WATER MANAGEMENT PLAN

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Project Name: Nolans Rare Earth Project

REVISION HISTORY

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1.0 INTRODUCTION

1.1 Background

The Nolan's Rare Earths Project (the Project) is located approximately 135 km northwest of Alice Springs, Northern Territory. The Project targets the Nolans Bore mineral deposit for rare earth elements. Activities will focus on construction, mining, processing, rehabilitation and decommissioning of an open-cut, rare earth mine, and its associated infrastructure.

The Project involves several key activities during construction and operations which have the potential to impact on groundwater and surface water.

1.2 Purpose

The key purpose of this plan is to describe how Arafura aims to minimise any potential impacts of the Nolans operation on the groundwater and surface water around the project mining leases and within the Reaphook Paleovalley. This includes meeting the following parameters:

The requirements of NTG Water and Mining Acts, their regulations and departmental policies including:

- The 80/20 policy.
- Not significantly impacting on existing users including the environment.
- Reporting requirements.

1.3 Objectives of the Water Resources Management Plan

The key objectives of this plan are to:

- Minimising water wastage and maximising reuse.
- Prepare a water conservation action plan, which includes plans to reduce water demand from the Reaphook paleovalley.
- Minimise impacts on existing users of the Reaphook paleovalley.
- Ensure there are no major water contamination occurrences downgradient of the mining operation.
- Establish a flexible groundwater monitoring program for each major aquifer system within and adjacent to the Project site.

1.4 Northern Territory Regulatory Setting

Regulatory settings include:

- Management, protection and use of the water resources within and adjacent to the Arafura mining Leases will conform to NTG policies, regulations and the Northern Territory Water Act.

- Reporting on the mining operations within the Mining Leases is required under NTG Mining Act. An approved Mine Management Plan is required for mining operations and includes monitoring and management of the water resources within and adjacent to the mining leases
- All required regulatory reporting to NTG Departments and Agencies including DEPWS and DITT to be completed on a timely basis.

2.0 ARAFURA WATER MANAGEMENT AREAS

The following is a list of all applicable surface and groundwater management areas that are relevant for the project:

- The Nolans open cut mine and the associated mining facilities within the Nolans Project mining lease ML 26659, including the Kerosene Camp Creek Diversion within ML 32416.
- The aquifers and surface water drainage and management systems within ML 26659.
- The aquifers and surface water drainage systems on Pine Hill Station downgradient of the Nolans open cut mine i.e. downgradient of ML 26659.
- The Nolans construction and permanent residential village located within ML 30702.
- The residue storage facility that will be located within ML A30703.
- The Nolans main ore treatment plant, power station, offices, ablution facilities, laboratory, vehicle wash down facilities, central offices, ablutions, workshops, stores, water treatment plant and water storage tanks that will be located within ML 30704.
- The Arafura Reaphook borefield and Reaphook paleovalley.

In addition to the above, other water management areas also include the aquifer systems and catchment areas adjacent to the Reaphook Paleovalley including:

- The northern Reaphook basement rock (Arunta, Aileron Province) outcrop and subcrop. This area includes ephemeral surface drainage systems and floodouts and alluvial/sand plains south of the Yalyirimbi Ranges and Aileron Hills.
- The Reaphook Hills (and its western extension the Stuart Bluff Range), Hann Range, and localised areas of Ngalia Basin outcrop including the area of sandstone outcrop adjacent to Dozer Gate on Aileron Station (near borefield Cluster E2).
- The Laramba Aquifer, believed to be a localised perched aquifer system associated with colluvial sediments and chemically formed rock e.g. silcrete, near Patty Well.
- The Northern Burt Basin which is a paleovalley connected to the eastern and south-eastern Reaphook feeder paleovalley.
- The Arafura Margins area which is an aquifer systems in the southern Ti Tree basin consisting of a narrow paleovalley of calcrete sheets, and the northeast Burt basin, which is a paleovalley and surface water catchment area and sheet flow drainage systems located on either side of the catchment divide between the Wiso and Burt River basins.
- The Arafura Allungra borefield and adjacent aquifer systems in the Ti Tree Basin including the Hammerhead paleochannel eroded into Arunta basement rock located to the west of the Allungra borefield.

3.0 MONITORING PROGRAMS

There are a range of water monitoring programs that will be implemented to manage the various water resources at the Project.

3.1 Surface Water

3.1.1 General Project Site

There is no permanent surface water located on the project site. Following periodic rainfall, there are some locations where ephemeral water sources are available for sample collection. These are associated with springs or soaks whose origins are from fracture/weathered systems within the hills around the Project site. Sampling opportunities with these sources are typically short lived and opportunistic.

There are a number of semi-permanent rock holes in the hills to the west of the Project. Annas Reservoir Conservation area is located about 10 km west of the mine and at an elevation about 50 m above the surface RL of the mine site. About 50 km further to west in creeks in the hills above the Napperby Station homestead there are waterholes in the creeks.

There will be sediment control dams constructed on ML 26659 down gradient from the mine and waste dumps near the northern boundary of the mining lease. These dams will collect all runoff from disturbed areas associated with the mining operation. This water is intended to be recycled but it will also be sampled for analysis prior to reuse.

Opportunistic sampling will be done on some of the natural sites near the Project area in accordance with our water sampling procedures.

To the north of the mine is Pine Hill Station and the creeks that drain the mining lease converge and flow into the Woodford River which runs north across Ti Tree Basin. During surface flows there are ponds within these drainages, and it is planned to underake opportunistic sampling during flows.

Arafura will establish a flexible surface water monitoring program for the major drainage systems associated with the mining leases including the major ephemeral rivers (creeks) which flow over the Reaphook Paleovalley. This programme will include the monitoring of the chemical quality, sediment load of runoff and stream flows in:

- West Kerosene Camp Creek and its major tributaries within Aileron Station
- Kerosene Camp Creek up gradient and down gradient of the open cut mine
- The upper catchment of East Kerosene Camp Creek on Aileron Station including major tributaries
- The central catchment of East Kerosene Camp Creek on Pine Hill Station
- Day Creek on Central Napperby Station
- Napperby Creek on Central Napperby Station
- Flows within and through the Kerosene Camp Creek diversions / maintenance and upgrades

- Monitor, record and report on the chemical quality of underflow at selected locations of Kerosene Camp Creek, West Kerosene Camp Creek, Day and Napperby Creeks

In addition, Arafura will opportunistically monitor, record and report on the chemical quality of small temporary water holes at selected locations within the bed of Kerosene Camp Creek, West Kerosene Camp Creek, Day and Napperby Creeks as well as temporary springs associated with Kerosene Camp Creek and adjacent areas, and the Aileron Hills, Yalyirimbi Range and their adjacent foothills

3.1.2 Nolan's Mine Site

Kerosene Camp Creek is the main surface water feature associated with the mine site and crosses the planned open pit footprint near the western end of the pit. The Kerosene Camp Creek flows through the mine site from south to the north before it leaves the mining lease and intersects with the larger western tributary about 4 km north of the open pit. Kerosene Camp Creek is fed by several minor creeks across the mine site. A second major drainage feature, Nolans creek, runs across the mining lease across the eastern margin of the lease.

Currently there are a number of Arafura rising stage water samplers installed in these creeks that collect samples when surface creek flow occurs. There are also a number of bed flow samplers installed at several locations in these creeks to allow the collection of samples during low flows.

3.1.3 Processing Site

There is one small creek and four minor creeks flowing through the processing area, but the predominate surface flow occurs as sheet flow off of the adjacent hills located to the north of the site. Four of these drainage features have bed flow samplers installed in them to enable collection of surface water samples when runoff occurs. Runoff in this area is generally of short duration because of the proximity of this area to these creek headwaters.

The processing area is generally covered in medium to dense mulga which assists in dissipating the surface flows. The majority of surface water flows in this area occurs as sheet flow (broad overland flow) however, old station tracks and the cleared gas pipeline easement tend to concentrate runoff. Low embankments (whoaboys) have been constructed across the gas pipeline easement to try to reduce erosion.

3.1.4 Borefield

No major creek systems intersect the main part of the planned borefield. The closest surface water bodies are Day Creek and Napperby Creek that cross the paleovalley at the western end of the planned borefield. The approximate distance to these creeks from the nearest planned production bore is outlined below:

- Day Creek (8 km) west of borefield Cluster A and adjacent Cluster F if developed.
- Napperby Creek (30 km west) of borefield Cluster A.

There is currently no surface water monitoring infrastructure in place within these creek drainages, but Arafura is considering the potential of installing rising stage water sampling equipment in each creek to collect samples for laboratory analysis after further advice from a hydrogeologist.

3.2 Groundwater

The groundwater water resource monitoring program is presented below:

3.2.1 Nolan's Open Cut Mine

Within mining lease ML 26659 there is an existing dewatering bore which is within the planned excavated area of the first planned open pit. Additional dewatering bores are planned to be constructed during early construction works to provide water for the planned early works. These bores will be located in at least two areas within the Nolan's orebody to allow dewatering to continue. During the early stages of mining there will be three separate open pits which will gradually merge into one pit in about year 6 of operations. As the pits develop each of the dewatering production bores will be progressively decommissioned.

Currently the Nolan's dewatering bore has the following monitoring program:

- Installed SWL and temperature borehole datalogger.
- Periodic manual dipper SWL check measurements and downloading of datalogger.
- Periodic groundwater sampling for laboratory chemical and radiological analysis.

As stated above, prior to mining commencing, Arafura plans to construct at least two additional dewatering bores to assist in dewatering the orebody (more if required). These new bores will require a permit to drill as the pit is within the Ti Tree Water Control District. A licence for extraction of groundwater from these bores will also be provided.

As the dewatering bores are decommissioned, sump pumps will be used in each of the planned initial pits to continue the dewatering process to continue enabling excavation of the orebody and adjacent country rock. Sump pumps may also be required in association with abstraction from the dewatering bores.

These bores will have installed headworks on each bore and pipeline to the water storage facilities. The headworks on each bore will include a calibrated water meter, shut off valve, water-sampling taps, non-return valve and water take-off valves. Similarly, any sump pumps will also have installed calibrated water meters.

These bores will be monitored using dataloggers and on a monthly basis, field data will be collected from each bore. Samples will be collected on a quarterly basis whilst the bores are accessible for water quality analysis.

In addition to these dewatering bores a number of monitoring bores will be constructed on the mining lease. These will be both up and down gradient of the open pit. It is likely that these bores may be dry as historical definition and exploration drilling at Nolans has shown there is very a very limited occurrence of groundwater within the rocks surrounding the Nolans orebody.

The existing orebody aquifer standing water level monitoring bores will continue to be periodically monitored until the dewatering bores lower the water level below their total depth.

Additional monitoring bores will also be installed near the planned waste rock dumps to monitor groundwater quality adjacent to these rock dumps. Given the trace level of metals within the waste rock lithologies these bores are unlikely to detect observable changes in quality.

Observations will be recorded in the open pit to monitor recharge to the pit from groundwater inflow from adjacent rocks and overlying shallow sediments.

Monitoring will be in place for the replacement New Nolans Bore. This bore was drilled by Arafura adjacent to Kerosene Camp Creek about 2 km southwest and up gradient of the old abandoned Nolans bore. This new bore has yet to be used by the station for stock watering but has been used by Arafura to monitor groundwater recharge and natural aquifer discharge. Water samples have been periodically taken for chemical and trace metal analyses.

A nearby monitoring observation bore was also drilled by Arafura to monitor recharge, natural discharge and impact of abstraction from New Nolans Bore. A SWL temperature borehole datalogger has been installed in this bore and periodic SWL measurements have been made using a water dipper. High quality water samples for laboratory chemical and radiological analyses are periodically taken from either the new Nolans stock watering bore or its observation bore. This monitoring will continue.

3.2.2 The Processing Site

There will be a number of monitoring bores installed at the processing site. As with the mine site, the presence of groundwater in this area is unlikely. Monitoring bores will be drilled to the basement rock but groundwater is not predicted in this area based on previous groundwater modeling. Bores will be drilled both up and down gradient of the processing facilities and the residue storage facilities (RSF). The precise location of these will be determined closer to the final designs of the RSF. Bores around the RSF will be positioned as much as possible to avoid future RSF expansion footprints of these storages over the life of the Project.

The groundwater monitoring stations will be installed downstream of the RSF perimeter embankment to facilitate early detection of changes in groundwater level and/or groundwater quality both during operation and at closure. Each monitoring station will consist of two monitoring bores. This will include a shallow bore (10 m) to monitor seepage from the facility flowing within the sediment and a deep bore (20-30 m) to monitor the chemical composition of the groundwater.

3.2.3 Borefield Area

The planned monitoring program at and around the borefield will consist of a number of aspects. This area will be the key focus of monitoring outside the main Project area because of the importance of these groundwater resources. The monitoring program will be completed in stages as borefield production increases and may be expanded if there are observable changes being recorded. Details of the planned monitoring programs in this area are detailed in the Groundwater Extraction Licence Application submitted to the Department of Environment Parks and Water Security for their approval. An outline of that program is provided below;

- In the borefield there will be observation bores associated with each production bore.
- Scattered regional monitoring bores will be recorded to show groundwater responses to the planned abstraction

- Bores will be constructed in the feeder channels to record aquifer behaviour and recharge.
- Bores will be constructed between the main borefield and the Laramba water supply as a precautionary measure to alert if any observable changes are noted.
- A number of bores will be constructed at sites that may contain groundwater dependant ecosystems (GDEs) to determine if in fact they are GDEs and secondly to record their behaviour if any groundwater impacts are observed from the planned abstraction.

3.2.4 Regional Monitoring

There will be a program of ongoing regional monitoring around the general Project area. Arafura has selected a number of existing bores to the north of the Project in the Ti Tree basin which have been periodically monitored and this monitoring will continue. Arafura also monitors several pastoral bores on Aileron, Pine Hill and Napperby Stations.

To the east of the Reaphook paleovalley, over the Stuart Highway in the area known as the 'Margins', the current monitoring program will continue on a series of monitoring bores, which were drilled by Arafura to establish if the Ti Tree and Reaphook were connected. This periodic monitoring will also continue to be done when borefield abstraction commences.

3.2.5 Scope of Monitoring

The planned monitoring programs for water on site will consist of a range of activities and techniques. The proposed methodologies have been outlined in the Surface Water Sampling Procedures and the Groundwater Sampling Procedures have been appended to the MMP. It should be noted that these procedures provide maps with potential sampling and monitoring bore locations but these may change once final Project layouts are determined and sites are selected.

Where water samples are collected, sampling will consist of in-field standard processes and follow up laboratory analysis. The in-field parameters used may consist of Temperature, pH, Electrical Conductivity, Total Dissolved Solids, Turbidity and Oxidation Reduction Potential. Where samples are collected and laboratory analysis is required, they will be sent to a NATA registered Laboratory for a range of analysis such as

- Total Dissolved Solids
- Total suspended solids (TSS)
- Total hardness
- Total acidity and alkalinity.
- Major ions ($CaCO_3$, CO_3, HCO_3, Ca, Mg, K, Na, Cl, SO_4, NO_3)
- Metals total and dissolved: Al, As, B, Ba, Cd, Co, Cu, Fe, Li, Pb, P, Mn, Hg, Mo, Ni, Rb, Se, Sr, Ag, U, Th and Zn

It should be noted that these are indicative analytes only. The final suite of analytes will be determined following review of the baseline data and may be varied over time as more data is acquired.

Arafura has an ongoing groundwater radiological monitoring program analysing alpha beta and strontium isotopes from selected bores. It is expected that this program will be periodically varied to meet future monitoring needs.

The additional monitoring techniques to be used for long-term monitoring of groundwater behaviour in bores will also include;

- Accurate land surveying of benchmarks at production and other key bores sites to allow for regular precise measuring and recording of standing water level responses in bores,
- Installation of down hole data loggers to record real time groundwater behaviour and parameters in selected bores,
- Recording abstraction rates via flow meters from each bore and collectively from the borefield
- Photographic record of vegetation around each bore site location

3.2.6 Groundwater Dependant Ecosystems (GDEs)

There are a number of locations adjacent to the southwestern edge of the Arafura Reaphook borefield near the Reaphook Hills which has been identified as potentially containing GDEs. This is primarily based on depth to groundwater which has been modelled in this area. Only one bore is located in the area, therefore there is a level of uncertainty if these are actually GDEs. Arafura has completed ecological surveys in the area and has developed a monitoring strategy which has partially been implemented to resolve this issue. A number of vegetation species have been selected and these are being routinely photographed to note species health. It has been observed that there have been significant species death in the area during the recent drought in this area. During the early development of the Project, it is planned to drill monitoring bores near these monitoring sites so the SWL can also be routinely monitored as water extraction for the Project water supply continues. A GDE monitoring plan has been included in the Groundwater Extraction Licence Application for DEPWS consideration and approval.

3.2.7 Groundwater Fauna

There have been two stygofauna surveys completed on the Project to date. The first was done at the Nolan's mine site to assess the presence of these fauna in the shallow aquifers associated with and near the Nolan's orebody. This survey was completed as part of the EIS site studies and no fauna were detected.

A second more comprehensive survey was completed in in late 2020 from bores within the planned Reaphook borefield area and in areas adjacent to the borefield that were identified as likely to provide a suitable environment for this fauna. A total of eighteen bores were sampled for the presence of stygofauna during this survey. The survey recorded no fauna in any of the bores.

4.0 MANAGEMENT AND MITIGATION

Water management refers to the wholistic management across the Project. It includes surface water, groundwater, rainfall and general water uses in the Project.

- **Key Activities, Impacts and Residual Risks:** A summary of the key activities being undertaken during the management period. The potential environmental impacts and residual risk levels are identified for each environmental aspect.
- **Objective:** The guiding environmental management objective(s) and activities that apply to the element.
- **Mitigation Measures:** The procedures to be employed to ensure that the relevant objectives are met.
- **Responsibility**: Nominates the responsible position for implementing actions and monitoring.
- **Trigger, Action, Response Plan (TARP):** The actions to be implemented in the case of non-compliance. This includes strategies of remediation and the person(s) responsible for the actions.

4.1 Key Activities and Potential Environmental Impacts

The key activities and potential environmental impacts have been identified for water management and are listed in Table 4—1.

Table 4—1 Key Activities and Potential Impacts

ID No	Activity	Potential Environmental Impact
1	Inappropriate water management leads to excessive water use or wastage.	Exceedance in groundwater allocation under our licence conditions.
2	Failure to identify groundwater drawdown.	Impacts to other users.
3	Contamination of surface water or groundwater from site activities.	Impacts on surface water and downstream users or impacts to groundwater resources.
4	Inappropriate management of surface water sources at the Project.	Potential impacts on native fauna and flora.

4.2 Mitigation Objectives

The water management objectives have been established and are detailed in Table 4—2.

Table 4—2 Mitigation Objectives

Objective	Target	KPI
Prevent environmental impacts from poor or inappropriate	No exceedances to trigger levels or water use targets.	Number of incidents which occur in relation to defined

Objective	Target	KPI
water management.		trigger levels for surface and groundwater. Water usage does not exceed water balance.
Borefield drawdown is in behaving in accordance with predictive modelling.	Monitoring ensures borefield groundwater drawdown does not exceed target levels.	Consistently monitor borefield behaviour and adjust management.
Monitor groundwater at potential GDE sites.	No impacts to vegetation communities.	No recorded impacts to vegetation at monitoring sites.
Monitor pastoral bores	No recorded impacts to other water users.	No recorded drawdown impacts.
Manage artificial surface water sources around the Project site to limit fauna impacts.	No recorded fauna deaths.	Regularly inspect all water locations and record and report fauna visitation and impacts.

4.3 Mitigation Measures

The water hierarchy is utilised to guide onsite management of water. In addition, mitigation measures have been developed to minimise potential impacts associated with any water related incidents. The mitigation measures, timing and responsibilities are provided in Table 4—3.

Table 4—3 Mitigation Measures

Mitigation Measure	Timing	Responsibility
Site Induction		
Site inductions will include the following specific water management components: ▪ Water efficiency in the processing facility ▪ Water usage in the village ▪ Borefield management ▪ Surface water management	Site Induction	All personnel
Water Management		

Mitigation Measure	Timing	Responsibility
A water management hierarchy will be implemented on site including: ▪ Water Efficiency audit, engineering controls	During design phase	All Project design personnel
▪ Constant monitoring borefield and site water usage	At all times	Process control room
▪ Inspections of site water bodies	As required by operations or as per schedules	Operations personnel and Environmental Officers
▪ Water monitoring and reporting	As per schedule	Environmental Officers
Management Plan Review		
Water Management Plan performance review as part of MMP submissions	As required	HSEC Manager

1.4 Trigger, Action and Response Plan

The Trigger, Action and Response Plan (TARP) outlines remedial actions and responses to the situation. The levels of incidents and TARP are provided in Table 4—4.

Table 4—4 Trigger, Action and Response Plan

Trigger	Action	Response
Water usage exceeds site predicted water balance	Complete all required monitoring and inspections.	HSEC Manager to continue standard monitoring as per the EMP and report variances.
Water contamination noted in sampling.	Complete confirmatory analysis and implement an investigation and remedial actions as required. Cross checked against typical seasonal fluctuations for the region by a qualified hydrogeologist	HSEC Manager to continue standard monitoring as per the EMP. Investigate the source of the contamination and review management as required. Report to regulators if required.
Borefield drawdown recorded.	Immediate recheck of levels. Continue to monitor and determine if trends are ongoing. Consult external hydrological consultants. Undertake remediation recommendations as required. Conduct regulatory reporting as required.	Review Water Management Plan and see if any management changes need to be implemented.
Drawdown noted in monitoring bores at or near potential GDE sites.	Immediate recheck. Review data and trends. Review vegetation health.	If vegetation stress noted consult external ecological consultant. Implement management measures as per GDE management strategy in groundwater licence application.

5.0 PERFORMANCE REVIEW

An annual review of performance of this management plan is to coincide with the review process of the Project's Mining Management Plan (MMP).

The review process is to assess performance against objectives of this plan and the stated actions within the MMP, with any relevant outcomes, supporting information, reports and/or data, discussed within the relevant section of the MMP, and supporting information/reports provided within the appendices