territory Government)
AB	Acid bake (in RE extraction process)
ALARA	As Low as Reasonably Achievable safety principle designed to minimize radiation doses
Allanite	A silicate mineral that may contain up to 30 wt% REO
ANSTO	Australian Nuclear Science and Technology Organisation (Australian Government)
Apatite	A phosphate mineral that may contain up to 19 wt% REO
Arafura or the Company	Arafura Resources Limited ABN 22 080 933 455 and its wholly owned subsidiaries, including Arafura Rare Earths Pty Ltd
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency (Australian Government)
ASX	Australian Securities Exchange
August 2012 Base Case	Base Case for the Nolans Project released to the ASX on 7 August 2012
BOO	Build own and operate
CAGR	Compound annual growth rate
CLC	Central Land Council
CNZ	Central North Zone of the Nolans Bore deposit
CPI	Consumer price index
CZ	Central Zone of the Nolans Bore deposit
DCF	Discounted cash flow
DCM	Department of the Chief Minister (Northern Territory Government)
DD	Diamond core (drilling)
DFS	Definitive feasibility study
DME	Department of Mines and Energy (Northern Territory Government)
DSP	Double sulphate precipitation (in RE extraction process)
EBITDA	Earnings before interest, tax, depreciation and amortisation
EIS	Environmental impact statement
EL	Exploration licence
EML	Extractive mineral lease
EPA	Environment Protection Authority (Northern Territory Government)
EPBC Act	Environment Protection and Biodiversity Conservation Act (Australian Government)
EPCM	Engineering, procurement, and construction management
FOB	Free on board
HRE or HREE	Heavy rare earth (element), being terbium Tb, dysprosium Dy, holmium Ho, erbium Er, thulium Tm, ytterbium Yb, lutetium Lu, and yttrium Y
HRE Oxide	Heavy rare earth mixed oxide
ILUA	Indigenous land use agreement. A formal agreement under the Native Title Act that contemplates access to land for the purposes of mining, mineral processing, and the placement of associated infrastructure.
IPP	Integrated pilot plant
IRR	Internal rate of return
JORC Code	Guidelines for public reporting of Exploration Results, Mineral Resources and Ore Reserves
LOI	Letter of intent
LOM	Life of mine
LRE or LREE	Light rare earth (element), being lanthanum La, cerium Ce, praseodymium Pr, and neodymium Nd
M&I	Measured and Indicated (Mineral Resources)
Mineral Resources	Defined under the JORC Code as concentration of solid material of economic interest in such form, quality and quantity that there are reasonable prospects of economic extraction.
Mineral Titles Act	Legislation that regulates mineral exploration and mining titles in the Northern Territory
ML	Mineral lease
Modifying Factors	Defined under the JORC Code as technical, commercial, legal, environmental, social and governmental factors that support conversion of Mineral Resources to Ore Reserves
Monazite	A phosphate mineral that may contain up to 70 wt% REO

Term (cont.)	Definition (cont.)
MOU	Memorandum of understanding
MRE or SEG	Middle rare earth (element) being samarium Sm, europium Eu, and gadolinium Gd
mRL	Metre reduced level
NdPr Oxide or Didymium Oxide	Neodymium and praseodymium mixed oxide
Nolans Bore	The Nolans Bore deposit, resource or Mineral Resources
Nolans Mine Site or the Mine Site	Area comprising Mineral Lease Application ML 26659 lodged with the Northern Territory Government by Arafura in February 2008. Includes the mine, concentrator and associated infrastructure.
Nolans Processing Site or the Processing Site	Area comprising the RE Intermediate Plant, ancillary plants and supporting infrastructure
Nolans Project or the Project	Comprises the development of the proposed Nolans Site and RE Separation Plant
Nolans Site or Nolans	The Nolans Mine Site and the Nolans Processing Site
NORM	Naturally occurring radioactive material
NPV	Net present value
NT	Northern Territory (of Australia)
OH&S	Occupational health and safety
Ore Reserves	Defined under the JORC Code. The economically mineable part of Measured and/or Indicated Mineral Resources.
P_2O_5	Phosphate
PFS	Preliminary feasibility study
RC	Reverse circulation (drilling)
RE	Rare earth (as in RE Intermediate Plant)
REE	Rare earth element
RE Extraction	Process converting RE concentrate to the RE intermediate product for RE separation
RE Intermediate	The product from the RE extraction process in the form of a mixed RE compound which is the feed for the RE separation process
RE Intermediate Plant	The plant within which the RE extraction processes are undertaken to produce the RE intermediate product
REO	Rare earth oxide
RE Separation Plant	Comprises the plant and associated ancillaries for processing RE intermediate to separated REO products
ROM	Run of mine
RSF	Process residues storage facility at the Processing Site
SAPL	Sulphuric acid pre-leach (in RE extraction process)
Section	A section reference within the Nolans Development Report
SEG Oxide	Samarium, europium and gadolinium mixed oxide
SX	Solvent extraction
TSF	Tailings storage facility at the Mine Site
U_3O_8 or UO_4	Uranium oxide
WHGMS	Wet high gauss magnetic separation
WLL	Water leach liquor

UNITS OF MEASURE

Unit	Description
A$	Australian dollars
A$m	Million Australian dollars
Bq	Becquerel
ft	Foot
G	Gauss
Gl	Gigalitre (thousand million litres)
h	Hour
ha	Hectare
kg	Kilogram (thousand grams)
kt	Kilotonne (thousand tonnes)

Unit	Description
kV	Kilovolt (thousand volts)
l	Litre
lb	Pound
lb/t	Pounds per tonne
m	Metre
m^3	Cubic metre
mE	Metre east
mm	Millimetre
mN	Metre north
Mt	Million tonnes

Unit	Description
Mtpa	Million tonnes per annum
MW	Megawatt (million watts)
tpa	Tonnes per annum
t	Tonne
US$	United States dollars
US$m	Million United States dollars
V	Volt
W	Watt
wt%	Weight percent

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