04

Project alternatives and cumulative impacts

4. Project alternatives and cumulative impacts

4.1 Introduction

This chapter discusses the alternatives considered during planning and scoping of the Nolans Project in Central Australia, and introduces potential cumulative impacts arising from compounding activities of multiple mining and processing operations, as well as aggregation and interaction of mining impacts with other past, current and future activities.

The TOR for the preparation of an environmental impact assessment issued by the NT EPA provided the following objectives in relation to alternative proposals:

> *Alternative proposals, which allow the objectives of the Project to be met, should be discussed … and the advantages and disadvantages of preferred options and alternatives detailed. The short, medium and long-term potential beneficial and adverse impacts of each of the options should be considered and associated risks should be detailed and analysed.*

Section 3.3 of the TOR provided the following environmental objectives in relation to cumulative impact:

> *An assessment of cumulative environmental impacts should be undertaken … to ensure that any potential environmental impacts are not considered in isolation.*

This chapter describes the project alternatives that have been considered by Arafura as part of the development process, and the potential cumulative impacts stemming from the effects of the Nolans Project on top of impacts that may arise from other significant mining or infrastructure projects within the local area. This includes impacts on community, environment and MNES, the duration of the potential impacts and potential mitigation measures.

4.2 Project history

The Nolans Project was initiated in 2005, and since then technical and commercial scoping and development has been ongoing in order to address the project's opportunities and constraints.

The Nolans Bore rare earths deposit comprises unique mineralogy that presents technical challenges in processing and recovery. The project's development timeframe has therefore been necessarily lengthy and has required a significant research and development phase. The benefit of this lengthy development timeframe is that Arafura has had the opportunity to gain significant insight into the project, the development options and appropriate outcomes for the owners, the stakeholders and the environment.

Various project development streams have been ongoing since project inception that focus on process and recovery including economics, process technical feasibility and treatment options, and marketable products. The planning and development phase has also had a focus on project optimisation, de-risking the project and mitigating the project's impacts, including impacts on the environment.

Accordingly, a range of project locations and processing configurations, project inputs and mitigation options have been considered and investigated.

The project alternatives considered since project inception include:

- Not proceeding with the project
- Location / configuration
- Processing alternatives
- Mining methodology
- Raw water supply
- Raw materials supply
- Carbonate material
- Power supply
- Accommodation
- Project supply, logistics and transportation
- Kerosene Camp Creek diversion
- Rehabilitation and closure.

4.3 Project Alternatives

4.3.1 Not proceeding with the project

Not proceeding with the project is an alternative in an economic environment dominated by falling commodity prices and increasing processing costs.

The Nolans Project has the potential to provide significant short and long term economic and social benefits to the Northern Territory and particularly to the Central Australian region including:

- Annual production and export of up to 43,000 tonnes of intermediate rare earths product (which represents a sizable supply alternative to Chinese production of this strategic material) and a source of production royalties and taxation payable to the Northern Territory and Australian governments
- Capital expenditure of about $850 million on construction of the mine, concentrator and processing plant, which includes nearly $145 million in the Territory and of that, about $70 million in Central Australia
- Operational expenditure of approximately $38 million in the Territory including about $18 million per annum in Central Australia, over the 40+ year life of the project
- 400-500 direct construction jobs
- 250-300 direct operations jobs
- Business opportunities to supply goods and services during construction and operations, with some coming from local suppliers in Alice Springs and other nearby communities
- Community benefits and royalties over the life of the project to local stakeholders.

These and other economic and social benefits are discussed in more detail in Chapter 15 and Appendix S and Appendix T.

4.3.2 Location / configuration

The Nolans Bore deposit contains moderate grades of rare earths and phosphate, and a relatively low grade of uranium. Given the mixed nature of the deposit, there are a range of challenges in economically processing the ore away from the general mine site.

Two options were investigated for an off-site processing location prior to Arafura deciding to locate most of the operation at the Nolans site.

Option 1 - Mineral concentrate transported from Nolans mine site to a Darwin processing plant

The initial project configuration included an open cut mining operation and concentrator, producing about 600,000 tpa of mineral concentrate which was then to be transported via a dedicated haul road, crossing the Stuart Highway, from the mine site concentrator to the Adelaide-Darwin railway line for loading and rail transport to Darwin. A large processing facility including a separation plant was to be built at Wickham Point in Darwin Harbour.

This configuration was eventually rejected based on logistical issues and environmental challenges which included:

- Water supply at the processing site could not be secured
- Land availability at Wickham Point was limited
- The size of evaporation ponds to manage water requirements and rainfall events in a cyclone region was excessive
- The logistics of transferring large volumes of reagents from the Darwin Port through an urban environment to Wickham Point were difficult
- Project power requirements could not be met
- Stakeholder resistance was anticipated, for a project near Darwin Harbour, processing a mineral concentrate containing rare earths and radioactive elements.

Option 2 - Mineral concentrate transported from Nolans mine site to China

The option to export up to 600,000 tpa of mineral concentrate to China for downstream processing was also considered early in the life of the project. However, it was rejected on the following grounds:

- The concentration of radionuclides in the mineral concentrate greatly exceeded the allowable limit of 0.05% defined in the relevant Australian export control regulations. This will make exportation difficult without onerous approvals and chain of custody controls.
- Uncertainty surrounding Chinese Government policy and potential constraints imposed by it on the marketing and commercial viability of rare earths.

Option 3 – Mineral concentrate transported from Nolans mine site to a Whyalla based processing plant

Option 3 considered an open cut mining operation and concentrator, producing 600,000 tpa of mineral concentrate, which was to be transported via a dedicated haul road, crossing the Stuart Highway from the mine site concentrator to the Adelaide-Darwin railway line for loading and rail transport to Whyalla in South Australia. A large processing facility including a separation plant was to be built on land owned by Arrium Steel near the steel works. This location and configuration was also eventually rejected based on a number of logistical and cost issues, and environmental challenges which included:

- Cumulative construction costs associated with the transport infrastructure (haul road, highway underpass and rail siding) linking the Nolans mine with the Adelaide-Darwin railway
- Water supply in Whyalla could not be secured without the construction of a large desalination plant
- The logistics of transferring large volumes of reagents via Port Adelaide and Spencer Gulf, in addition to transporting mineral concentrate from the Nolans mine to Whyalla
- Gas requirements could not be met without substantial pipeline upgrades
- Storage areas and stockpile requirements for processing by-products (e.g. gypsum) were problematic
- Environmental concerns around cumulative project impacts in the Upper Spencer Gulf. The Olympic Dam copper-uranium expansion was being considered at that time and a large desalination facility was being contemplated for that development. The Upper Spencer Gulf is a known breeding ground for the giant cuttlefish
- Cost of construction to build a processing plant to include what would have been Australia's largest chlor-alkali plant (for pre-leach processing and rare earth separation).

Option 4 - Mineral concentrate at Nolans mine site and a Nolans site-based processing plant

Following the discovery of a water supply suitable for the project southwest of the Nolans mine site in late-2012, work then focused on reconfiguring the project for a Central Australia operation. Two sub-options were considered:

- Option 4a – all project infrastructure at the mine site, separation offshore
- Option 4b – project infrastructure split into two parts, separation offshore

Option 4a

Initial project scoping located all project infrastructure at the mine site. After investigation, this configuration was modified to remove the final rare earth separation plant to an offshore location.

The final separation (refining) phase of rare earths recovery requires large quantities of hydrochloric acid and caustic soda. It was concluded that this part of the process should be completed nearer to sources of these reagents where plentiful supply is available as by-products of existing large-scale chemical operations. This aspect of the project was further investigated and two locations have been selected for final scoping and assessment, one in South Korea and one in the Gulf States region of the USA. This decision also removed the requirement to transport very large volumes of liquid reagents to the Nolans site from Darwin Port.

Whilst the project configuration investigation was occurring, environmental studies and community consultation work was ongoing. From these, stakeholder concerns were raised about the placement of the processing plant within the Ti Tree Basin catchment. Arafura did not conduct any hydrological studies to determine if the proposed processing plant would impact on the Ti Tree Basin catchment, but elected to investigate a modified split site configuration to address these perceptions and concerns.

Option 4b

This option considered splitting the site operations into two parts resulting in a mining operation and concentrator at the Nolans Bore site, and a processing facility about eight kilometres south of the mine site. This will place the processing plant in the Southern Basins water catchment, thus removing it from the Ti Tree Basin catchment. A suitable area was selected on shallow basement rock located near the Amadeus Basin – Darwin natural gas pipeline.

Mineral concentrate will be pumped to the processing plant via a bunded slurry pipeline running between the two sites. An access road will connect the two sites and a power and water corridor will follow the road alignment.

The decision to relocate and consolidate the processing plant back to the Nolans site in Central Australia has a number of clear, short and long-term economic benefits for the region and additionally has other logistical and environmental benefits. These include:

- Transport of large quantities of radioactive mineral concentrate (600,000 tpa) via road and rail through communities (e.g. Alice Springs) is eliminated
- All radioactive elements remain at the Nolans site following processing and removal into secure storage
- Reduced importation of reagents and transport requirements
- Increased opportunities for regionally based infrastructure to leverage off the project.

Option 4b is the option proposed in this EIS.

4.3.3 Processing alternatives

Test work and optimisation has been completed to determine the most efficient way to produce a mineral concentrate (i.e. beneficiation) from Nolans Bore. This research and development test work has been ongoing since 2005 and has been supported, in part, by Commonwealth grants and test work in Commonwealth laboratories including CSIRO and ANSTO. The initial comminution test work utilised multistage crushing and screening. This option has now been replaced with an alternative single stage crushing process and a grinding circuit. The most important advantage of this change in the comminution process has been a significant reduction in potential dust emissions, throughout the life of the mine.

Hydrometallurgical test work has been undertaken over the past eight years. These programs have employed a variety of leaching acids to deliver the most cost- and capital-efficient process option. Arafura has investigated a hydrochloric acid-based process, but from an economic and risk management perspective, the case for sufuric acid (i.e. sulfuric acid pre-leach – double sulfate precipitation, or SAPL-DSP) has outweighed the alternative process.

Arafura continues to investigate further process improvements. An alternative pre-leach reagent and purification process currently remains under active consideration, however the SAPL-DSP process is technically proven and financially viable' and is the foundation of the project described in this EIS.

Additionally, Arafura has and will continue to investigate the recovery of all potential products from the Nolans Project, including rare earths, phosphate and uranium. The current SAPL-DSP process is focused only on the commercial recovery of rare earths, however if the economics of phosphate or uranium improves sufficiently; or should a commercial market for thorium emerge, consideration may be given to modifying the process to recover and commercialise some or all of these co-products, or to investigating the viability of co-product recovery from tailings or process residues.

4.3.4 Mining methodology

The Nolans Bore resource is near surface and extensive. It occurs as wide, steeply dipping interconnected veins and zones, and as a consequence, is most efficiently mined using open pit truck and haul methods. The resource is delineated only to a depth of 215 metres below surface however, and deeper drilling demonstrates that mineralisation continues down beneath this level.

Consequently, underground mining may be contemplated in the future, following the open pit mining of the upper section of the orebody; but this is unlikely within the current life of mine plan. The current mining schedule (see Chapter 3) is aimed at optimising recovery of the orebody using the open pit mining methodology.

4.3.5 Raw water supply

In 2010, a source for a sustainable water supply for the mine and concentrator were investigated based on processing off site. Initial investigations focussed on locating a groundwater supply from the Ti Tree Basin, a 25-30 kilometres north and northeast of the mine site. These investigations were successful and established the presence of a suitable groundwater supply for the mine and concentrator requirements, of up to two gigalitres per annum.

In the latter part of 2012 Arafura began scoping a shift of the processing plant from Whyalla back to the Nolans site. As part of this process, and taking account of the likely increased raw water requirements of an expanded operation at Nolans, it became apparent that the concerns of competing users of the Ti Tree Basin and other stakeholders will need to be considered. Consequently, the company undertook a wider regional search for alternative sources of groundwater.

In 2012 alternative studies into securing a larger groundwater supply were initiated, in order to facilitate a shifting of the processing plant back to the Nolans site. The Ti Tree Basin would not be suitable for this process, due to competing users of this resource and stakeholder concerns.

In December 2012, Arafura commenced a water exploration program about 35 kilometres southwest of the mine site. This initial exploration was successful and a follow-up investigation program was completed in early 2013. This program confirmed the presence of an extensive groundwater system of aquifers, and was a key determinant in the company's decision to relocate the processing plant to the Nolans site.

Subsequent investigation and modelling have now confirmed this alternative water supply can sustain the Nolans Project well beyond the present life of mine, whilst also providing water for pastoral usage on a substantial area of Aileron Station which previously was unproductive. Details of the hydrogeological investigation work is provided in Appendix K.

Studies have also been completed to minimise raw water requirements. The production of rare earths is a water intensive process, requiring a number of washing phases for purification. Since the initial process design and test work was completed for the project however, the raw water requirement has been reduced by about 40% from 6 GL to 4.2 GL per annum.

Further optimisation is occurring, with aim of further reducing raw water supply requirements. Groundwater from the mining operation, packaged sewerage treatment plants and tailings return are intended to be recycled and reused throughout the project. A packaged water treatment plant will be incorporated into the processing plant to provide potable water for personnel and a treated supply for critical cleaning aspects of the rare earths processing. Process water that can no longer be recycled will be disposed via the TSF, RSFs or evaporation ponds.

4.3.6 Raw materials supply

The project has a range of raw material requirements for construction and operations. It is intended that the bulk of the raw materials, which includes rock, gravel, sand, topsoil and carbonate material, will be sourced either from within or near the Nolans site.

Rock will be selected during the initial pre-strip of the pit for use in various aspects of construction. Care will be taken to ensure this material is benign in terms of its chemical composition and radionuclide concentrations.

Gravel material will be sourced from an old road construction quarry on the Stuart Highway about 25 kilometres from the processing plant, or from a local source on Aileron Station about 12 kilometres from the plant. Prior to this occurring the necessary regulatory approvals will be sought. Other gravel for cement manufacture will be transported to site from quarries near Alice Springs.

Sand also required for cement making will be mined from that part of the Kerosene Camp Creek that will be mined as part of the open pit. Any additional sand requirements will be sourced locally but appropriate approvals will be sought prior to this occurring.

Topsoil will be removed as construction progresses, and will be stored in designated areas around the operation to ensure adequate quantities are available for use in rehabilitation. It is intended that topsoil removal will be staged as much as is practicable and reused progressively to ensure the viability of the soil is maintained.

4.3.7 Carbonate material

Carbonate material is required in the processing operation to maintain pH control. Arafura has investigated two alternatives for providing the required volumes needed for the project.

Option 1 considers transporting processing reagent requirements for pH control (lime) to the Nolans site from external suppliers (30,000 tpa). This would require additional rail transport and road transport for the life of the mine, on the Stuart Highway.

Option 2 considers site-based and nearby supplies of suitable carbonate material. The preferred strategy is to initially mine known calcrete occurrences at the mine site. These areas will eventually be buried by WRDs.

In addition to these modest resources, a large mapped occurrence of marble is located on Pine Hill Station that adjoins Aileron Station along its north western boundary. Initial test work on this material indicates it may be suitable for acid neutralisation, but further work is required to verify this. Arafura intends to complete an exploration program over the area to confirm sufficient marble is present to support the life of mine requirements of the project.

Should process test work and exploration prove successful, Arafura will seek a separate mining and environmental approval for a small quarrying operation of about 125,000 tpa. This would include the construction of an internal project haul road connecting the quarry with the processing plant (Figure 4-1). This small quarrying operation would provide further economic

and social opportunity in the local region, but has not been factored into any of the studies presented in this EIS.

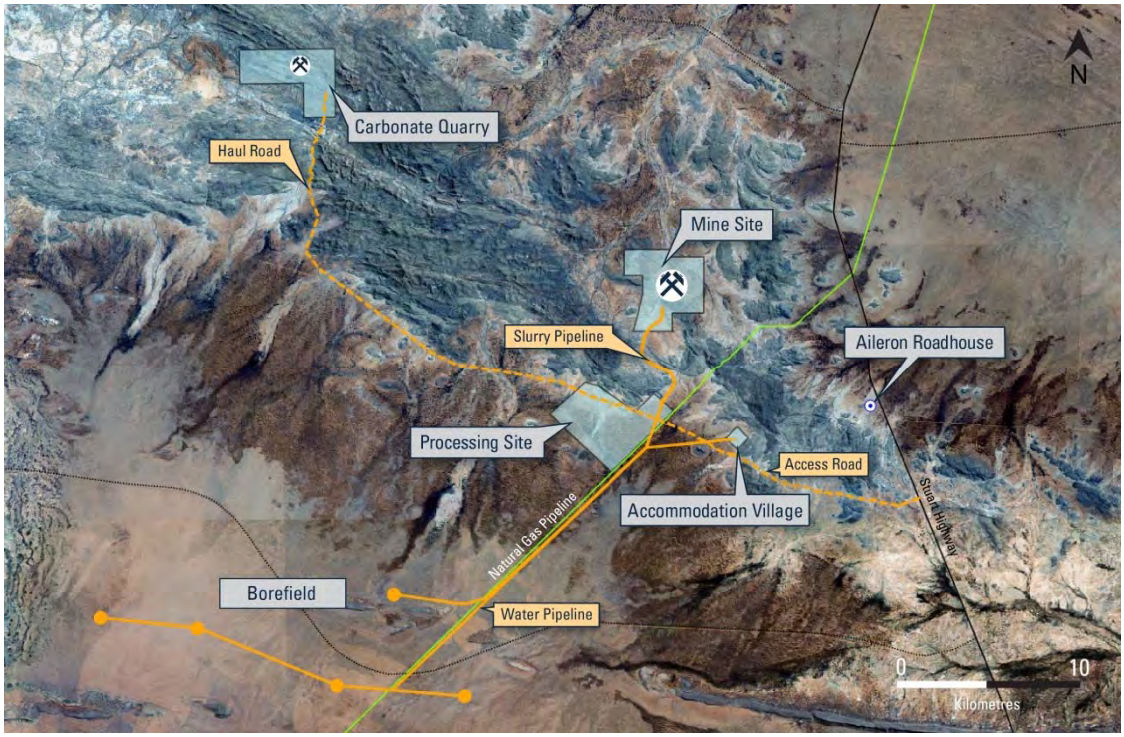

Figure 4-1 Nolans Site Layout, including the Woodforde Carbonate Project (source Arafura 2014)

4.3.8 Power supply

The inclusion of sulfuric acid plant within processing facility will also enable the project to recycle heat energy created from the exothermic reaction when producing sulfuric acid to be used to produce steam for turbines to generate about 6 MW of power. This recycling will enable 6 MW of gas fired generation to be turned off for long periods except when the acid plant is shut down for maintenance or repair, thus providing cost savings and reducing project emissions.

Additionally, Arafura is engaging with a number of power providers to investigate the potential for a regional power station, to not only service the project's requirements, but also the potential needs of local communities and horticultural developments in the Ti Tree Basin.

4.3.9 Accommodation

Two options for providing accommodation to employees have been investigated for the project.

Option 1 considered constructing the project's accommodation needs in close proximity to the Aileron Roadhouse. This was possible when the project's onsite scope was limited to a mine and concentrator, and a smaller estimated workforce of about 150. This would have provided significant growth for facilities at the roadhouse.

Option 2 followed reconfiguration of the project to incorporate a processing plant. It was determined that the placement of an accommodation village near the roadhouse to cater for a much larger workforce (250-300 during operations) would place too significant an impact on the operation and character of this iconic location. Locating a substantially larger village near the roadhouse would also increase the likelihood of interactions between the project workforce and local and passing trade, potentially leading to social tension and related issues.

The project's accommodation village has subsequently been relocated to a site four kilometres southeast of the processing plant. Additional temporary construction accommodation may be

required during construction of the project but this will be removed as soon as practicable following completion of construction.

The roadhouse is only 20 kilometres by road from the project. To ensure economic benefits are realised locally, it is intended that visitors, shutdown workers, etc. will still be accommodated at the roadhouse facilities, to reduce the need for ongoing additional accommodation at the project.

4.3.10 Workforce transportation

Options to transport both the construction and operational workforce to the Nolans site from Alice Springs have been investigated.

Option 1 considered a fly-in fly-out operation directly to the Nolans site but this was ruled out because of cost, and because the option did not take advantage of the excellent regional transport infrastructure in Alice Springs.

Option 2 is the current proposal considered within this EIS. The construction and operational workforce will be bused in and out of Alice Springs to the site. Traffic volumes on the section of Stuart Highway between Nolans and Alice Springs are relatively low and the incremental additional traffic resulting from this option is unlikely to have an impact on other highway users or highway safety. Safety concerns with the use of private vehicles to and from site was another contributing factor in reaching this decision.

Consideration may be given to upgrading the Aileron Station airstrip to deal with emergency response situations.

4.3.11 Project supply logistics and transportation

Options have been investigated to provide logistical support and supply transport to the project.

Option 1 intended that a rail siding and logistics handling area would be constructed either 65 kilometres east of the project or just north of the Plenty Highway / Adelaide-Darwin rail intersection. Both of these options were discarded based on construction costs and the operational requirements of these types of facilities. There would also be additional short and long term environmental impacts from the construction and operation of this handling area.

Option 2 is the preferred alternative. This considers using existing logistical facilities and transport operators based in Alice Springs. The incremental impact of using the Stuart Highway as the main supply access to the project is low. This option will also result in the better use of existing local facilities, economic opportunity for local business, and local employment opportunities throughout the life of the mine.

4.3.12 Kerosene Camp Creek diversion

The existing course of the ephemeral Kerosene Camp Creek must be diverted as it intersects the planned open pit. This creek has a catchment of about 26 km^2 upstream of the pit and it is planned to divert the creek early in the establishment of the mining operation. Seven options for this creek have been considered, with four involving realignment. They are:

- Option A. Realign the creek bypass upstream of the pit to the west of the pit perimeter between the open pit and a natural hill at the western end of the pit, following the pit perimeter and then back into the original creek channel
- Option B. Realign the creek bypass upstream of the pit to the west between two natural hills and then around a small natural hill and then east back to the northern edge of the pit perimeter between the open pit and the northern WRD and then back into the original creek channel

- Option C. Realign the creek bypass upstream of the pit to the east around the pit perimeter between the open pit and the ROM pad and concentrator and then north and back into the original creek channel
- Option D. Realign the creek bypass and establish the diversion to the west between two natural hills and establish the channel to flow into a western arm of the Kerosene Camp Creek system
- Option E. Build a wall across the creek upstream of the pit and create an event pond to deal with storm events. Install a pump and pipeline and pump collected flow around the pit and back into the original channel
- Option F. Allow the creek to intersect with the pit and manage flow into the pit via the mine pumping system
- Option G. Mining of the western end of the deposit would not be undertaken and therefore the creek could remain in its original course.

The four realignment options considered (Options A through to D) are shown in Figure 4-2.

All options were investigated and assessed for their level of risk. Options A, B, C all require permanent diversion of the creek with regular prolonged road crossings for mining equipment and trucks that result in increased risks associated with the deposition of contaminated material into the creek bypass. They are also very close to dust sources, which present management challenges. These non-preferred options also feature difficulties in managing anticipated surface runoff from entering the creek system prior to monitoring and potential release.

Option D is the preferred option. This option also requires permanent diversion of the creek but keeps the creek diversion further away from mining activities and substantial ground disturbance, thereby reducing the risk of offsite contamination.

Options E and F present management and safety challenges, and Option G has significant economic implications for the project as a material quantity of ore would be excluded from the mining and processing inventory.

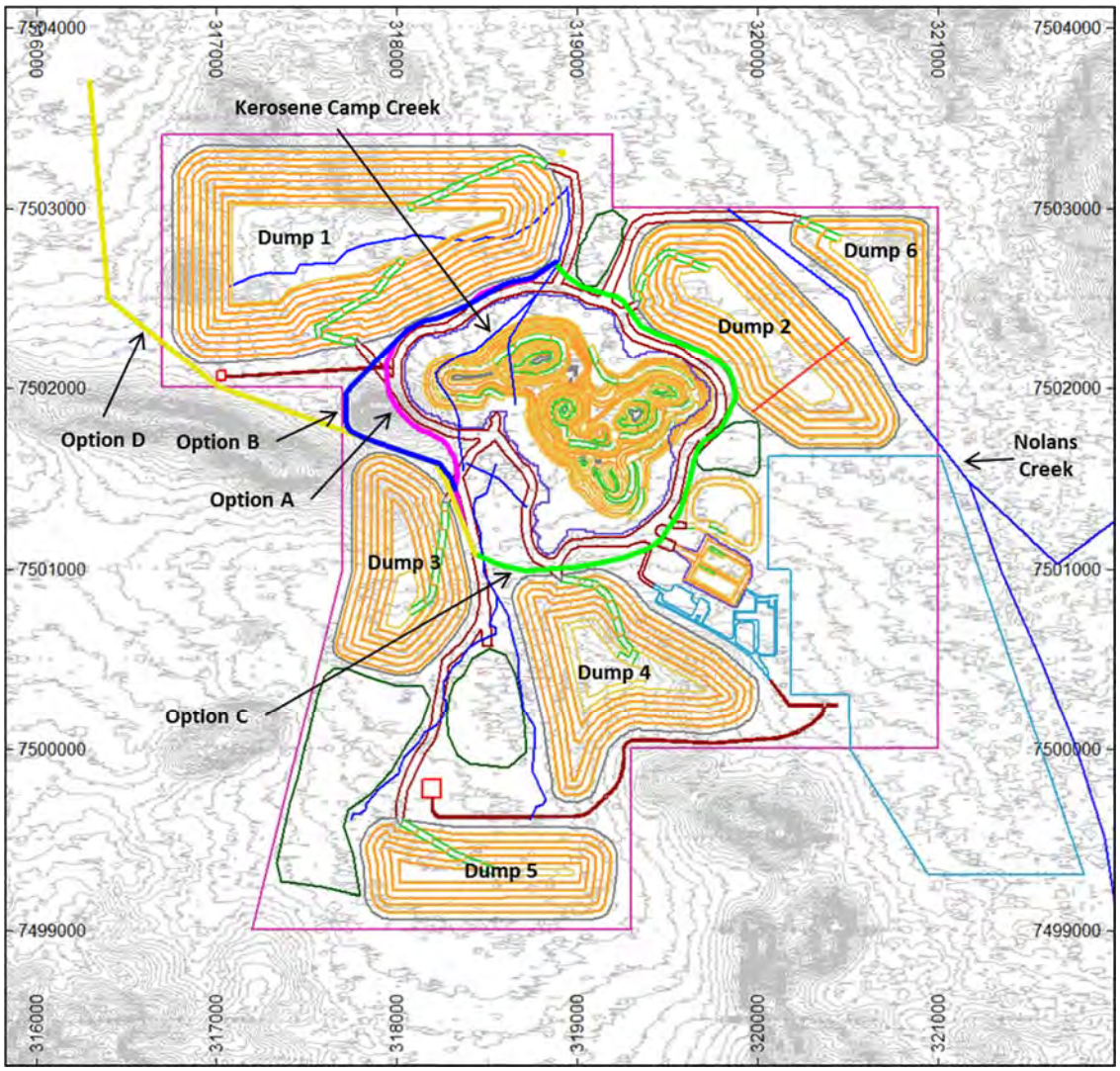

Figure 4-2 Kerosene Camp Creek Diversion Options (Source: Knight Piésold 2014)

4.3.13 Rehabilitation and closure

A closure concept design has been completed for the infrastructure components on the Nolans site, namely WRDs, TSFs and RSFs. These have been sited to avoid, as far as practicable, natural features on the site, and when completed and decommissioned will be rehabilitated to return the land to its pre-mining land use, that being pastoral activity.

It is proposed that all rehabilitation will be progressive on waste rock dumps, and the TSF and RSF cells will be closed down and rehabilitated during the operational phase of the project.

The mine and waste rock dumps are situated on a plain surrounded by natural rocky hills. The locations of the WRDs have been designed to avoid rectangular shapes to ensure they assume a more natural appearance when rehabilitated.

The nearby rocky hills are known to provide habitat for the Black-footed Rock wallaby and it is Arafura's intention during the final rehabilitation process to utilise larger waste rocks from the mining process to artificially create suitable habitat on the WRDs to encourage colonisation post mining.

These WRDs will also be designed as water-retaining structures i.e. to encourage water infiltration and assist vegetation establishment on the tops of the dumps. The tops of the dumps will be broken into a series of small cells so when it rains, water is retained and the vegetation can establish rapidly. These retention cells will also assist in reducing erosion risk from water discharge down the dump face.

Over the life of mine, a total of around 300 million tonnes of waste rock will be mined. Pegmatite and schist lithologies together account for about 25% of the total waste rock mass. The company's geochemical characterisation studies on waste rocks indicate that a small percentage (around 1%) of these particular waste lithologies may require additional management that could include encapsulation within benign waste rock. Confirmation of the quantity of waste rock that falls into this category will be determined pre-production following additional classification studies during pre-strip, etc.

In addition to geochemical characterisation, Arafura has developed a waste rock model to classify the rock lithologies into two broad categories based on radioactivity. A combination of analytical data and geophysical data was used to derive the model which classifies waste rock as either <1 Bq/g (i.e. benign), or >1 Bq/g (i.e. low-level naturally occurring radioactive materials, or low-level NORM). Very conservative parameters were used when constructing the model and consequently the amount of waste rock in the low-level radioactive waste category is likely to be overstated.

Waste rock >1 Bq/g will be managed by placing it within the waste rock dumps and covering it with benign waste rock. It should be noted that waste rock in this classification presents little or no risk to humans; nevertheless, it will be treated very conservatively. About 50% of the total waste rock mass falls into each of the above categories so there is adequate benign waste rock to provide a cover for all mine closure activities. One metre of benign material is more than adequate to encapsulate and shield radioactive material within the WRDs, or in the TSF and RSFs.

The open pit will remain as a pit void at the cessation of mining. The geometry and grade distribution of the Nolans Bore resource does not facilitate open pit mining by multiple pits, which might allow mining and backfill. Mining will commence in individual pits but these will quickly coalesce into a single large open pit as it deepens to access the orebody at depth. Arafura is yet to define the depth extent of the deposit. Arafura cannot justify deeper exploration drilling at present, and in any event, sufficient resources have been delineated to support 40+ years of production.

At the end of mining a pit lake will form in the bottom of the pit. The pit itself will be a natural water sink on the mine site with all natural mine site groundwater flowing into the pit rather than around or away from it.

Arafura is a member of the Minerals Council of Australia (MCA) and as such will, once operational, undertake audits to assess performance against the MCA's 'Enduring Values' charter. The company produces an annual sustainability report and this will be expanded when operations commence to report against the various management plans and objectives. The MCA produces best industry practice guidelines and these will be used to guide and assist rehabilitation and management programs at the Nolans operation. Arafura also intends to develop an integrated management system compliant with Australian ISO 14001, 4801 and 9001 standards. Following an implementation period, Arafura will seek third–party certification of this system.

4.4 Assessment of potential cumulative impacts

4.4.1 Projects

The location of the Nolans site is isolated from other major potential projects. The closest activities and other potential projects to the site are:

- Rum Jungle Resources Ammaroo phosphate mine about 100 km to the north east
- TNG Mt Peake titanium-vanadium mine about 140 km north
- Australian Abrasive Minerals Harts Range garnet mine, about 140 km south east
- KGL Jervois copper mine about 250 km east
- Tellus Chandler salt mine and waste storage facility about 250 km south.

The technical assessments provided in Chapters 7 to 19 provide a description of the existing environment and potential impacts that may result from the Nolans Project, including cumulative impacts.

Section 4.4 below summarises the cumulative impacts that may arise in combination with the projects identified above.

4.4.2 Cumulative socio-economic impacts

The cumulative socio-economic impacts are likely to impact on the larger geographic region, including Alice Springs, as a result of other large projects potentially going through construction and commissioning phases at the same time. Impacts may include drawing on a common workforce, services and supplies or creating cumulative pressures on key government services.

Other potential major projects in Central Australia in addition to those identified in section 4.4.1, include potential expansion of the Newmont Granites gold mine (Tanami) drawing on the same employment pool from around Ti Tree, and Central Petroleum and Metals X nickel-cobalt Wingellina project which may source supplies from Alice Springs.

Additionally, a proposed railway from Tennant Creek to Mt Isa, Jemena's proposed Northern Gas Pipeline and other potential construction projects in and around Alice Springs may also source supplies from Alice Springs. The timelines of these projects are uncertain, however some are imminent.

Some of the key potential positive cumulative impacts arising from concurrent resource project developments, including the Nolans Project, are:

- Opportunity for the establishment of shared regional infrastructure, leveraging off the resource developments (e.g. regional power station potentially providing competitively priced electricity for horticultural development)
- Growth of the horticultural sector around Ti Tree and the opportunity to provide produce to caterers working at accommodation villages (with shortly supply chains and more lucrative local markets)
- Collaborative employment and training programs for local Aboriginal people, both with other resource companies and Central Desert Regional Council
- Combined recruitment campaigns with other employers to encourage families to move to Alice Springs, including a potential pool of migrants moving to Alice Springs for work
- Greater capacity within the Central Australian service and supply industry, with reduced reliance on individual projects

- A greater population base in Alice Springs, with increased retail spending, a stronger regional economy and other spin-offs including more recreational facilities and sponsorships.

Potential adverse cumulative impacts include:

- The balance of water allocation to major projects in both Alice Springs and the broader Central Australian region are perceived to impact on communities, pastoral properties and horticulture
- Demand for accommodation in Alice Springs for both management staff, specialist contractors and FIFO workers impacting on tourism
- Pressure on potential employees and services in Ti Tree and Alice Springs, should both the Nolans Project and TNG's Mt Peake project start work within a similar timeframe
- Compounding workforce and recruitment shortages as people leave existing jobs to work at the mines, particularly for other businesses and the tourism and hospitality industry
- FIFO workers creating pressure on the cost and availability of flights to Alice Springs
- FIFO workers or those who relocate to Alice Springs to work on the projects, congregating in hotels and night spots, leading to antisocial behaviour
- The cumulative pressure of workers and their families exceeding available housing supply (rental and purchase), thus forcing prices and the cost of living up and increasing demand for public housing
- A negative image for the mining industry from wider concerns about legacy issues from mining.

4.4.3 Heritage

Whilst all Aboriginal archaeological places and objects are protected under NT legislation, destruction of some sites may be necessary to allow project activities to proceed. Without mitigation (such as avoiding certain types of landscape features), archaeological resources are also expected to be unknowingly impacted by the proposed infrastructure.

Whilst other projects will not directly impact the same places and objects affected by the Nolans Project, regionally there will be a cumulative increase in the potential impact to Aboriginal heritage across the Central Australian region, through the loss or damage of sites or objects.

4.4.4 Other impacts

The majority of water for the project will be sourced from the Southern Basins borefield. Modelled drawdown from the operation peaks at approximately six metres in the centre of the borefield. The predicted drawdowns are negligible in the Lake Lewis area and not likely to be measureable. Use of the Southern Basins borefield is not proposed by other projects and therefore no cumulative impacts due to other projects are considered likely.

Surface water impacts will be localised to the mine site and therefore will not be increased cumulatively by other projects or activities.

Impacts to flora and fauna have been assessed as relatively low and localised. It is likely that cumulative, localised impacts associated with significant numbers of resource projects in the region have the potential to impact on biodiversity conservation in Central Australian bioregions including the Burt Plain bioregion where the project is located. The Nolans Project has already, and will continue to, contribute to knowledge about the ecological integrity of threatened species populations in the local area.The implementation of a biodiversity management plan containing conservation activities including regular population monitoring surveys will aid this knowledge

base. Additionally, Arafura will continue to review and be guided by the current threat abatement and recovery plans for listed species that are relevant to the project.

Traffic volumes on the section of Stuart Highway between Nolans and Alice Springs are relatively low and the incremental additional traffic resulting from the project is unlikely to have an impact on other highway users or highway safety. Any additional traffic from other projects is not expected to significantly restrict capacity of the highway network.