GROUNDWATER SAMPLING AND DATA COLLECTION PROCEDURE

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Project Name: Nolans Rare Earths

REVISION HISTORY

Date	Revision	Description	Prepared	Reviewed	Approved
05/08/2024	Rev 1	Submit to DEPWS with groundwater monitoring program	Yemaya Smythe McGuinness S. Environmental Scientist	Gloria Calderon Environmental Scientist	Daniel Jordan Manger Environment
16/11/2023	Rev B	Prepared for internal use	Gloria Calderon Environmental Scientist	Yemaya Smythe McGuinness S. Environmental Scientist	In development
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RECORD OF CHANGES

Revision	Reason for Change	Page Number(s)
Rev B	Updated with feedback from review – including advice from GHD regarding methodology for the use of HydraSleeves, and QA/QC requirements.	Whole Document
Rev 1	Updated to include pumping methodology from the Mine Site Groundwater Sampling Procedure. Level of detail and content adjusted for support of the groundwater Monitoring Program rather than for internal use.	Whole Document

DOCUMENT HOLDS

Number	Reason for Hold	Section(s)

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ABBREVIATIONS AND DEFINITIONS

Abbreviation	Meaning
Arafura	Arafura Rare Earths Limited
CoC	Chain of Custody
DO	Dissolved Oxygen
EC	Electrical Conductivity
GPS	Global Positioning System
LDPE	Low Density Polyethylene
LED	Light-emitting diode
L10013	Groundwater Extraction Licence L10013 granted to Arafura Nolas Project Pty Ltd 20 March 2023, and amended 8 August 2023.
Nolans	Nolans Rare Earths Project
ORP	Oxidation-Reduction Potential
pH	Potential of Hydrogen
Project	Nolans Rare Earths Project
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
Shall / Must	A requirement is mandatory
TDS	Total Dissolved Solids
ToC	Top of Casing
TSS	Total Suspended Solids

1.0 INTRODUCTION

1.1 Background

Arafura Rare Earths Limited (Arafura) is developing the Nolans Rare Earths Project (Nolans, or the Project) which is a rare earths mine targeting NdPr located approximately 135 km north-northwest of Alice Springs in the Northern Territory.

Arafura has been granted two licences to extract groundwater for the Project, one (L10010) for the purpose of dewatering the mine pit; and one (L10013) for the purpose of providing project water supply. These licences require a robust groundwater monitoring program to be undertaken by Arafura to monitor for any potential impacts of Arafura's water extraction on the environment, and on the water supply of surrounding groundwater users.

The groundwater monitoring program is detailed in the Nolans Borefield Monitoring Program (GHD 2024a); and the associated management actions in the Nolans Borefield Adaptive Management Plan (GHD 2024b). Key requirements of the monitoring program include monitoring of groundwater levels, water extraction rates, and groundwater quality. Monitoring results need to be accurate and reliable to inform meaningful management of the borefield area.

1.2 Purpose

The purpose of this document is to define the procedures to be followed while undertaking groundwater monitoring activities for the Nolans Project. To ensure the sampling methods deployed are accurate, reliable, consistent, undertaken in a safe manner, and follow best-practice procedures in accordance with relevant Australian standards. This document provides a guideline for the intended methodology and steps to achieve quality monitoring results – details may change over time as relevant to improved knowledge, any relevant changes to the sampling requirements, guidelines and standards – as intended through the process of adaptive management and continual improvement.

The scope of this document includes procedures relating to monitoring of groundwater levels, water extraction rates, and groundwater quality. With steps outlined for these monitoring activities from planning and preparation; mobilisation to field; sample and data collection; sample dispatch and transport; to data management (see Figure 1—1 below). This document has been prepared to align with and expand upon the previously prepared Mine Site Groundwater Sampling Procedure.

Figure 1—1 Aspects of the groundwater sampling procedure

2.0 PLANNING AND PREPARATION

Regular groundwater monitoring will be undertaken by Arafura in accordance with the Nolans Borefield Monitoring Program (GHD 2024a). Planning and preparation for monitoring activities includes the steps below.

1. **Confirm monitoring requirements**
   - Review the monitoring requirements in the Nolans Borefield Monitoring Program (GHD 2024a) to understand what type(s) of monitoring needs to be undertaken and the required cadence
   - Plan at least 3 months in advance for the upcoming required monitoring activities
   - Plan travel, site and safety logistics one to three months in advance as appropriate.
2. **Prepare a monitoring plan for each trip**
   - Determine all monitoring activities required for the planned dates
   - Determine all equipment and field supplies required
   - Determine all monitoring locations
   - Prepare a field plan considering the mobilisation times and distances from one monitoring site to another; the time required to undertake monitoring activities at each location; and required sample holding times prior to dispatch
   - Ensure all required field sheets and forms are prepared
   - Ensure all monitoring methods are well understood
   - Ensure any required training is undertaken in advance.
3. **Confirm adequate stock of monitoring supplies**
   - Review the groundwater monitoring equipment check lists in Table 2—1 below to understand what is required for the monitoring to be undertaken
   - Confirm sufficient supplies are in stock (refer to Table 2—1 below)
   - It is recommended this is undertaken at least one month in advance of the planned monitoring to allow time to source additional supplies if required
   - Order additional supplies if required.
4. **Check monitoring equipment**
   - Check all equipment is available for use on the planned monitoring dates
   - Check and confirm all equipment are in good working condition
   - Check the calibration log and ensure all equipment are up to date with any calibration requirements
   - Conduct calibrations if required.
5. **Confirm laboratory arrangements**

- In all cases where water quality samples are being taken, ensure an up-to-date laboratory arrangement is in place for the receival, processing and analysis of samples. Including current costing and payment arrangements.
- Ensure all aspects of sample handling, preservation, preparation, transportation, and holding times are well understood for the types of samples/analytes being taken. Enquire with the laboratory to clarify any unknown aspects
- Ensure the relevant sample submission and chain of custody (CoC) forms are prepared.

6. Notify any relevant stakeholders

- Notify any relevant stakeholders of the planned monitoring activities including landholders.
- This is relevant where activities may interact with other land user's activities; where monitoring locations are located outside of Arafura's mining tenure; when monitoring bores are owned by other parties (e.g. pastoralists or Power and Water Corporation); or activities may interact or affect tradition owner use of the land.
- In any such cases notification and/or consultation may be appropriate in advance to advise of and determine:
  - Planned monitoring locations
  - Planned monitoring activity type(s)
  - Accessibility of roads/tracks
  - Any third-party induction requirements
  - Any supervision, approval or permission requirements.

7. Prepare ready for mobilisation

- Prior to sampling, prepare the field equipment and sample bottles ready for mobilisation
- Details of the indicative steps are provided in Section 2.1 below, this may be adjusted as appropriate to the monitoring activities being undertaken at the time.

The below equipment check lists can be used to aid with the planning and preparation for monitoring activities (Table 2—1).

Table 2—1 Groundwater monitoring equipment check lists

HydraSleeve water quality sampling equipment check list	
Water quality meter (calibrated and fully charged)	
Water quality meter calibration solutions (depending on the meter usually pH, EC and ORP)	
Labelled sample bottles (ensure there is enough for blanks, duplicates and triplicates) with spare bottle sets in case replacements are required	
Sample cup and bucket (20 L)	
Hydra sleeves, collars, weights and clips (require cable for deployment)	
Syringes threaded 5mL (with luer-lok nozzle) and filters 0.45 µm	
Syringes catheter 5mL, GoPro filters and endline filter	
Sampling gloves – disposable, nitrile, powder-free	
Clamps	
Scissors/multi-tool	
Clipboard, pens/pencil and permanent marker (and spares)	
Ziplock bags for each set of bottles (if the lab does not provide them)	
Camera/phone to take photos	
Esky (with ice or ice bricks to keep the samples chilled)	
Bailers (if applicable)	
Decontamination spray bottles (1 filled with DI water and 1 filled with 2-5% Decon detergent)	
Tape and security seal for eskies	
Spare batteries and/or charger for water quality meter, camera, GPS, field test meters and water level meters	
Bore padlock keys and tools to remove well caps	
Field folder, pencils and pens with relevant printed forms including: • Field sheets/ field records • Laboratory CoC forms • Relevant procedures • Site safety information including emergency contact details, site maps, Job Hazard Analysis, etc.	
Pumping water quality sampling equipment check list	
Water level gauge or interface probe	
Water quality meter (calibrated and fully charged)	
Low-flow sampling pump/equipment	
Disposable low-flow sampling tubes	
0.45 µm water filters and suction pump	
Eskies and cool bricks	
Laboratory sample bottles	
Sampling gloves	
Decontamination plastic or stainless-steel bucket and container of 2-5% Decon detergent mixture to fill	
Decontamination spray bottles (1 filled with DI water and 1 filled with 2-5% Decon detergent)	
Bore padlock keys and tools to remove well caps	

Permanent marker for writing on bottle labels	
Field folder, pencils and pens with relevant printed forms including: • Groundwater Gauging sheet • Groundwater Purging sheet • Field record sheets • Laboratory CoC forms • Relevant procedures • Site safety information including emergency contact details, site maps, Job Hazard Analysis, etc.	
Standing water level equipment check list	
Water level meter (dipper) calibrated	
Spare batteries for water level meter	
Tablet with Win-Situ Software full charged (login details required)	
Docking station for Rugged TROLL and BaroTROLL	
USB cable for Level TROLL	
Spare automatic water level loggers	

2.1 Prepare ready for mobilisation

Once arriving to site, and before mobilisation to the field, prepare all required monitoring equipment and sample bottles. This is recommended at least one day prior to sampling. Indicative guidance is provided below based on current monitoring requirements; this may change over time.

2.1.1 Sample bottle preparation

- When undertaking water quality monitoring, prepare and label the set of sample bottles required
- Prepare the sample bottles with any preservatives required (if not already prepared by the laboratory)
- As per current laboratory requirements for general water quality parameters at monitoring bores, a set of five (5) sample bottles are required for each monitoring bore to be sampled (see Figure 2—1 below)
- As per current laboratory requirements for radionuclides analysis, a set of four (4) sample bottles are required for each monitoring bore to be sampled (see Figure 2—1 below)
- Extra bottles should be prepared for duplicate and rinsate/blank samples, as required to meet the QA/QC requirements (see Section 4.3 below for details)
- Each sample bottle should have a waterproof label attached appropriate for the required labelling details (see Figure 2—2 below for an example). Information on the labels can be handwritten in the field, or labels can be pre-printed with some of the required information to reduce error.
- An indication of sample volume, preservation and holding times to meet laboratory requirements relevant to the current groundwater quality parameters being sampled is shown in Table 2—2 below.

Figure 2—1 Example of bottle set prepared for: general parameters (left); and radionuclides analysis (right).

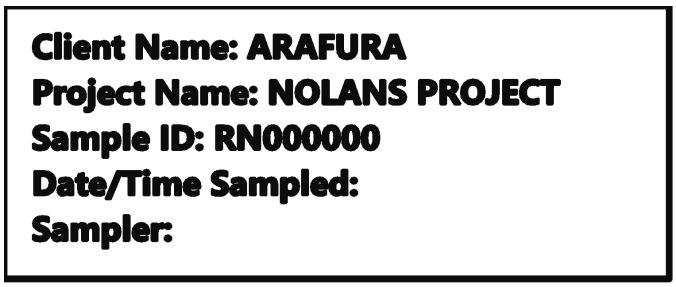

Figure 2—2 Example of sample container label

2.1.2 Equipment preparation

- Ensure all equipment to be used is in good working order, and fully charged.
- Pack all essential items and equipment required to take to the field. Place all essential items for the water sampling into one field box for easy access and time management, and all spare items in a second one. Use the appropriate checklists for reference (Table 2—1 above).
- If ice bricks are to be used for water quality sample preservation in the field, ensure they are placed in the freezer. Alternatively, ensure the ice machine is switched on and working.
- Ensure freight has been booked for the day of sampling, with all required instructions given to the freight company relating to sample handling and transport. Print out the consignment note and transport labels to be attached to each parcel.

2.1.3 Transport Booking

In all cases where water quality samples are being taken:

- Check freight/courier arrangements available to ensure samples will meet required holding times
- Ensure the freight/courier is aware of and able to meet the handling requirements, e.g. keeping the samples cool during transportation
- Make a booking with the freight/courier for the planned day(s) of water quality sampling
- Ensure correct consignment details and transport labels are received for printing, to attach to the samples.

Table 2—2 general indication of sample volume, preservation & holding times for laboratory analysis

Parameters	General parameters					Major ions	Radionuclides			
	pH, EC, Total Suspended Solids (TSS), Total Dissolved Solids (TDS), Total Hardness and Total Acidity and Alkalinity.	Dissolved Metals (Al, As, B, Ba, Cd, Co, Cu, Fe, Li, Pb, P, Mn, Hg, Mo, Ni, Rb, Se, Sr, Ag, U, Th and Zn).	Total Metals (Al, As, B, Ba, Cd, Co, Cu, Fe, Li, Pb, Mn, Hg, Mo, Ni, Rb, Se, Sr, Ag, U, Th and Zn).	Total Phosphorous (P)	Nutrients (NO2, NO3) & Reactive Phosphorous	Major ions (CaCO3, CO3, HCO3, Ca, Mg, K, Na, Cl, SO4).	Pb-210 & Po-210	U-238, U-234, Th-230, Th-232, Th-228 & U-235	Ra-226 & Ra-228	Rn-222
Typical volume bottle	1L (unfiltered)	60mL (filtered)	60mL (unfiltered)	60mL (unfiltered)	60mL (filtered)	1L (unfiltered) *Volume from the same bottle with green label)*	1L (unfiltered)	1L (unfiltered)	0.5L (unfiltered)	0.2L (unfiltered)
Container	Plastic	Plastic	Plastic	Plastic	Plastic	Plastic	Plastic	Plastic	Plastic	Glass or Teflon
Preservation	Refrigeration (to 1–10°C)				Frozen	Refrigeration (to 1–10°C)	Refrigeration (to 1–4°C)			No preservation or pre-treatment required
Holding Time	pH: 6 hours others: 7 days +	Metals: 180 days	Metals: 180 days Hg: 28 days	28 days	4 days	7 days +	180 days	180 days	180 days	3 days

3.0 MOBILISATION TO FIELD

Follow all site entry and safety requirements including (but not limited to):

- Follow site access procedures
- Complete vehicle inspections before mobilising to site
- Ensure the first aid kit, tracking and communication devices are functional, charged, and packed in the vehicle
- Notify relevant site personnel of the monitoring plan for each day, confirming emergency contacts, meeting points, and any active project work areas
- Ensure any incidents that occur during field work are reported
- At each sample location, take a moment to assess the area for dangers, including potential slips / trip hazards, flooding, signs of snakes, etc.
- Do not proceed with monitoring activities if unsafe to do so.

4.0 SAMPLE AND DATA COLLECTION

Groundwater monitoring activities will be undertaken as described in the Nolans Borefield Monitoring Program (GHD 2024a). Activities include taking water quality samples, standing water level readings, and water extraction readings. Water quality samples can be taken using one of three methods:

1. Tap sampling method
2. HydraSleeve sampling method
3. Pumping sampling method

Standing water level readings can be taken using one of two methods:

1. Automatic water level loggers
2. Manual readings

Water extraction readings are currently taken only by manual reading of flow meters when in the field.

Details of these methods are provided in the sections below, together with information on when each method is appropriate to use. As well as details related to Quality Assurance and Quality Control (QA/QC) and field data to be collected.

4.1 Tap Sampling Method

Sample taps have been installed at some groundwater monitoring bores to allow for water quality samples to be easily taken. This is the preferred method where available.

For sampling collection from a pre-installed sample tap the following steps are to be taken:

- Arrive at the sample location and check that the monitoring tap is working.
  Note: Taps not used frequently can become seized or blocked. If the tap is blocked, use a piece of wire to remove the blockage. If the tap is still not working, detail this on the field sheet and move to the next site – or use an alternative means of sampling if available.
- Open the tap and allow water to flow until field measurements have stabilised
- Collect water in a 20 L bucket (or as appropriate) and measure field data with a water quality meter to determine when field measurements have stabilized
- Parameters need to stabilise prior to sampling, they are considered stabilised when three consecutive readings are within the following limits:
  - 10% for Dissolved Oxygen
  - ± 3% Electrical Conductivity
  - 0.05 pH units for pH
  - ± 0.2 °C for Temperature
  - ± 10 mV Redox.
- Once the field measurements have stabilised, collect a fresh bucket of water and turn off the tap.
- Measure and record the stabilised readings for field data
- Transfer water to the sample bottles.

4.2 HydraSleeve Sampling Method

HydraSleeve groundwater samplers can be used to collect a representative sample for most physical and chemical parameters without purging the well. It collects a whole water sample from a user-defined interval (typically within the well screen), without mixing fluid from other intervals.

One or more sleeves are placed within the screened interval of the monitoring well, and a period of time is allocated for the well to re-equilibrate. When activated by rapid upward motion, the check value opens and the HydraSleeve collects a sample. Hydrostatic pressure keeps the devise closed except during sample collection. Once the sampler is full, the one-way reed valve collapses, preventing mixing of extraneous, non-representative fluid during recovery. HydraSleeve go in flat and closed and come out full and closed.

HydraSleeves are useful in cases where groundwater monitoring bores are narrow, constricted, or damaged. They also allow sampling of one or multiple specific screen intervals or target horizons; and allow sampling in bores with low water levels and/or low rates of recharge, as they cause minimal drawdown and minimal agitation of the water column.

For sampling collection using HydraSleeves, the follow steps are to be taken:

1. Assemble the HydraSleeve
2. Deploy the HydraSleeve
3. Retrieve the HydraSleeve

These steps are detailed in the sections below.

4.2.1 Assemble the HydraSleeve

Standard HydraSleeves have white reinforced strips at the top for connecting to a Spring Clip fastened to the tether and are available in Low Density Polyethylene (LDPE). To assemble a Standard HydraSleeve the steps shown in Figure 4—1 below are to be taken.

<table>
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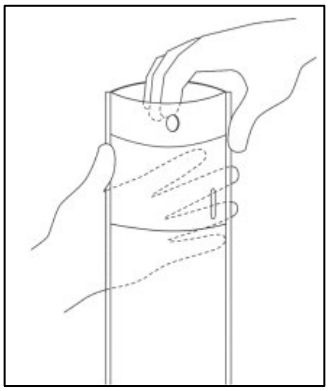
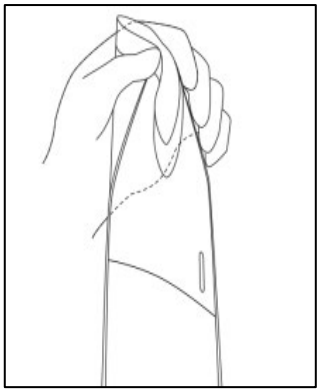
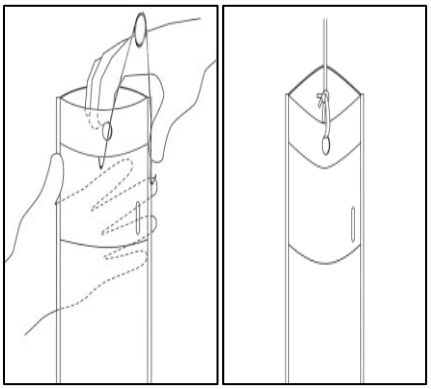
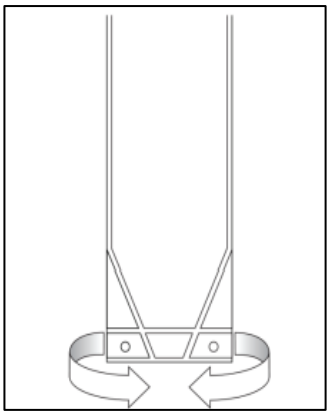
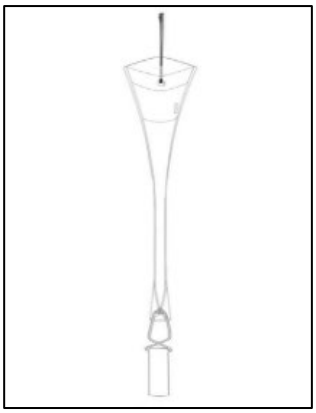
<td> 
1. Remove Hydra Sleeve from package and grasp top to “pop” open. Remember to save the straw for later.</td>
<td> 
2. Squeeze side fins together at top to bend reinforcing strips outward. Crimp the corners to remain open.</td>
<td> 
3. Option 1 (on the left). Attach the tethered spring clip; or
Option 2 (on the right)). Alternatively attach the cord to one side of the HydraSleeve if spring clips are not secure enough. Be sure the top is sharply crimped open.</td>
</tr>
<tr>
<td> 
4. Align the two holes at bottom of HydraSleeve together and attach weight with the weight clip.</td>
<td> 
5. Sampler is ready to be placed in the well.</td>
<td></td>
</tr>
</table>

Figure 4—1 Assembly a HydraSleeve

4.2.2 Deploy the HydraSleeve

To deploy the HydraSleeves, follow the steps below:

- Open the bore cap and allow some time for stabilisation before measurements are made
- Gauge the water level to the Top of Casing (ToC) using the water level meter (see Section 4.5)
- Confirm the water column is at least double the length of the HydraSleeve to allow use
- Knowing the standing water level, calculate the length of tether needed to suspend the sleeve at the desired sampling depth/ saturated screened interval. Account for the HydraSleeve length in the calculation.

- Assemble the HydraSleeve (see Section 4.2.1 above) attach the tether to the top of the sleeve and the weight to the bottom, then slowly lower the weighted sleeve into the well to the desired sample depth. Use a plastic tarp or plastic tub when installing and retrieving the HydraSleeve to avoid any contamination (e.g. to prevent the rope or equipment entering the well from being contaminated by dirt)

  Note. Wear nitrile gloves at all the times while assembling and handling the HydraSleeve

- Secure the upper end of the tether to the well cap prior to beginning deployment to ensure it will not be lost downhole. Then smoothly lower the HydraSleeve, in a continuous downward motion to avoid premature opening. Do not pull the tether upwards in the water column until water samples are being collected. If required, pull up extremely slowly and smoothly for a short distance only. Any rough upwards motion can open the check valve requiring the HydraSleeve to be replaced due to non-representative fluid being collected.
- Once lowered to the final position (at least 2 m above bottom of well), leave in-place for at least 24 hours for the well to equilibrate. This "equilibration time" ensures that flow dynamics and contaminant distribution restabilize to natural flow conditions to represent the aquifer conditions after vertical mixing occurs which may be caused by installation of a sampling device in the well.
- For future monitoring events, reinstall a new sleeve after sampling a well to be retrieved during the next monitoring event.
- Label the string after deployment with a piece of tape and a marker for easy identification from other equipment already deployed in the well.

In cases where multiple screen intervals or target horizons are to be sampled, or larger sample sizes are required, HydraSleeves can be installed in tandem.

The process for installation of tandem HydraSleeves is shown in Figure 4—2 below. The first HydraSleeve is attached to the tether as described above; and a second HydraSleeve is attached to the bottom of the first using your desired length of tether between the two; with a weight attached to the bottom of the second HydraSleeve. To install more than two, follow the same process of attaching each consecutive HydraSleeve as for two, with the weight attached to the bottom of the last HydraSleeve.

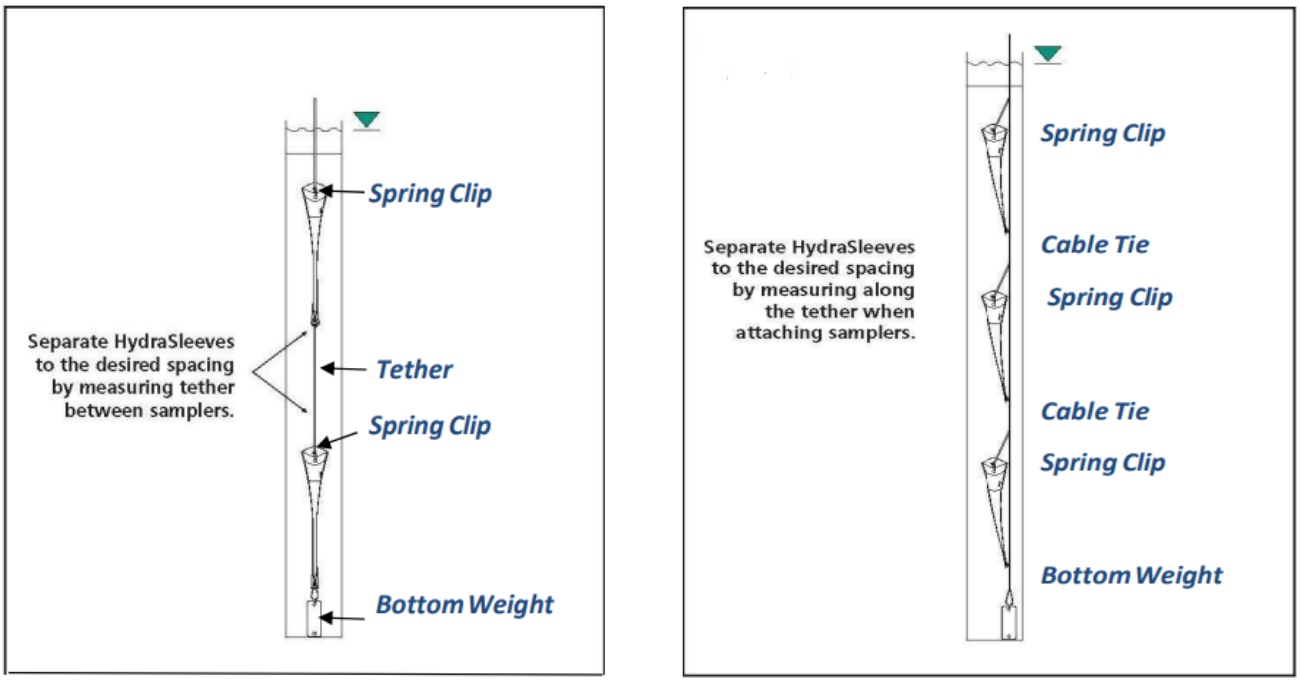


Figure 4—2 Deployment of HydraSleeves in tandem. A: two HydraSleeves; and B: more than two

4.2.3 Retrieve the HydraSleeve

- Prepare a clean area next to the monitoring bore with sample bottles ready. Use a plastic tarp when retrieving the HydraSleeve to avoid any contamination (e.g. to prevent the rope or equipment entering the well from being contaminated by dirt)
- Open the bore cap and allow some time for stabilisation before measurements are made
- Gauge the water level to the Top of Casing (ToC) using the water level meter (see Section 4.5) before retrieval
- Locate the previously installed HydraSleeve tether
- Pull the tether rapidly upwards (approximately 0.5 m per second) in the water column to fill the HydraSleeve
- Slowly draw the tether up until the HydraSleeve is at the surface
- Squeeze the full sampler just below the top to expel water resting above the check valve
- Pierce the sleeve at least 3-4 inches below the top collar with the straw provided, then discharge the water either into a sample cup, or directly into sample bottles
- To control the flow of the sample, raise and lower the bottom of the sleeve or pierce the sleeve just below the discharge tube -sleeve can be squeezed, forcing fluid up through the discharge tube
- Filter any samples required prior to filling sample bottles. For example, when sampling for metals, a total metals sample (not filtered) and a dissolved metals sample should be collected. The dissolved metals sample requires field filtration through a disposable 0.45 µm filter.

- Fill the sample bottles to top with no air space allowed and with the least amount of agitation as possible, and immediately tighten the lid
- Note. Sample collection should be done immediately after the sleeve has been brought to the surface to preserve sample integrity
- Once collected, groundwater samples should be labelled and stored in ice chilled cooler boxes. Samples should be kept out of the sun. Samples should be returned to the laboratory under Chain of Custody (COC) documentation.
- To measure field data, discharge a small amount of water into the sample cup (enough to submerse the water quality probe). Then place the probe of the water quality meter into the sample cup, wait until readings are stabilized and then record the data. Then discharge the water
- Store the old HydraSleeve and remove from site for disposal, to be disposed at the site office. HydraSleeves cannot be reused.
- Deploy a new HydraSleeve for the next monitoring round. Gauge the water level to the Top of Casing (ToC) before deployment. The weight and weight clip can be reused after decontaminating. The tether may be dedicated to the well and reused or discarded as appropriate.

4.3 Pumping Sampling Method

4.3.1 Pump Installation

Insert pump into well with care to avoid excessive disturbance and re-suspension of sediment within the well. The pump intake should be suspended inside the well screen to minimise the volume of stagnant groundwater required to be purged and intercept the inflowing groundwater from the target formation.

4.3.2 Purging

Commence purging of well, the aim of this process is to remove 'stagnant' groundwater from the well so that groundwater is representative of the surrounding unit. Water quality parameters should be recorded at regular intervals (i.e. every 2 to 5 minutes or every 2 to 5 litres) on the groundwater gauging sheet.

Parameters need to stabilise prior to sampling, they are considered stabilised when three consecutive readings are within the following limits:

- 10% for Dissolved Oxygen
- ± 3% Electrical Conductivity
- 0.05 pH units for pH
- ± 0.2 °C for Temperature
- ± 10 mV Redox.

4.3.3 Contingency

If after prolonged purging the parameters do not stabilise to within the specified limits, the original well and gravel pack volume should be calculated and ensure at least 3 well volumes of groundwater has been purged.

If a well is low yielding it may be purged dry. In such cases it should be left to recover. Following recovery of groundwater levels in the well, sampling can proceed on the assumption that the groundwater represents inflow from the unit screened by the well. In this instance, measurement of stabilisation parameters should record a minimum of three consecutive readings prior to sampling.

4.3.4 Sampling

A groundwater sample should be collected after the measured parameters have stabilised. Commonly the purging device is used to sample the groundwater. Sampling should be undertaken so as to minimise the entry of air into the sample – run the outflow from the sampling device down the side of the container, rather than allowing it to cascade into the container.

Filter any samples required prior to placing in sample bottles. For example, when sampling for metals, a total metals sample (not filtered) and a dissolved metals sample should be collected. The dissolved metals sample requires field filtration through a disposable 0.45 µm filter.

Once collected, groundwater samples should be labelled and stored in ice chilled cooler boxes. Samples should be kept out of the sun. Samples should be returned to the laboratory under Chain of Custody (COC) documentation.

4.3.5 Waste Disposal

Purged groundwater is to be pumped onto the ground and all used disposable sampling equipment should be stored and removed for the field for disposal at the site office.

4.3.6 Electronic Transfer

All purging results, duplicate locations and CoC are to be scanned and kept on file. The final purging results prior to sampling are to be entered into the groundwater database. Purging sheets should be stored online for reference.

4.4 Quality Assurance / Quality Control

Both duplicate samples and rinsate blanks are to be collected in the field as QA/QC measures. Duplicate and rinsate samples should be sent as blind samples to the laboratory, labelled and recorded accordingly.

Duplicate samples are taken as a duplicate set of samples at the same time and place and using the same methodology as a routine water quality sample, bottled and labelled separately. Duplicate samples provide an estimate of the error associated with the subsampling/splitting process and laboratory analysis and are a measure of precision. If an acceptably low level of error is occurring, the difference between the duplicate and the routine sample will not be statistically significant.

Rinsate blanks (or equipment blanks) are to be taken from the final rinse of equipment after decontamination, or prior to the use of disposable sampling equipment. Rinsate samples are taken by collecting the deionised water used to rinse equipment following a routine water quality sample being taken. These samples provide information relating to cross-contamination of samples from the sampling equipment. If no contamination is occurring, sample results will be null.

A guideline for the frequency of duplicate and rinsate samples to be taken during routine water quality monitoring for the project is provided in Table 4—2 below.

Table 4—1 Guidance of sample collection for quality control

Sample type	Frequency
Duplicate	One for every ten water quality samples taken
Rinsate blank	One per day of monitoring

4.4.1 Reducing Sample Contamination

It is important to ensure that samples are not contaminated during sampling. Sources of potential sample contamination include from manual handling (e.g. sunscreen, insect repellent, cigarette smoke, etc.), from contaminated water quality probes or other non-disposable field equipment used, and from sample bottle preservatives from other bottles during storage and transport.

The following steps are to be taken to reduce the risk of sample contamination from manual handling:

- Apply sunscreen and insect repellent prior to leaving for sampling and avoid applying directly on hands and wrists. Ensure that hands and wrists are washed with soap and water prior to conducting sampling to remove any excess product
- Do not smoke or eat when sampling
- Use clean disposable gloves at each sampling site immediately before opening sample bottles. Do not wipe gloved hands on your skin or clothing. Change gloves if contamination is suspected
- Keep sample bottles closed until sampling. If grime is present on the outside of the bottle, rinse with sample water prior to opening.
- Sample with hands away from the bottle opening

4.4.2 Decontamination of Equipment

All items and equipment used in between locations for water sampling and testing need to be decontaminated. Both deionised water and a 2-5% Decon 90 detergent solution are used for decontamination.

In the case of smaller equipment like the water quality meter use the decontamination spray bottles. First spray the equipment with the Decon 90 solution, then apply the deionized water. In the case of larger items like the pump and cables, use the decontamination bucket containing Decon 90 solution, and submerge the pump and cables in the bucket.

Decontamination must be completed prior to leaving each site. Ensure the storage areas are clean during transport to the next site – if in doubt, repeat the decontamination procedure prior to sampling at the next site.

4.5 Manual Readings of Water Level

Manual readings of standing water levels within groundwater bores are taken with the following steps:

1. Open the bore cap and allow some time for stabilisation before measurements are made
2. Hang the dipper on the side of the casing then run the tape over the tape guide
3. Loose the brake to start lowering the probe into the water. The buzzer will sound, and the Light-emitting diode (LED) will turn on when the probe touches the water. If there is any cascading water in the well, sensitivity needs to be adjusted to get a clear signal
4. Once the probe touches water, tighten the brake and take the depth reading
5. Repeat 1-3 times to refine and ensure the reading is accurate. Where possible, depth measurements should be recorded to the nearest 1 mm.

4.6 Retrieving Data from Loggers

Automatic water level loggers are used to record standing water level in some of the groundwater monitoring bores. Loggers are installed as per manufacturer's instructions. To retrieve the data from these loggers, a field tablet is used, and data is downloaded while in the field. The logger remains installed to continue data downloads until no longer required. Batteries are to be replaced as per manufacturer's recommendations.

4.7 Retrieving Data from Flow Meters

Flow meters are installed at Arafura's extraction bores and at some of the surrounding groundwater user's bores to monitor water extraction rates. Manual readings of flow meters are taken while in the field, reading the flow meter dial from right to left. Guidance on reading various types of flow meters is provided in the Reading Your Water Meter Factsheet (DEPWS 2024) and general guidance. Extraction volumes are recorded in the field sheet, as well as any observed conditions.

4.8 Field Sheet Records

At each sampling location, field records will be taken using prepared field sheets. Field sheets will include the following minimum information:

- Location (monitoring point and GPS coordinates)
- Date and Time
- Name of personnel
- Type of monitoring activities, including equipment and methods used
- Weather conditions
- In-situ water quality parameter readings (pH, EC, DO, TDS, temperature, etc.) when required
- When taking water samples, the physical characteristics of each sample (e.g., odour, sheen, colour)
- Sample equipment decontamination procedures used, in cases when non-disposable

sampling equipment is used

- Photograph of sample and location
- Relevant field observations including any unusual observations such as visible grease/scum or colour of water, visible disturbance of the monitoring site, etc.

5.0 SAMPLE DISPATCH AND TRANSPORT

Groundwater samples have potential to deteriorate following collection. Samples are to be placed into onsite fridge pending dispatch to laboratory. At completion of the sampling round bottles are to be packed into Esky's and ice bricks placed on top of samples and transferred to Alice Springs haulage depot. Samplers are to contact the haulage companies and laboratory to inform of sample delivery and requirements to keep refrigerated.

For packaging and dispatching ensure to arrive to Arafura office with plenty time, at least three hours before dispatching time. For that follow the steps below,

- Water samples are to be kept chilled in the field during monitoring activities.
- Once returning to the site office samples must be refrigerated or frozen (e.g., samples for nitrates) before packaging to comply with the preservation requirements.
- Allow a minimum of three hours for sample preparation and packaging prior to the arranged dispatch time.
- Prior to packaging, ensure all sample bottles are correctly labelled.
- Take samples from the fridge and place them in the transport cooler boxes/eskies. The frozen samples are to be kept in a separate cooler box/esky. Cover all samples with ice.
- Place the Chain of Custody in a Ziplock bag and place it inside each cooler box/esky
- Secure each cooler box/esky with tape
- Affix the transport label and a 'Fragile' label to each cooler box/esky (see Figure 5—1 for example).
- Transfer the packaged samples to the arranged transport pick-up point.
- Once dispatched, email the relevant lab to confirm the expected delivery time of the samples, attaching the CoC form, and Transport consignment number for tracking.
- Check with the laboratory following the expected delivery time to ensure the samples were received as expected.

Figure 5—1 Example of packaging of water samples

6.0 DATA MANAGEMENT

- Following completion of monitoring activities, all field sheet records will be entered into Arafura's environmental monitoring system for safe record keeping.
- When laboratory results are received, these will be uploaded into Arafura's environmental monitoring system for safe record keeping.
- Data will be analysed on a monthly to quarterly basis (as appropriate to the parameters) in accordance with the Nolans Borefield Adaptive Management Plan (GHD 2024b).

7.0 ROLES AND RESPONSIBILITIES

Table 7—1 below outlines the responsibilities of personnel in relation to this Groundwater Sampling Operational Procedure.

Table 7—1 Roles and Responsibilities

Job Title	Responsibilities
Environment Manager	▪ Groundwater Sampling Procedure review and approval
Environmental Scientist(s)	▪ Monitoring, data analysis and reporting

7.1 Training and Competency

All personnel conducting water sampling shall be familiar with this operating procedure and have received field training from experienced personnel. This includes training in sample collection, dispatch, using and calibrating field meters.

8.0 REFERENCES

DEPWS 2024 Reading your water meter, Department of Environment, Parks and Water Security, Water Resources Northern Territory, Available at: https://nt.gov.au/__data/assets/pdf_file/0008/193886/how-to-read-your-water-meter-for-water-extraction.pdf (nt.gov.au 2024).

GHD 2024a *Nolans Borefield Monitoring Program*, July 2024, GHD Consulting. Prepared for Arafura Nolans Project.

GHD 2024b *Nolans Borefield Adaptive Management Plan*, July 2024, GHD Consulting. Prepared for Arafura Nolans Project.