Government of South Australia
Department for Energy and Mining

Doc ID: EPR-04096

12 June 2026

Ms. Amy Jacka,
Havilah Resources Limited,
31 Flemington Street,
GLENSIDE SA 5065

email: amy.jacka@havilah-resources.com.au

Dear Ms. Jacka

Notification of Approved Exploration Program for Environment Protection and Rehabilitation (EPEPR) Review

In reference to your final submission dated 4 June 2026, the EPEPR has been approved pursuant to section 70C(5) of the *Mining Act 1971* (the Mining Act).

The approved EPEPR will be made publicly available on the Mining Register and the Department for Energy and Mining (DEM) website. Details of the approved EPEPR are listed below.

Approval Granted to	**Havilah Resources Limited**
Tenement Type & Number	*Exploration License: EL5873; EL 6415; EL 6660; EL 6659*
Program Number	EPR-04096
EPEPR Description	EPEPR Review- 12-month time extension to complete drilling of 39 RC (on EL 5873), 19 RC (on EL 6659), 10 RC (on EL 6415) and 10 RC (on EL 6660) drill holes on the Central Curnamona Project area.

You are reminded that you must always implement and comply with this approved EPEPR.

This approval does not constitute endorsement of the systems that you have in place to manage the mining operations in compliance with the Mining Act. Whilst your capability to undertake this activity has been considered in this approval, the responsibility for compliance with the Mining Act always remains with the tenement holder.

The legislative requirements associated with the EPEPR are outlined below, and certain requirements must be actioned prior to commencement of operations authorised by the EPEPR.

1	**PEPR Conditions** In accordance with section 70B(7a)(b) of the Mining Act, the approved EPEPR is subject to the conditions listed in the Notice of Approval Conditions – EPR-04096. (Appendix 1)
2	**Public Liability Insurance** Pursuant to Regulation 81 of the *Mining Regulations 2020* (the Mining Regulations), you are required to provide a copy of a certificate evidencing the insurance coverage over the tenement(s).
3	**Compliance Reporting** You are required to submit an annual exploration compliance report. The report is required to be submitted **within 2 months** after the anniversary of the date the licence/ease was granted, or in accordance with joint reporting requirements agreed to with the Minister. Please refer to the DEM website for more information on the reporting requirements. You are reminded that a separate compliance report is required **2 months after** the expiry or surrender of the EL.
4	**Work, Health and Safety Compliance** In accordance with Chapter 10 of the *Work Health and Safety Regulations 2012* (SA), you must meet the requirements for mine operators in South Australia, which include a notification for mining operations, the establishment of a Safety Management System, the identification of Principal Mining Hazards and development of a Principal Mining Hazard Management Plan. Further information on your responsibilities, including a guide to Chapter 10, and the Mine Operator Notification Form, is available on the SafeWork SA website.
5	**EPEPR Timeframe** The EPEPR Review is approved for a period of twelve months from the date of this letter. A further 3 months after expiry of the 12-month period is provided to complete all rehabilitation.

Please note, proposed changes to exploration operations stated in the approved EPEPR may require a EPEPR review to be submitted for assessment. Where a EPEPR review is required, implementation of the operational changes can only occur after the revised EPEPR is approved. Further information on when an exploration PEPR review is required can be found in Departmental guideline *MG22 Conducting mineral exploration.*

In addition to the requirements under the Mining Act, you are reminded that your operation will have other legislative requirements that you will need to comply with.

If you have any further queries, please contact DEM staff as below:

MINERALS REGULATION

11 Waymouth Street, Adelaide SA 5000 | GPO Box 618 Adelaide SA 5001
Tel (+61) 8 463 3000 | ABN 83 768 683 934

Government of South Australia
Department for Energy and Mining

General enquiries	Cobus Martins Assessment Officer, Exploration Regulation DEM.exploration@sa.gov.au

Yours sincerely

Simon Constable

DIRECTOR, MINERALS EXPLORATION
In accordance with delegated powers and functions

The Department's Regulatory Guidelines, Ministerial Determinations and Information Sheets are available at:
https://energymining.sa.gov.au/industry/minerals-and-mining/forms-legislation-and-guidance

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Appendix 1

Notice of Approval Conditions - EPR-04096

In accordance with section 70B(7a)(b) of the *Mining Act 1971*, EPR-04096 is approved subject to the following conditions:

Notice of Approval Conditions – EPR-04096	
1	Conduct the Namba Formation Strata Self-Sealing Test in accordance with Attachment 1 referenced in the *Namba Formation Strata Self-Sealing Test Method* within Appendix 2 of the *Technical Memorandum: Namba Formation Strata Self-Sealing Test Report – Update*, dated 26 February 2026.
2	Conduct the Groundwater Quality Sampling Test as described under the Drillhole Construction and Decommissioning section within EPR-04096.
3	Provide the test results and data interpretation of the Namba Formation Strata Self-Sealing Test and Groundwater Quality Sampling Test, in accordance with conditions 1 and 2, within 14 calendar days on completion of each tested drill hole, to inform the drillhole decommissioning strategy. Test results and data interpretation must be provided to DEM via email to DEM.Exploration@sa.gov.au.

MINERALS REGULATION

11 Waymouth Street, Adelaide SA 5000 | GPO Box 618 Adelaide SA 5001
Tel (+61) 8 463 3000 | ABN 83 768 683 934

Exploration PEPR - EPEPR | 12 Month PEPR Review

Reference Number: **EPR-04096** • Status: **Submitted**

Select Applicable PEPR

Previous MERS EPEPR?

◉ No ○ Yes

Previous PEPR ID

2024-015

Search PEPRs

—

Applicant and General Details

Applicant Details

Amy Jacka

Full Name *

Amy Jacka

Business Phone

Mobile Phone

0438 822 771

Email *

amy.jacka@havilah-resources.com.au (mailto:amy.jacka@havilah-resources.com.au)

Project Supervisor

Traviss Just, Havilah Resources Limited, Chief Geologist
traviss.just@havilah-resources.com.au, 0428 425 789,
B.App.Sc, MSc in Geology. Over 30 years' experience in exploration and mining geology.

General Details

Tenement Details *

Tenement Type	Tenement Name	Tenement Holder
Exploration Licence	EL 5873	Havilah Resources Limited
Exploration Licence	EL 6415	Havilah Resources Limited
Exploration Licence	EL 6660	Havilah Resources Limited
Exploration Licence	EL 6659	Havilah Resources Limited

Operating Company

Havilah Resources Limited

If there is another Operating Company, please provide

Account Name	Entity Type	Registered Address	Registered Email

There are no records to display.

Project/prospect name

Central Curnamona

Mineral Model

Northern Area – Birksgate and Eurinilla (Maps 1 to 5):
• IOCG and skarn style Cu-Au mineralisation at various prospects at the Birksgate Prospect. Kalkaroo / Nth Portia style Cu-Au mineralisation in the prospective sequence (Portia Fm.) around the margin of the Eurinilla Dome.

Southern Area – Johnson Dam (Maps 1, and 6 to 7) and Deep Well (Maps 8 and 9):
• Kalkaroo replacement & structurally controlled styles of Cu-Au mineralisation at the Johnson Dam Prospect.

Primary Commodities *

Commodity Name ↑	Commodity Group	Grade
Copper	Exploration	
Gold	Exploration	

Secondary Commodities

Commodity Name ↑	Commodity Group	Grade

There are no records to display.

Project Description

PROJECT DRILLING
EL5873 – 50 RC, EL6415/EL6660 – 20 RC, and EL6659 – 30 RC, 2 DD – possible diamond tails at Johnson Dam prospect and Deep Well Prospect (previous holes) – Total 102 holes, ~21,600 m.

Proposed Project Schedule

Start Date

15/06/2026

End date

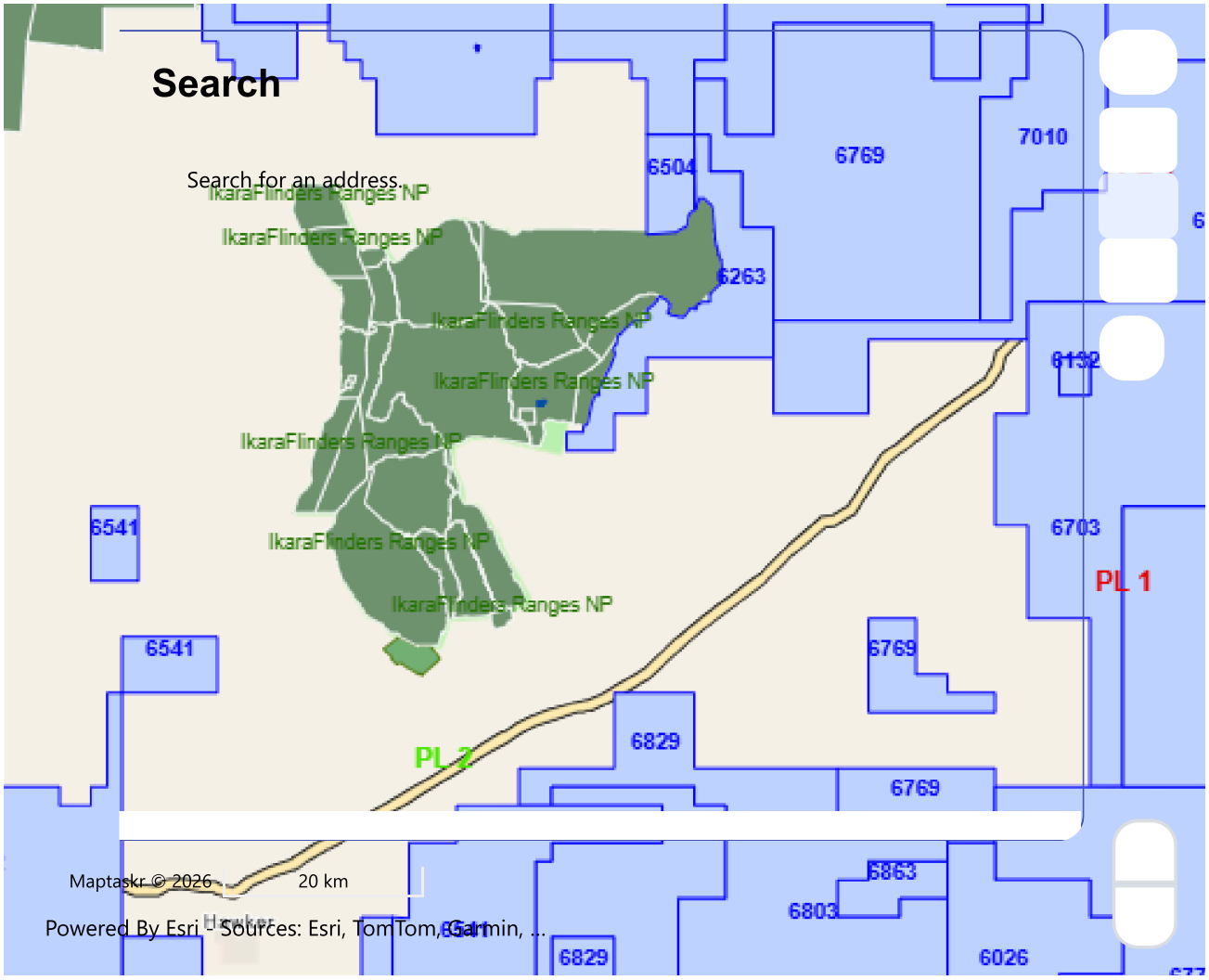
15/06/2027

Clearly describe why a PEPR review is required, summarise all content changes made to the approved PEPR, and provide appropriate justification where a time extension is required.

The current PEPR period was listed as 15/04/2025 to 15/04/2026. The approval letter (2025D031583) was dated 6 May 2025, so due to point 8 of the letter we believe we have up to 6 May 2026 to work on this PEPR. Havilah have recently submitted an Ongoing PEPR (EP-04062) to continue work on this project area and surrounds, although with the delay for PEPR approval and Program Notification approval following this, it may surpass the 6 May 2026, which leaves Havilah stuck and unable to drill. By reviewing this PEPR, all Havilah wish to change is the date range to allow drilling to continue past May 6, and ensure all new documents have been adequately finalised and compliant with DEM. No other changes are required and with the new Sandfire deal, this review is for a 12-month time extension. Havilah are keen to be on ground drilling with no delays or downtime.

11 out of 50 RC holes on EL 5873 and 11 holes out of 30 RC holes on EL 6659 have already been completed under EPEPR2024-015 and this approval seeks authorisation for the rest of the holes not completed.
12 out of 50 costeans on EL 5873 and 11 out of 30 costeans on EL 6659 have already been completed under EPEPR2024-015 and this approval seeks authorisation for the rest of the costeans not completed.

Identify Application Area



Map Layer Intersects

Application Area Details

Location Description

Kalkaroo area approximately 70km north of Olary

Area (Sqkm)

2,142.73

Spatial Data Intersects - Summary Table

Show 10 entries

Search:

Spatial Layer Name	Category	Referral	Intersect Count
No data available in table			

Showing 0 to 0 of 0 entries Previous Next

Spatial Data Intersects - Details Table

Show 10 entries Search:

Spatial Layer Name	Shape	Primary Attribute	All Attributes	Category
No data available in table				

Showing 0 to 0 of 0 entries Previous Next

Program Preparation

Work undertaken in preparing the proposal

The drill hole locations were planned following extensive collation and interpretation of existing data (both historical from previous companies and from Havilah's ongoing regional exploration) in combination
with the extensive local geological knowledge of the Havilah geologists, who have been working in the area for many years.
Notices of Entry on Land (Form 21B) have been or will be served on the relevant landholders in advance of entry on the land. Havilah have longstanding good relationships with all landholders within the area
and maintain continual and open communication regarding any on-ground activity, especially where ground disturbing drilling is involved. Ongoing dialogue (face-to-face as much as possible) both formally and
informally with the landowners normally occurs before, during and after all drill programs.
All native title claimants have been served Form 21Bs and requests for native title clearances have or will be submitted to the relevant parties in relation to the drilling on the respective native title claim areas.
Reconnaissance visits have been made to each prospect area, in preparation for pegging the drill sites for clearance.
The pastoral lease on which the Kalkaroo deposit is located is owned by Kalkaroo Pastoral Company Pty Ltd., a wholly owned subsidiary of Havilah Resources Limited.

Operator Capability

Havilah Resources are an established and competent exploration company with over20-year history of exploring in this region. The company employs capable geological and exploration staff with an average of more than 25 years exploration industry experience spread over many varied terrains, environments, and jurisdictions. Throughout its history Havilah has maintained best practice industry standards of exploration and rehabilitation compliance in South Australia. It has successfully rehabilitated thousands of drill sites in the area and typically no traces of the historic drilling sites remain after one or two good seasons.

Havilah Resources operates its own equipment including an AC/RC drilling rig and support vehicles, backhoes, and grader. Experienced and trained operators are employed directly by the company and these operators are engaged to conduct the drilling programs and environmental rehabilitation associated with these activities. The company's exploration staff have a long history of working on pastoral country and are also responsible and involved in the management of Kalkaroo Station which is owned by Havilah Resources.

Havilah Resources have a number of operational and procedural documents in place including but not limited to;

- Employee Induction and HSE Booklet.
- Remote Areas Operations – Emergency Response and Hazard Awareness Booklet.
- Guidelines for working on Station Properties.
- Project Specific Inductions including guidelines regarding Heritage Clearance conditions and governmental drilling approval conditions.
- Field Emergency Response Manual.
- Incident Investigation Management Procedure.
- Communication, Consultation, and Involvement.
- Pre-Drilling Safety and Equipment Checklist.
- Drill Rig Safety Inspection Checklist.
- Equipment, Drill Rig and Vehicle Inspection Reports.
- Numerous Hazard, Risk Management, Incident Reporting and JSA documents and records.
- Toolbox Meetings, Training Registers.

In addition to the geological and field exploration staff, Havilah have a Principal Environmental Advisor engaged, Geoff Borg, MSc (Hydrogeology and Groundwater Management): Geoff is an experienced hydrogeologist with over 25 years of experience directing, managing, and advising environment assessment, compliance, risk management, and approvals for industrial operations and resource projects across Australia. Experienced in incorporating technical, legal, and business requirements into effective communications and plans for strategic assessment and implementation of approvals and work plans to achieve environmental compliance. Geoff's experience includes oil refineries and storage terminals, planning and environmental approvals for projects including fuel storage facilities, ranging from service stations to underground coal gasification, carbon capture and storage, and mining projects.

An Environmental Management System specific to the project is being developed which details the environmental management approach adopted for the project to achieve the environmental outcomes as defined in this PEPR. The Environmental Management System will include Environmental Management Plans with procedures and processes to ensure continuous improvement and compliance with legal and other requirements.

The Environmental Management System will also incorporate information for the following:

- environmental governance
- environmental training, awareness, and competence
- audits and inspections
- emergency preparedness, incidents, and response

• monitoring, measurement, and evaluation
• management review
• documentation and records.

All staff and contractors at the current drilling PEPR area will be required to work under the Environmental Management System.
Havilah Resources has developed an Environmental Policy, which will be used for the project as follows:
Havilah Resources is committed to conducting all its operations in an environmentally responsible manner. The Company will plan and manage its activities to minimise disturbance to the environments in which it operates.

To fulfil our objectives, the Company will observe all environmental laws and regulations and use all available resources to:
• Review, update, and audit this policy and environmental management plans to affect positive environmental outcomes in all the Company's activities.
• Discuss and resolve with stakeholders any possible area of environmental conflict.
• Integrate environmental considerations into our work planning and operations.
• Assess and where possible, reduce the potential impact of our operations on the environment in which we work.
• At all times work towards improving our environmental performance.
• Rehabilitate the environment affected by our operations, where required by legislation.
• Actively promote environmental awareness and provide relevant environmental information, instruction and training for management and personnel.
• Where necessary, engage the services of expert external personnel to advise on environmental matters.
• Co-operate with government authorities, Traditional Owners, environmental groups, landowners and any other stakeholders in the formulation and application of rational and practical environmental guidelines and legislation.

The aim of this Environmental Policy is to provide realistic and achievable guidelines for all personnel involved in the Company's activities.

Lease Conditions

N/A

Land Access

Identify the Owners of Land and authority to access land

Land Title Reference	Plan Parcel Reference	Type of Land	Owner of Land ↑	Land Access Authorisation Method	Date of Form 21 or Agreement Signed	Instrument or Uploaded Document Id	Uncheck land not applicable to your application ar
CL 6180/12	H834800BL896	Crown	Brian and Anne Treloar - Mooleulooloo Station	Service of Notice of Entry	12/07/2022	21 B NT-01255	Checked
CL 6179/994	H834800BL979	Crown	Greg and Sanchia Treloar - Yarramba Station	Service of Notice of Entry	21/07/2025	21 B NT01019	Checked
CL 6162/839	H83488BL1121	Crown	Kalkaroo Pastoral Company Pty Ltd.	Service of Notice of Entry	03/02/2026	21 B NT-01017	Checked
CL 6181/747	H834800BL984	Crown	Mr James Morgan - Mulyungarie Station	Service of Notice of Entry	30/05/2025	21 B NT-01022	Checked

Land Title Reference	Plan Parcel Reference	Type of Land	Owner of Land ↑	Land Access Authorisation Method	Date of Form 21 or Agreement Signed	Instrument or Uploaded Document Id	Uncheck land not applicable to your application ar
CL 6181/746	H834800B L121	Crown	Mr James Morgan - Mulyungarie Station	Service of Notice of Entry	30/05/2025	21 B NT-01022	Checked
CL 6181/765	F251701F L25	Crown	Mr James Morgan - Quinyambie Station	Service of Notice of Entry	30/05/2025	21 B NT-01023	Checked

Is any of the application area over a road, street or highway

No

Woomera Prohibited Area (WPA)

Will activities be conducted within the WPA

No

In which zone will activities be conducted?

Name	Are you intending to undertake work?	Closure start date	Closure end date

There are no records to display.

Does the tenement holder hold a valid and current Resource Exploration Permit under the WPA Rule?

—

Permit No.

—

What is the expiry date of the permit?

—

Does the Exploration Permit allow the operator to conduct exploration operations in the WPA?

—

Other Land Owned or Controlled by the Commonwealth Department of Defence

Indicate if you are intending to undertake exploration operations within the identified defence land

No

Other Commonwealth defence land

Defence Land	Applicable
There are no records to display.	

Do you have a Deed of Access with Defence?

—

Expiry date of the Deed of Access

—

Date the Range Control Officer granted permission to conduct the proposed exploration operations.

—

Describe the results of consultation and how any concerns raised were addressed

—

Native Title

Does 'Native Title land' exist within the application area?

Yes

Using the table below, describe how you have complied with the requirements of Part 9B of the Mining Act for each tenement.

Name of Determined / Claimant Group	Agreement Type	Instrument Number	Applicable

There are no records to display.

Provide any additional relevant information

Each of the drilling areas is on a different native title claim area and each relevant claimant group will be dealt with separately.

Exempt Land

Exempt Land

Has Exempt land been identified?

No

If a "Waiver of Exemption" has been reached to waive the benefit of the exemption, a notice of the agreement must be given to the Mining Registrar, either within 21 days after the agreement was entered into or when an application for the mineral tenement is made under the Mining Act.

In the table below enter the relevant instrument numbers for any Form 23C - Notice of wavier of exemption provided to the Mining Registrar.*

Land Title	Plan Parcel	Owner of Land that has benefit of exemption ↑	Why is the land exempt land?	Waiver of exemption(s) been negotiated	Instrument Number or Uploaded Document Id
CL 6180/12	H834800BL896	Brian and Anne Treloar - Mooleulooloo Station			
CL 6179/994	H834800BL979	Greg and Sanchia Treloar - Yarramba Station			
CL 6162/839	H8348 8BL1121	Kalkaroo Pastoral Company Pty Ltd.			
CL 6181/746	H834800BL121	Mr James Morgan - Mulyungarie Station			
CL 6181/747	H834800BL984	Mr James Morgan - Mulyungarie Station			
CL 6181/765	F251701FL25	Mr James Morgan - Quinyambie Station			

Consultation

Consultation

Stakeholder ↑	Land Use	Matters raised	Stakeholder concerns raised and how addressed
Brian and Anne Treloar - Mooleuloolo o Station	Grazing	N/A	Maintain good relations with manager and property owner and no issues ever raised.
Greg and Sanchia Treloar - Yarramba Station	Grazing	Notification and consultation were undertaken with Station Owner in 2025. Renewed consultation (form 21B) provided July 2025.	Maintain good relations with manager and property owner and no issues ever raised.
Kalkaroo Pastoral Company Pty Ltd.	Grazing	Renewed consultation (Form 21B) provided Feb 2026.	Owned by Havilah Resources Limited.
Mr James Morgan - Mulyungarie Station	Grazing	Notification and consultation were undertaken with Station Owner in 2025. Renewed consultation (form 21B) provided May 2025.	Maintain good relations with manager and property owner and no issues ever raised.
Mr James Morgan - Mulyungarie Station	Grazing	Notification and consultation were undertaken with Station Owner in 2025. Renewed consultation (form 21B) provided May 2025.	Maintain good relations with manager and property owner and no issues ever raised.
Mr James Morgan - Quinyambie Station	Grazing	Notification and consultation were undertaken with Station Owner in 2025. Renewed consultation (form 21B) provided May 2025.	Maintain good relations with manager and property owner and no issues ever raised.

If any individual or group of similar affected persons were not able to be consulted, what steps were taken to consult with them?

Havilah maintains good relationships with all its neighbouring landholders. It is in regular contact with them and frequently updates them on its exploration plans.

Provide any additional relevant information.

Consultation has or will be carried out as follows:
• Serving of the NOEs to the owners of both the pastoral blocks, the native title claimants, SANTS and the Mining Registrar.
• Liaise with the manager of all listed stations about the timing and location of the planned drilling.
• A request for heritage clearance of the drill sites has been or will be submitted to the relevant native title claimants via their legal representatives and heritage clearance surveys organised to clear nearly all the planned drillholes on the respective claim areas. This includes ATLA, NAWNTAC and Malyangapa native title claimants.
• The South Australian Dog Fence (Marty Bower – Dog Fence Program Manager (marty.bower@sa.gov.au) and Ash Rees – Dog Fence Inspector (ash.rees@sa.gov.au)) were notified of Havilah's proposed activities by email.

Describe any council policies (or out of council) or development plans that may impact the program area and a description of any known plans for future land use changes by other parties.

N/A

Description of Environment

Proximity to Infrastructure and Housing

Provide the following information:

There are no settlements or places of human habitation within any of the areas of proposed drilling. Station roads, tracks, fences, bores, tanks, and dams are the only infrastructure, none of which will be affected by the proposed drilling activities. The nearest inhabited station homesteads are at Strathearn, Mooleulooloo, Yarramba and Mulyungarie, well outside the three areas. The old Benagerie homestead is derelict and abandoned. Havilah's exploration camp is located at the Kalkaroo Homestead, which is the closest to the proposed Johnson Dam
prospect drilling and is owned by the Kalkaroo Pastoral Company Pty. Ltd., a wholly owned subsidiary of Havilah Resources Limited. The station homesteads and other infrastructure are too far removed from the areas of proposed drilling for there to be any impact from the proposed activities Maps 1 to 9.

Attach Files

Expand/Collapse

File Name	File Size (Mb)	Created On	Download
Brooks Dam Proposed Drilling.jpg	1.1 Mb	18-05-2026 14:03:40	Download (MERS/EPR-04096/Proximity to infrastructure/Brooks Dam Proposed Drilling_2026-05-18T04-33-41.060Z.jpg)
EPEPR2024-015_Maps 1-9.pdf	1.68 Mb	27-03-2026 13:56:19	Download (MERS/EPR-04096/Proximity to infrastructure/EPEPR2024-015_Maps 1-9_2026-03-27T03-26-20.450Z.pdf)

Landform, topography, soil and surface cover

Describe the topography and soil and surface cover (e.g. gibber) of the general area affected by the exploration program. Include details on the susceptibility to compaction, erosion, dust, runoff and visual attributes (steep or undulating slopes, plains, rocky outcrops, dunes, saltpans, claypans etc) any other characteristics (e.g. acid sulphate soils) that may require control strategies to reduce environmental impacts during operations or rehabilitation.

The Central Curnamona Project Area lies within the plains of the Lake Frome Basin. The plains are flat to slightly undulating, with the land surface falling gradually at a gradient of about 1 in 1,000 towards Lake Frome, 100 km to the northwest of the project area.
Apart from three isolated basement ridges (Mooleulooloo Hills and Mt. John) near Mooleulooloo Homestead and a rocky knoll at Kalkaroo (Johnny Hill), the nearest areas of elevated topography are the Olary Ranges about 60 km to the south. To the east, the Barrier Range lies beyond the New South Wales border.
The landscape surrounding the project area is characterised by a flat to slightly undulating sandy plain, with low sandy dunes and shallow interdunal areas with scattered small claypans, trending in a south westerly to north easterly direction. Photos 1 to 6 attached, show indicative landform, vegetation, and topography.
The project area is situated within the Benagerie Association of the Southern Frome Basin Region. Soil types and other parameters are described on a schematic profile basis.
The most widespread soil type is found on the principal landform of the area (flat plain with maximum slope 1%) as a brown calcareous earth.
Low undulating dunes, the sub-dominant landform type, are characterised by deep reddish sands and some brown calcareous earths. Both are well drained and contain carbonate nodules in the B horizon and below. Occasional pans (small depressions) occur and are distinguished by poorly drained soils: where Gilgai micro-relief is present, the soil is a uniform brown loam, self-mulching with cracking clays, and where a surface crust occurs, the soil is a crusty red duplex type with a strongly structured B horizon. All soils in the Benagerie Association described above have an alkaline reaction trend.
Both the deep reddish sands and the brown calcareous earth are moderately susceptible to powdering and wind erosion, because of disturbance when the ground cover is removed by overgrazing or by vehicle movements.
The susceptibility for significant erosion due to water runoff is very low, because of the low topographic relief and low rainfall of the area. Very localised minor erosion of disturbed areas due to runoff in heavy downpours from rare thunderstorms is the only possibility.
The area has low rainfall, high evaporation rate and resulting sparse vegetation. Previous overgrazing by native and introduced animals has led to soil becoming exposed, often resulting in the generation of large amounts of dust in periods of strong winds, particularly during the warmer months and in times of drought. The amount of dust generated by exploration activities is minor, very localised, and insignificant compared to this source.
The effects of compaction, erosion, dust, and runoff on the integrity of the soils of the area can be mitigated by keeping vehicle movements to a minimum and by prompt rehabilitation involving scarification and revegetation, largely from existing seed stock within the topsoil.

Attach Files

Expand/Collapse

File Name	File Size (Mb)	Created On	Download
No Files Uploaded			

Surface Water

Will the proposed program interfere with surface water bodies and natural drainage (e.g. drainage lines, creeks, floodplains, wetlands)?

No

Describe the potential interference and surface water bodies and natural drainage on maps.

—

Indicate how you will avoid disturbance

Permanent surface water bodies do not exist (except for man-made dams) and well defined creeks are rare. All drainage lines, creeks, floodplains, ephemeral wetlands are assigned a 50 m avoidance buffer. As part of the heritage clearance process, a 50 m avoidance from the edges of all watercourses, washouts and creek lines throughout all survey areas is a condition. The clearances are subject also to creeks and drainage line crossings may be necessary in some areas to gain access to a work site and in such circumstances access tracks be kept to a single defined track.

Is the program area located within water protection areas defined under the River Murray Act 2003?

No

Select the name(s) of protected water areas

Is the program area located within any prescribed watercourses or prescribed surface water areas under the Landscape?

No

Select the name(s) of the prescribed watercourses or prescribed surface water areas under the Landscape South Australia Act 2019.

Attach Files

Expand/Collapse

File Name	File Size (Mb)	Created On	Download
No Files Uploaded			

Name	Applicable
There are no records to display.	

Groundwater

Is groundwater likely to be intersected when conducting the exploration program?

Yes

Provide evidence or any supporting information demonstrating this.

—

Description of the localites/areas where different groundwater conditions may be encountered

Appendix 1 (attached) provides a more detailed discussion of the hydrogeology of the Curnamona prospects that are the subject of this EPEPR.

Basement geology comprises metamorphosed Palaeoproterozoic Willyama Supergroup rocks, Mesoproterozoic Benagerie Volcanics, and Ninnerie Suite granitoids of the Curnamona Province and some Neoproterozoic metasediments. Basement rocks are unconformably overlain by Cenozoic cover strata that generally increase in thickness towards the north, excepting over basement topographic highs.

The basement rocks typically have a deeply weathered profile of clay rich saprolite to saprock above the fresh unweathered variably fractured bedrock. This varies locally depending on basement topography, the sulphide content of the original basement strata, and the presence of structural features such as shear zones that result in deeper weathering or removal (erosion) of the profile.

Cenozoic cover includes Eyre Formation, typically preserved as white to grey soapy clays (Eyre Clay) as localised remnants in basement topographic lows. Eyre Formation sands and gravels are limited to rare, incised channels in the basement such as the Yarramba Palaeochannel that is host to the Honeymoon Uranium Mine. Cenozoic Namba Formation clays and sands unconformably overlie the Eyre Formation and basement and form a blanketing cover over much of the Curnamona North area that is typically capped by Quaternary outwash sediments of the Frome Plains (including frequent hardpan) that in turn are overlain by Holocene aeolian sands that increase in abundance towards the north.

These cover strata are variably developed from place to place, and their thickness is controlled by the Benagerie Ridge basement high and local basement topography. In the south basement rocks outcrop (Olary Ranges) or are very near surface (Johnson Dam) and they can also subcrop or have minimal cover many kilometres to the north (Croziers, Birksgate). More generally, there is significant cover of Namba Formation clays (and more rarely Eyre Clay) lying unconformably on the basement over much of the area (Eurinilla).

Namba Formation consists predominantly of medium to high plasticity, highly fissured smectitic clay with occasional thin lenses of clayey sand and silt. Eyre Formation may occur locally beneath the Namba Formation and consists of plastic, highly fissured clay and silty clay in this area.

Surficial Quaternary sediments and underlying Cenozoic Namba (where present) and Eyre (where present) Formation strata are clay rich with low permeability. Clay rich Cenozoic strata are highly fissured with joints and slickensides providing secondary permeability. Basement rocks are generally of low permeability with joints and fractures providing secondary permeability.

Ephemeral perched water tables in the Quaternary cover sediments are not identified in geotechnical studies (Water Technology, 2021 and Mining One, 2017), Portia Tailings Storage Facility compliance monitoring of wells screened in these sediments, or the Portia mine open pit.

Groundwater occurs in a single, low permeability, unconfined aquifer with a potentiometric surface (water table) with a low but consistent general hydraulic gradient across the region indicating flow from south (Olary Ranges – recharge area) to north (toward Lake Frome). The water tables are in basement rocks to the south and transitions to the Namba Formation to the north. Saturated formations are transmissive and low permeability (Namba Formation, Eyre Formation – Eyre Clay, and basement – including the highly weathered clay dominated saprolite to saprock to unweathered rock). Groundwater is slow moving with a generally increasing salinity with distance away from recharge zones (Olary Ranges). Water quality is typically saline across the exploration prospects.

In previous phases of exploration drilling on Havilah's exploration prospects the intersection of regional groundwater has typically been evident as wet or mushy RC (reverse circulation) returns and occasional slugs of saline water suggesting intersection with water filled permeable sedimentary lenses, joints, or fractures. Intersection with larger water filled structures tends to produce initial water discharge that decreases over time as drilling progresses beyond the structure.

Groundwater quality in this low permeability, regional unconfined aquifer is saline, typically around 13,625 mg/L total dissolved solids, with a pH of around 7.8.

Eromanga Basin (and hence Great Artesian Basin) aquifers such as the Cadna-owie Formation do not occur in the areas of proposed drilling based on past exploration drill hole data (See Appendix 1).

Callabonna Sub-basin in the Kati Thanda - Lake Eyre Basin, Curnamona Province.

Add the different groundwater conditions for each localities/areas to the table below.

Name ↑	Formation age and/or stratigraphic unit	Stratigraphic intervals (depth range) (m)	Aquifer formation name	Aquifer Interval/thinkness (from-to) (m)	Aquifer Type	Aquifer salinity (TDS)	Depth to ground water (m)	Comments
Birksgate Prospect	Quaternary sediments	6	N/A	0	Unconfined	N/A	0	0-6m.
Birksgate Prospect	Namba Formation – Early-Mid Miocene	10	N/A	0	Confined	N/A	0	0-16m.
Birksgate Prospect	Willyama Supergroup Curnamona, Strathearn Groups, overlying weathered profile (saprolite) ~1700ma	400	Regional low permeability water bearing zone	370	Confined	Saline groundwater (TDS ~13,625 mg/L, pH ~ 7.8).	30	16m - beyond limit of drilling.
Eurinilla Prospect	Quaternary sediments	14	N/A	0	Unconfined	N/A	0	0-14m.
Eurinilla Prospect	Namba Formation – Early-Mid Miocene	42	Regional low permeability water bearing zone	26	Confined	Saline groundwater (TDS ~13,625 mg/L, pH ~ 7.8)	30	14-56m.
Eurinilla Prospect	Eyre Formation – Eocene	10	Regional low permeability water bearing zone	10	Confined	Saline groundwater (TDS ~13,625 mg/L, pH ~ 7.8)	56	if present, 56-66m.

Name ↑	Formation age and/or stratigraphic unit	Stratigraphic intervals (depth range) (m)	Aquifer formation name	Aquifer Interval/thinkness (from-to) (m)	Aquifer Type	Aquifer salinity (TDS)	Depth to ground water (m)	Comments
Eurinilla Prospect	Willyama Supergroup Curnamona, Strathearn Groups, overlying weathered profile (saprolite) ~1700ma	334	Regional low permeability water bearing zone	344	Confined	Saline groundwater (TDS ~13,625 mg/L, pH ~ 7.8)	66	66m - beyond limit of drilling.
Johnson Dam Prospect	Quaternary sediments	2	N/A	0	Unconfined	N/A	0	Largely absent, if present, up to 2m.
Johnson Dam Prospect	Willyama Supergroup Curnamona, Strathearn Groups, overlying weathered profile (saprolite) ~1700ma	400	Regional low permeability water bearing zone	355	Confined	Saline groundwater (TDS ~13,625 mg/L, pH ~ 7.8)	45	surface to beyond limit of drilling.

Provide the environmental value of each aquifer present determined according to the current Environment Protection (Water Quality) Policy.

Due to the salinity being generally higher than is usable for longer term stock watering (i.e. >10,0000 mg/L for sheep and half for cattle), the groundwater in the area is not presently used for any domestic or commercial purposes.

Provide a description of the existence, location and value of all Groundwater Dependent Ecosystems (GDE) within and immediately surrounding the project area

There are no known permanent GDEs in the area, excepting possibly Lake Yantaweena in the northeast corner of EL5873 (Map 11 and 12 - EPEPR2024-015_Maps 11-12 attached) which is distant from any drilling sites. This is because all surface water is runoff that is related to infrequent rainstorms and quickly dries up due to evaporation. All vehicle movement during drill programs will be restricted to cleared overland access routes and drilling on selected pad areas.

Is the proposed program located within a prescribed wells area?

Yes

Select the prescribed wells

Far North Prescribed Wells Area

Is the proposed program located within a prescribed water resource area?

No

Select the prescribed water resource areas

Provide any additional information

The planned Birksgate drillholes lie within the Far North Prescribed Wells area, however previous drilling in this area has encountered relatively shallow Willyama Supergroup rocks with no Great Artesian Basin (GAB) aquifer formations present. Therefore, drilling methodologies like that at other prospects to the south will be employed (refer to Appendix 1).

Attach Files

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File Name	File Size (Mb)	Created On	Download
Appendix 1 Tech Memo Central Curnamona Metal Prospects Hydro_FINAL.pdf	3.82 Mb	27-03-2026 13:59:33	Download (MERS/EPR-04096/Ground water/Appendix 1 Tech Memo Central Curnamona Metal Prospects Hydro_FINAL_2026-03-27T03-29-33.606Z.pdf)
EPEPR2024-015_Maps 11-12.pdf	0.46 Mb	27-03-2026 13:58:23	Download (MERS/EPR-04096/Ground water/EPEPR2024-015_Maps 11-12_2026-03-27T03-28-23.832Z.pdf)

Native Vegetation

Will you be working within areas of native vegetation?

Yes

Provide the following information:

Northern Area – Benagerie (Birksgate and Eurinilla)

The regional vegetation is dominated by saltbush, bluebush and bindii, with sparse scattered patches of turpentine bush and sheoaks or black oaks on the sandy dunes.

Given the very close proximity between the proposed drilling areas and the Portia Mine site, flora surveys conducted for the mining PEPR are easily translatable to the current proposed drilling prospects. To complement these surveys, searches of both the State and Australian threatened species databases were made.

This area lies within the Broken Hill Complex Bioregion (Neagle, 2003) and consists mainly of sandy-clay plains with low shrubland vegetation (Playfair and Robinson, 1997). The Benagerie Dome area is located within the North Olary Plains region. Two vegetation surveys covering the Portia gold deposit, which is near the proposed drilling areas, on Mulyungarie Station were conducted under a South Australian Department for Environment and Heritage Permit to Undertake Scientific Research No. G24191 8 held by Dr F.J. Badman. The first survey formed part of an official DEH biological survey, designated “Number 577, Oban – Curnamona Energy”. The second survey also undertaken by Badman Environmental occurred during the second week of October 2007 and is complementary to the earlier survey in June 2007. The two surveys occurred under very different environmental conditions with the first survey after a period of rainfall when conditions were wet and the second when conditions were dry, and all ephemeral species had dried off. Data from the two surveys have been combined. Vegetation of the Portia survey area fell within five groups. A brief description of the vegetation groups is summarised below.

Group 1

This is the most common vegetation type in the area. It consists of low open or sparse shrublands dominated by Maireana astrotricha on sandy-loam soils. Maireana aphylla (Cotton-bush) occurs at most sites in this group and Atriplex vesicaria was recorded at a majority of sites. Gunniopsis quadrifida (Sturt’s Pigface) is common at some sites. At the time of the 2007 survey, the understorey was dominated by Atriplex holocarpa (Pop Saltbush) and Sclerolaena ventricosa (Salt Bindyi).

No other species were dominant in this group and very few tall shrubs and no trees were recorded here. Other species that were often recorded in the understorey include Austrostipa nitida (Balcarra Spear-grass), Dissocarpus biflorus (Two-horn Saltbush), Gnephosis arachnoidea (Spidery Button-flower), Salsola kali (Buckbush), Sclerolaena decurrens (Green Bindyi), Sclerolaena intricata (Tangled Bindyi) and Tripogon loliiformis (Five-minute Grass).

Only four introduced species were recorded in this group. The most common of these were Carrichtera annua (Ward’s Weed) and Schismus barbatus (Arabian Grass). Other alien species recorded here are Brassica tournefortii (Wild Turnip) and Sonchus oleraceus (Common Sow- thistle), neither of which was very common.

Group 2

Group 2 vegetation includes sites that are like those in Group 1, but generally support more trees or tall shrubs. This group was found to occur on sandy or sandy-loam soils, with the upper storey including some or all of Acacia aneura (Mulga), Dodonaea viscosa ssp. angustissima (Narrow-leaf Hop-bush), Hakea leucoptera (Silver Needlewood) and Senna artemisioides ssp. petiolaris (Senna). The understorey includes the low shrubs Gunniopsis quadrifida, Maireana astrotricha and Rhagodia spinescens (Spiny Saltbush) and the herbs and forbs Atriplex holocarpa, Atriplex limbata (Fan Saltbush), Salsola kali, Sclerolaena decurrens and Sclerolaena diacantha (Grey Bindyi). Less common species include Atriplex velutinella (Sandhill Saltbush), Austrostipa nitida, Enchylaena tomentosa (Ruby Saltbush) and Tripogon loliiformis. Schismus barbatus was the most recorded alien species in this group, with Brassica tournefortii also recorded here.

Group 3

Although only one site was sampled in this group, it is typical of the numerous cane-grass swamps and claypans that occur throughout the survey area. These have a clay base and hold water for varying periods following significant rainfall events.

The dominant species is the hummock grass Eragrostis australasica (Cane-grass). The shrubs Chenopodium nitrariaceum (Nitre Goosefoot), Muehlenbeckia florulenta (Lignum) and Rhagodia

spinescens are slightly less common. Dodonaea viscosa ssp. angustissima also occurs here in the upper storey.
The understorey is made up mainly of short-lived species with a few biennials, and includes Atriplex holocarpa, Atriplex spongiosa, Bulbine sp. (Bulbine Lily), Osteocarpum sp. (Bonefruit), Sclerolaena brachyptera (Short-wing Bindyi), Sclerolaena ventricosa and Zygophyllum iodocarpum (Violet Twinleaf). Eragrostis setifolia (Bristly Love-grass) occurs near the margins of swamps. Some swamps are fringed by a narrow band of Eucalyptus largiflorens (River Box).
Three introduced species were recorded in this vegetation group, Brassica tournefortii, Schismus barbatus and Carrichtera annua. The first two of these prefer sandy soils and were recorded only on the sandy margins of the swamps.
Group 4
This group contains areas of Casuarina pauper (Black Oak) woodland that occur on clay-loam soils just to the east of the central part of the survey area. Casuarina pauper dominates the overstorey, but Alectryon oleifolius (Bullock Bush) also occurs here. The understorey commonly includes the low shrubs Maireana aphylla and Maireana pyramidata (Black Bluebush), with Gunniopsis quadrifida and Atriplex vesicaria being less common. Other understorey species include Einadia nutans (Climbing Saltbush), Enchylaena tomentosa, Eremophila glabra (Tar Bush), Rhagodia spinescens, Sclerolaena decurrens, Sclerolaena obliquicuspis, Tetragonia eremaea (Desert Spinach), Tripogon loliiformis and Zygophyllum iodocarpum. No introduced species were recorded at the site that forms the basis for the description of vegetation in this group.
Group 5
The final group contains sites on very low sand dunes and sandplain just to the west of centre of the survey area. Vegetation comprises low open shrubland or tall shrubland with a low shrubland understorey. Tall shrublands include Dodonaea viscosa ssp. angustissima or Eremophila sturtii (Turpentine Bush), while low shrublands include Atriplex vesicaria, Gunniopsis quadrifida, Maireana astrotricha and Sclerolaena decurrens. Other groundcover species include Atriplex limbata, Erodium sp (p)(Heron’s Bill), Sclerolaena diacantha/uniflora and Tetragonia eremaea. No introduced species were recorded within this group.

Southern Area – Kalkaroo (Johnson Dam)
The Kalkaroo project has typical low shrubland vegetation consisting of sparse saltbush or bluebush, with very minor patches of acacia scrub and minor sheoak/black oaks. The area is one of disturbed vegetation with a long history of heavy grazing by native and domestic herbivores, combined with past drought conditions. Badman (2008) assessed the Kalkaroo Project area as falling into the category of “Native vegetation with some disturbance” based on the following criteria:
• The vegetation structure has been altered.
• Most seed sources are available to regenerate the original structure
• Obvious signs of disturbance
• Minor clearing of native vegetation (<10 % of the area cleared by grazing)
• Evidence of some grazing

Vegetation Group 1 (dominant group): Low Shrubland and Herbland Species include:
• Maireana astrotricha, Maireana aphylla (Cotton-bush)
• Atriplex vesicaria (Bladder Saltbush)
• Rhagodia spinescens (Spiny Saltbush)
• Atriplex holocarpa (Pop Saltbush)
• Dissocarpus biflorus (Two-horn Saltbush)
• Pycnosorus pleiocephalus (Soft Billy-buttons)
• Sclerolaena ventricosa (Salt Bindyi)

Vegetation Group 2 (less common): Contains less low shrub and has lower species richness Species include:

• Atriplex lindleyi (Lindley's Saltbush)
• Sclerolaena divaricate (Tangled Copperburr)
• Carrichtera annua (Ward's Weed)
• Dissocarpus paradoxus (Ball Bindyi)

Vegetation Group 3 (along watercourses): quite diverse because it contains sites along creeks with a larger variety of Species include:
• Eucalyptus camaldulensis (River Red Gum)
• Acacia victoriae (Elegant Wattle)
• Maireana brevifolia (Short-leaf Bluebush)
• Atriplex holocarpa (Pop Saltbush)
• Dissocarpus paradoxus (Hard-headed Saltbush)
• Goodenia glauca (Pale Goodenia)
• Pycnosorus pleiocephalus (Soft Billy-buttons)
• Sclerolaena diacantha (Grey Bindyi)
• Sclerolaena ventricose (Salt Copperburr)
• Tetragonia eremaea (Desert Spinach)

Vegetation Group 4 (dominated by Acacia carneorum (Purple-wood Wattle)): area of low species richness outside the drilling area Species include:
- Acacia carneorum (Purple-wood Wattle)
- Acacia carneorum (Needle Wattle)
- Enchylaena tomentose (Barrier Saltbush)
- Gunniopsis quadrifida (Sturt's Pigface)
- Maireana astrotricha (Low Bluebush)
- Rhagodia spinescens (Spiny Saltbush)
- Atriplex holocarpa (Pop Saltbush)
- Atriplex limbata (Spreading Saltbush)
- Sclerolaena decurrens (Green Bindyi)
- Sclerolaena ventricose (Salt Copperburr)
- Tetragonia tetragonioides (New Zealand Spinach)

Significant Flora
A search for information on threatened species indicated that there are no flora species listed as threatened under either the Commonwealth EPBC Act 1999 or the South Australian National Parks and Wildlife Act 1972. The Acacia carneorum (Purple-wood Wattle or Needle Wattle) however is listed as vulnerable. There are no known sightings of Acacia carneorum (Purple-wood Wattle or Needle Wattle) within the vicinity of any of the proposed drilling prospects. Havilah field personnel are supplied with Fact Sheets to assist with the recognition of Threatened Flora.

Indicate why you will not be working within areas of native vegetation?

—

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Fauna

Describe the native and feral fauna that may be present in the application area, including feral species.

Northern Area – Benagerie (Birksgate and Eurinilla)
Given the very close proximity between the proposed drilling and the Portia Mine site, fauna surveys conducted for the mining PEPR are easily translatable to the current proposed drilling prospects. To complement these surveys searches of both the State and Australian threatened species databases were made.
The arid zone region (both generally and in this region) is species-poor for most groups and many of the populations of arid zone mammal and bird species have been and are threatened by anthropogenic influences, especially the impacts of pest plants and animals. A few of the larger species, such as kangaroo (two species), euro and emu, and some of the medium sized bird species, have benefited by the introduction of permanent water points.

Birds:
Seasonal conditions, primarily rainfall and its season of occurrence, have a major influence on the presence of most avifauna species. The KBR survey of 2011, undertaken after exceptional winter and summer rainfall, indicated that avifauna diversity was moderate with a total of 48 bird species recorded at the Portia site and nearby areas during the study period. In general, most of the avifauna recorded was in woodland areas (black oak and mulga) which are not present in the drilling area. However, many birds of prey from the Accipitridae (hawks and eagles) and Falconidae (falcons) were recorded.
Two species observed at the site and in adjacent areas, Elanus scriptus (letter-winged kite) and Lophoictinia isura (Square-tailed kite), have a State conservation status of Rare and Endangered respectively. Falco hypoleucus (Grey falcon) is also listed as Rare in South Australia (NPW Act). Grey falcon was observed well south of the site. Also recorded were the Aquila audax (Wedge-tailed eagle), the Emblema pictum (Painted finch) and the Turnix velox (Little Button-quail) which are species of interest for the wider region but are not of listed conservation significance.
Pedionomus torquatus (Plains-wanderer) was not recorded at any of the surveyed sites and marginal habitat is present here for it.
Feral species: Passer domesticus (House sparrow) was observed.
Mammals:
There is, apparently, a low frequency and diversity of small terrestrial mammals recorded for the wider region with larger mammals (kangaroo species) and introduced and pest species dominating records. The KBR fauna survey in March 2011 was undertaken after exceptional winter and summer rainfall i.e., under ideal conditions for the occurrence of mammals. Macropus rufus (Red kangaroos) were observed on numerous occasions in the general area and were not specific to any site or habitat type. Macropus fuliginosus (Western grey kangaroos) were also observed but they were not as abundant as red kangaroos.
Small native mammal species observed included: Pseudomys bolami (Bolam’s Mouse), Notomys fuscus (Dusky Hopping-mouse), Pseudomys hermannsburgensis (Sandy Inland mouse), Sminthopsis macroura (Stripe-faced dunnart) and Leggadina forresti (Forrest's mouse).
Feral species: The majority of the commonly observed feral species were the house mouse, which was present in plague numbers. Domestic sheep and cattle are still present within areas adjacent to the drilling prospects, as are introduced species such as European red fox, feral cat, dingo, and dingo-dog hybrid which are known to occur in the wider region. More recently feral pig and goats have been observed.
Reptiles:
The KBR survey (2011) indicates that reptile diversity is low given the range of habitat types present at the site and the surrounding areas. Six reptile species had been identified to occur within areas adjacent to the drilling prospects. These include: Ctenotus schomburgkii (Sandplain Ctenotus), Pogona vitticeps (Central Bearded Dragon), Ctenophorus nuchalis (Central Netted Dragon), Nephrurus levis (Knob-tailed gecko), Lucasium damaeum (Beaded gecko) and Diplodactylus tessellatus (Tessellated gecko).
Varanus gouldii (Gould’s goanna) tracks and scats were present in all habitat types at the site and one individual was caught in a patch of black oak.
Havilah field personnel are supplied with Fact Sheets to assist with the recognition of Threatened

Fauna.
Southern Area – Kalkaroo (Johnson Dam) Birds:
A total of 40 bird species were recorded in the region during the survey. Most species were recorded in small numbers only.
Feral Species: Passer domesticus (House sparrow), and Sturnus vulgaris (Common starling).

Mammals:
Kellogg Brown & Root (2009) survey of the area noted that the diversity of mammal species was low. The following species were observed:
- Macropus rufus (Red Kangaroo) – dominant macropod
- Macropus fuliginosus (Western grey kangaroo)
- Dingo and Dingo-dog hybrids (scats observed)
- Sminthopsis macroura (Stripe-faced dunnart)
- Planigale tenuirostris (Narrow-nosed planigale)
- Sminthopsis crassicaudata (Fat-tailed dunnart)

Feral Species: European rabbit, Felis catus (Feral cat), Vulpes vulpes (European red fox), Mus musculus (House mouse), and Sus scrofa (Feral pig).

Reptiles:
A total of 7 reptiles (KBR, 2009) were observed in the proposed drilling area as listed:
- Tympanocryptis tetraporophora (Four-pored dragon)
- Tiliqua rugose (Sleepy lizard)
- Tympanocryptis lineata (Lined dragon)
- Lucasium byrnie (Gibber gecko)
- Lucasium damaeum (Beaded gecko)
- Nephrurus levis (Smooth knob-tailed gecko)
- Ctenotus robustus (Eastern striped skink) – most recorded lizard.
- Pseudonaja nuchalis (Western brown snake) – observed by Havilah personnel.
- Pseudechis australis (Mulga snake or King Brown snake) – observed by Havilah personnel.

Significant Habitats, Flora & Fauna

Are there any significant habitats, flora and fauna within the project area?

Yes

Use the table below to list any significant habitats and any rare or endangered flora and fauna species located or reported to have been in the area that may be impacted by the proposed program. Include known sightings of listed species on a locality plan/map.

Species name/habitat	Common name	NPW Act Rating	EBPC Act Rating
Acacia carneorum	Purple-wood Wattle (Needle Wattle)	Vulnerable (VU)	Vulnerable
Swainsona procumbens	Broughton Pea	Vulnerable (VU)	Conservation dependent
Pedionomus torquatus	Plains-wanderer	Endangered (EN)	Critically endangered
Elanus scriptus	Letter-winged Kite	Rare (RA)	Conservation dependent
Lophoictinia isura	Square-tailed Kite	Endangered (EN)	Conservation dependent
Falco hypoleucus Grey Falcon	Grey Falcon	Rare (RA)	Vulnerable
Notomys fuscus	Dusky Hopping-mouse	Vulnerable (VU)	Vulnerable

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Weeds and Pathogens

Provide information of the extent the area is affected or potentially affected by weeds and pathogens (e.g. phytophthora; buffel grass Cenchrus ciliaris).

The proposed drill areas are in the Buffel Grass Management Zone 2 (Contain Spread) however there are no known occurrences of Buffel Grass within the project area. Should an area of Buffel Grass infestation be encountered during the drilling program, cleaning procedures will be implemented when leaving the area of infestation and the area avoided.
The vegetation surveys surrounding drilling within the north found a low incidence of alien species which appears to be due to the lack of gullies and creeks flowing through the area. The most common introduced species recorded during the surveys were Carrichtera annua (Ward's weed) and Schismus barbatus (Arabian Grass). Other declared plants and high priority weeds recorded within the region are: Marrubium vulgare (Horehound), Xanthium spinosum (Bathurst burr) and Xanthium strumarium sp. agg (Noogoora burr), all declared plants under the NRM Act and Carthamus lanatus (Saffron thistle), Cucumis myriocarpus (Prickly paddy melon) and Sisymbrium erysimoides (Smooth mustard), all high priority weeds. Havilah field personnel are supplied with Fact Sheets to assist with the recognition of introduced weeds.
In the south Badman (2008) recognised twenty introduced species of which two Echium plantagineum (Salvation Jane) and Lycium ferocissimum (African Boxthorn) are Proclaimed Species, as listed by APCC (2004). The introduced species recorded during the October 2007 survey represent 16% of the total species list for this survey.

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Aboriginal Heritage

Describe the steps taken to identify Aboriginal heritage sites within the proposed area of exploration. Include a statement advising if an Aboriginal heritage survey has been conducted by the proponent and if so, the results of the survey.

Heritage surveys with the relevant Native Title claimant groups will be completed before drilling occurs.

Environmentally Sensitive Locations

Indicate if you are intending to undertake exploration operations within the environmentally sensitive locations listed.

No

Name	Applicable
There are no records to display.	

Are you likely to impact on the environmentally sensitive area?

—

Detail the likely effects the proposed program may have.

—

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Exploration Operations

Equipment and Personnel requirements

Using the table below, describe the maximum composition of field crews (operator, contractors, and geologists) and proposed working hours/days for each type of activity.

Type of Personnel	Number	Name of contractor company (if applicable)
Geologists	2	Havilah personnel or contractors
Land access/environmental	1	Havilah Environmental Manager
Field assistants/technicians	2	Havilah personnel or contractors
Drilling Crew	3	Certified contractor
Site Preparation and rehabilitation	2	Havilah personnel or contractors

Shifts worked per day	Hours worked per day	Days worked per week
1	12	7

Using the table below, describe the equipment (size, number and contractor details) required to conduct the proposed operations.

Name	Owner/Operator	Description/capacity	Activity/purpose
Multi-purpose drill rig (RC and DD capable)	Drilling Contractor (TBD)	UDR 1000	Drilling
Compressor/Rod Truck	Drilling Contractor (TBD)	1 x 8-wheel flat bed	Auxiliary Drilling Support
Water Truck	Drilling Contractor (TBD)	1 x 8-wheel 20,000L	Auxiliary Drilling Support
Backhoe	Havilah or Certified Contractor (TBD)	CAT Backhoe or equivalent	Site prep/sump construction/rehab
4WD light Vehicles	avilah and other contractors	2, Hilux dual cab or similar	Site access for field crew/maintenance
Loader	Havilah or Certified Contractor (TBD)	one	Site preparation, track maintenance and rehabilitation

Low impact exploration activities

Will low impact exploration operations be conducted that are not covered by the Generic program for environment protection and rehabilitation – low impact mineral exploration in South Australia, (generic PEPR)?

No

Describe each type of low impact operations proposed.

—

Drilling Operations

Will exploration drilling Operations be conducted?

Yes

Fill out the below table

Tenement	Drilling Types	Maximum number of drillholes	Maximum drillhole depth (m)	Number of drill pads	Maximum number of sumps required at each site	Maximum size of sumps (lenght x depth x width)	Average size of each drill pad	Number of sites requiring pad excavation	Average volume of material to be excavated
EL 5873	Reverse Circulation	39	400.00	39	1	30.00	900.00	0	0.00
EL 6415	Reverse Circulation	10	400.00	10	1	30.00	900.00	0	0.00
EL 6660	Reverse Circulation	10	400.00	10	1	30.00	900.00	0	0.00
EL 6659	Reverse Circulation	19	400.00	19	1	30.00	900.00	0	0.00

Other Drilling Method(s)

—

Drillsite preparation

If exploration drilling activities are proposed, describe the methods used to prepare sites, including vegetation clearance requirements, site levelling and digging of sumps.

• Drill sites are located on existing tracks or open areas to minimise ground and vegetation disturbance, wherever possible.
• Vehicles to be restricted to existing/cleared overland access routes and the cleared drill pad, to minimise ground and vegetation disturbance.
• Ground cover clearing or minor levelling is normally done by hand (rakes & shovels)
• Drilling will be restricted to flat areas between dunes (dune swales) to avoid cut and fill pads or drilling on dune crests to the extent possible. Some access may be required across dune crests to reach drill sites, although this will be avoided as far as possible.
• Clearing will always be of a minimal nature to reduce environmental impact and lessen the requirement for extensive rehabilitation.
• All sumps are to have a ramp, to enable animals to escape, should they happen to fall in.
• Sumps will be fenced if stock are at risk, and they may be bunted for safety.
• Topsoil and subsoil dug up is stockpiled separately.
• 30 m x 30 m (900 m2) for RC and 40 m x 40 m (1,600 m2).

Drillhole construction and decommissioning

Drillhole construction and decommissioning

Drillhole construction and decommissioning explained below.

Have the personnel responsible for implementing the proposed program read and understood the Earth Resources Information Sheet M21, Mineral exploration drillholes – general specifications for construction and backfilling?

Yes

Describe how drillholes will be constructed, including the casing material to be used, depth of casing, if the casing will be cemented, cementing intervals and the class of driller that will install the casing.

Reverse circulation holes will be pre-collared using either a 9” blade bit or hammer into the plastic Namba clay to a depth of between 24 to 36m (depending on depth of unconsolidated cover) and cased with 6” (150mm) Class 9 PVC. The casing is pushed into the clay, grouted at the base with cement or gypset, then cemented in with polyurethane foam (Sifoam) down the outside of the casing. The hole is then drilled to depth using a ~5 1/2” hammer.

When describing drillhole decommissioning requirements, include the materials to be used, stratigraphic intervals where cement plugs will be placed, if the casing will be removed and when decommissioning will occur after drilling is completed.

Havilah's updated groundwater and strata properties interpretation (Appendix 1 attached):
• Groundwater in the Namba Formation and underlying basement rocks form one continuous low permeability unconfined aquifer as opposed to groundwater in the basement rocks being confined by Namba Formation sediments where the regional water table is above the basement. This updated understanding of groundwater conditions is based on over 20 years of exploration drilling in the region and review and re-interpretation of detailed groundwater studies completed for Portia Gold Mine and Kalkaroo Copper Gold Mining Lease.
• The physical properties of Namba Formation clay strata (see attached Technical Memorandum) result in unsupported drillholes becoming sealed by swelling clays thus restoring the controlling geological conditions before the hole was drilled. Potential for downward migration of contaminants or water from surface or potential near surface ephemeral water tables to the single low permeability unconfined aquifer is prevented and the regional water table will remain unaffected.

Havilah acknowledges this interpretation is at variance to prevailing characterisation of hydrogeological conditions in this area, but it is supported by Havilah's drilling information to date. To further support this interpretation proposed drillhole decommissioning will include collection of additional data during exploration drilling. Should this additional data suggest differing strata properties and groundwater conditions to those observed to date then alternative decommissioning methods are included to ensure compliance with M21 (Table attached below).

• A regional groundwater sampling program is being implemented to characterise water chemistry in different formations, in particular saturated strata in basement and overlying Eyre Clay and /or Namba Formation where these form one continuous low permeability saturated zone. Currently (May 2026) the search continues for groundwater wells screened in these formations and accessible for sampling. The sampling and analysis will include:
o Identify existing registered groundwater wells / bores or open vertical exploration drillholes screened or open in either basement or Namba Formation / Eyre Clay water bearing zones.
o Using drilling or well construction data, the downhole interval open to water-bearing strata will be identified using well construction or drilling logs for the hole.
o Measure groundwater SWL with a Water Level Meter before sampling.
o Discrete groundwater samples will be collected using a passive, no-purge methodology (such as HydraSleeve water samplers) from the undisturbed water column within the screened or open hole section of the bore / exploration drill hole.
o Groundwater discharged during exploration drilling will be sampled, where possible, from drill holes where sustained groundwater discharge occurs at the outflow from the drill collar. Samples will be collected directly into laboratory prepared containers.
o Groundwater samples will be transferred from the sample collection device to laboratory prepared containers at the well / drill hole location. Containers will be labelled and stored in a laboratory provided cooler suitable for transport.
o NATA certified laboratory analysis will be by Australian Laboratory Services and include:
- EC
- pH
- Major Anions
- Major Cations
o All methods, results, and interpretation will be documented in the compliance report.
On prospects where saturated Namba Formation strata are intersected, a drill site will be selected at random to repeat the Namba Self Sealing Test using the methods described in Appendix 2.

Proposed drillhole decommissioning if Additional Control Measures (above - Table attached) identify different conditions:
• Groundwater chemistry confirms the basement and overlying saturated Namba Formation are one continuous low permeability unconfined aquifer:

o Backfill the drillhole to the extent practicable with drill cuttings.
o Cut the PVC collar 50 cm below surface and cap, then bury with topsoil and restore surface ground conditions consistent with surroundings.
• Namba Formation and basement groundwater chemistry indicates they are different aquifers:
o Plug the drillhole at the basement – Namba interface.
o Grout back to a minimum of 15 m into the Namba Formation as per M21 guidelines.
o Cut the PVC collar 50 cm below surface and cap, then bury with topsoil and restore surface ground conditions consistent with surroundings.
• No groundwater encountered in RC drill hole:
o Backfill the drillhole to the extent practicable with drill cuttings.
o Cut the PVC collar (through surficial sediments to top of Namba Formation strata) 50 cm below surface and cap, then bury with topsoil and restore surface ground conditions consistent with surroundings.

Attach Files

Expand/Collapse

File Name	File Size (Mb)	Created On	Download
Appendix 1 Tech Memo Central Curnamona Metal Prospects Hydro_FINAL.pdf	3.82 Mb	27-03-2026 14:03:01	Download (MERS/EPR-04096/Drillhole construction and decommissioning/Appendix 1 Tech Memo Central Curnamona Metal Prospects Hydro_FINAL_2026-03-27T03-33-01.789Z.pdf)

File Name	File Size (Mb)	Created On	Download
Appendix 2 Tech Memo Namba Fmn Strata Self-Sealing Test Report Update.pdf	1.64 Mb	27-03-2026 14:03:04	Download (MERS/EPR-04096/Drillhole construction and decommissioning/Appendix 2 Tech Memo Namba Fmn Strata Self-Sealing Test Report Update_2026-03-27T03-33-04.939Z.pdf)
Drillhole Construction_Additional Information.pdf	0.09 Mb	27-03-2026 13:16:40	Download (MERS/EPR-04096/Drillhole construction and decommissioning/Drillhole Construction_Additional Information_2026-03-27T02-46-41.477Z.pdf)

Costeans and bulk sample disposal pits

Will costeans/bulk sample disposal pits be required for the proposed program?

Yes

Tenement	Number of costeans/pits	Size of costean (length x width) (m2)	Average depth (m)	Volume excavated (m3)	Total Volume Excavated (m3)	Total area of disturbance
EL 5873	38	3.0	2.0	6.00	228.0	114.0
EL 6415	10	3.0	2.0	6.00	60.0	30.0
EL 6660	10	3.0	2.0	6.00	60.0	30.0
EL 6659	21	3.0	2.0	6.00	126.0	63.0

Describe site preparation methods, vegetation clearance, and safety and maintenance requirements

• Clearing will always be of a minimal nature to reduce environmental impact and lessen the requirement for extensive rehabilitation.
• All sumps are to have a ramp, to enable animals to escape, should they happen to fall in.
• Sumps will be fenced if stock are at risk, and they will be bunted for safety.
• Topsoil and subsoil are stockpiled separately to cap the disturbed area.

Sample management

Describe the size of samples collected (including drilling samples and bulk sampling), collection methods, materials used when collecting the sample, sample disposal methods (including removal of sample bags), safety management and any other sample management requirements at the exploration site (e.g. tarps or matting used to contain cuttings). Include requirements for on-site geological sample management (splitting of archive samples, bag farms, core processing and storage).

• A small area (5 m x 15 m) within each site will be reserved for samples.
• Drill samples are collected through a cyclone/dust suppression unit with attached cone or riffle splitter. Bulk sample reject is collected in 20-30L buckets then laid out in rows on the ground adjacent to the drill rig. Assay samples are collected from the splitter in 10”x 14” calico bags which are put in polyweave sacks (gen 5 per sack), for transport to the assay lab.
• Bulk sample reject weights vary between ~15 to 40 kg, and assay samples from ~1 to 3 kg, depending on the nature of the material being drilled and sample quality coming to surface.
• Large plastic bags (900 x 600mm) are being phased out for the bulk sample reject where possible, for environmental reasons and the difficulty in handling and disposing of them (Note: photos on page 29 and 31 representative of previous drilling campaigns that used bags).
• A geologist will sieve and log each sample and collect representative cuttings in 20 compartment plastic chip trays.
• The RC samples will be retained at each site until all assaying and any resampling has been completed, at which time the material will be disposed of into the sumps or pit dug at each site.
• If practical RC samples of the cover sequence will be disposed of firstly down the drill hole and then in either a small trench or the sump during the partial rehab of the site, shortly after drilling has been completed.
• There will be no need to store bulk sample or samples in a pit or bag farm. No sample material will remain on the surface. All rubbish will be removed and disposed of appropriately.
• Diamond core will be removed and processed offsite at Havilah’s Kalkaroo Camp.
• All drilling, sampling and rehabilitation activities will be conducted under company safety and environmental protocols, to minimise risks to personnel, wildlife and the environment that might be associated with sumps, pits, sampling, and rehabilitation.

Access routes to work areas

Will existing tracks require upgrading and/or maintenance?

No

Detail the work required to upgrade/maintain existing tracks.

Existing tracks will not require upgrading but they will be maintained and any damage or deterioration due to Havilah’s activities will be remedied, using our grader or backhoe.

Will access be required across adjoining tenements?

No

Detail the method(s) for gaining access, and if an agreement is in place with all stakeholders. Include the total area of disturbance required (i.e. length (km) and width (m) of tracks) and provide on a locality map.

N/A

Will access off existing tracks be required?

Yes

Detail the method(s) for gaining access and if vegetation clearance is required. Details of the total area of disturbance (includes drill traverses and seismic lines) required off existing tracks (i.e. length (km) and width (m) of new tracks) must be provided in the program notification.

Much of the area within the included tenements is flat and sandy and the vegetation consists of bluebush and saltbush, with very minor
patches of acacia shrubs and rare sheoak or black oak, allowing for most track access to drilling sites to be across country with no construction or earthworks required. Several strategies to minimise impacts of creating new overland access routes (vehicle movement or equipment used) include:

- The most direct and clearest route to the site will be taken to minimise impact to the environment.
- All larger vegetation and trees will be avoided.
- Access route will be checked and marked out (LV or on foot, during heritage surveys).
- Backhoe raised bucket (blade ~0.3m above ground) may be used in very rare instances where the terrain is too rough. This method minimises disturbance to rootstock and topsoil.
- Natural drainage lines will not be blocked.
- Creating windrows avoided.
- Use interdune corridors for access as much as possible to avoid traversing over dune crest.
- Dune crossing locations will be selected across low-dunes and at right angles, and to minimise impact on soil and vegetation.

Maximum new access/drill line track required for each tenement is shown below (Maps 1-9)*:

- EL5873: ~9 km x 3 m
- EL6415: ~10 km x 3 m
- EL6659: ~7.2 km x 3 m
- EL6660: ~3.8 km x 3 m

*Note that nearly all this access and drill line track is for one-off or single pass access for the drilling rig and LVs and has no prior backhoe or grader clearance. Disturbance is minimal and normally no backhoe rehabilitation is required (and is avoided except in rare circumstances as it would result in more disturbance than the vehicle access).

Attach Files

Expand/Collapse

File Name	File Size (Mb)	Created On	Download
Brooks Dam Proposed Drilling.jpg	1.1 Mb	14-05-2026 15:34:05	Download (MERS/EPR-04096/Access routes to work areas/Brooks Dam Proposed Drilling_2026-05-14T06-04-06.972Z.jpg)
EPEPR2024-015_Maps 1-9.pdf	1.68 Mb	27-03-2026 13:26:32	Download (MERS/EPR-04096/Access routes to work areas/EPEPR2024-015_Maps 1-9_2026-03-27T02-56-33.728Z.pdf)

Campsites and equipment laydown areas

Indicate where staff and contractors will be accommodated during the exploration program.

Staff and contractors will be accommodated at the existing Portia Mine Site camp or Kalkaroo Station quarters during the exploration program.

What is the maximum number of personnel requiring accommodation?

10

Is a campsite required to be established?

No

Provide a description and justification of the camp location (e.g. previously cleared areas etc.), and any other relevant information.

—

What will be the total area (ha) of the campsite(s)?

—

Will native vegetation clearance be required?

—

What will be the total area (ha) of vegetation clearance for the campsite?

0.00

Describe the methods used to prepare the campsite includuing vegetation requirements and site levelling.

N/A

Will any excavations be required?

—

Describe the purpose of the excavation

N/A

Describe the maximum volume (m3) of material to be excavated.

0.00

Provide confirmation that the proposed ablution facilities have been endorsed for use by the Department of Health or local council, where applicable.

—

Indicate why endorsement approval is not required by the Department of Health or local council.

N/A

Proposed infrastructure (includes caravans, tents, offices, hydrocarbon and water storage requirements etc)

Proposed infrastructure	Quantity	Description / capacity
N/A	0	No Infrastructure Required.

Will laydown areas be required?

No

Will the laydown area(s) be located at the same location as the campsite?

Yes

Provide a description and justification of the location (e.g. previously cleared areas), and any other relevant information if required.

N/A

What will be the maximum area (ha) required for the laydown area(s)?

0.00

Will native vegetation clearance be required?

No

What will be the total area (ha) of vegetation clearance for the site?

—

Describe the methods used to prepare the laydown area includuing vegetation requirements and site levelling.

—

Will any excavations be required?

—

Describe the purpose of the excavation.

—

What will be the volume (m3) of material to be excavated.

—

Proposed infrastructure (includes hydrocarbon and water storage requirements)

Proposed infrastructure	Quantity	Description / capacity
N/A	0	No Infrastructure Required.

Attach Files

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File Name	File Size (Mb)	Created On	Download
No Files Uploaded			

Other exploration methods and/or ancillary operations

Are any other proposed exploration methods (e.g. seismic) and/or ancillary exploration operations required?

No

Describe the activity(s), site preparation, vegetation clearance, and safety and maintenance requirements.

N/A

Water supply and management

Will camp and/or drilling water be required?

Yes

Describe how and where water will be sourced for drilling, track maintenance and camping purposes (e.g. groundwater, surface water, mains). Indicate how wastewater and/or runoff water will be managed.

For RC drilling, minor drilling water (<500 L / day) is usually brought in from existing dam water supplies at the Kalkaroo camp site.
For DD Drilling, water will be obtained from local dams on Kalkaroo station (owned by Havilah). The water will be piped directly to the drill site from the laydown water tanks or transported directly to the drill site via water truck and will be retained in the sumps and circulation by appropriate bunding. There will be no wastewater or runoff from the site.

Will surface water and/or mineral drillholes be used as a water source/supply?

No

Indicate if a licence for water extraction/usage is required (refer to relevant Natural Resources Management water allocation plan available on the Department for Environment and Water (DEW) website.

No

Attach a copy of the licence or include a statement confirming that a licence will be obtained before the extraction and/or usage of water.

N/A

Groundwater investigation and water affecting activities

Will any water investigation (e.g. pump testing, water monitoring sites, water storage, turkey nests/dams) and/or water affecting activities, be undertaken (refer to s. 127 of the Landscape South Australia Act 2019)?

No

Describe the water investigation and/or water affecting activities, including site preparation, vegetation clearance, and safety and maintenance requirements.

N/A

Indicate if water affecting activities permits (eg well and water extraction/discharge permits) have been obtained and in accordance with the Landscape South Australia Act 2019.

No

Attached Files

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File Name	File Size (Mb)	Created On	Download
No Files Uploaded			

Management of hazardous materials

Will activities be conducted in areas of known uranium and thorium mineralisation?

No

Attach Files

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File Name	File Size (Mb)	Created On	Download
No Files Uploaded			

Will any other hazardous material be encountered when exploring in the area?

No

List the types of hazardous materials and provide a management plan on how these materials will be managed.

N/A

Rehabilitation

Detail all the activities and strategies relating to the remediation of all impacts associated with the proposed exploration operations (includes exploration camps and laydown areas, tracks). Completion of rehabilitation must be achieved within 3 months after the expiry of each program notification.

Staged Rehabilitation will be undertaken:
• Stage 1 to be completed shortly after drilling is completed:
o Drill hole decommissioning (as described above)
o Move drill spoil into sumps
o Raking or lightly scarify the drill site using a backhoe
o Remove all external waste material to an appropriate waste facility

• Stage 2 (final) rehabilitation will occur once assays are available, and remaining samples can be disposed of into the sump (usually within 2 months after drilling is completed):
o Sumps will be allowed to dry out before backfilling
o Sump rehabilitation – deposit remaining samples, backfill, cover with stockpiled topsoil, and rake or lightly scarify (to promote vegetation regeneration) with a backhoe
o Where no sumps are used, a short trench will be excavated (1m W x 3m L x 2m D) dug at the end of the sample rows and the samples buried and capped with the stockpiled topsoil
o Overland access routes will be raked or lightly scarified to promote regrowth of vegetation

• Rehabilitation will always aim to return areas disturbed by drilling activities to its original land surface profile and in a condition that will promote regrowth of native vegetation.
• Photo 7 shows an example of a rehabilitated area (EPEPR2024-015_Photos 1-7 attached).

Continuous rehabilitation (not leaving more that 20 drill sites un-rehabilitated at any time) during the drilling campaign is proposed.

State the estimated budget required to rehabilitate all impacted sitesState the estimated budget required to rehabilitate all impacted sites. Include a breakdown of the cost associated with each rehabilitation component

Notes:
• Not all planned drillholes shown on the maps may be drilled as completion of the total program is results dependent.
• Budget estimates are based on the time taken by Havilah to rehabilitate each drill site using its own backhoe and personnel:
backhoe rate plus operator $200 / hour including fuel and light vehicle. Based on experience 10 sites are rehabilitated per day on average for a 10-hour day = 1 site rehabilitated per hour = $200 / site. Drill sites are close together for each prospect so travel time between drill sites is minimal.

Stage 1 – drill hole decommissioning and drill site clean-up: 100 drill sites - $10,000.

Stage 2 (final) – Sump, sample, and overland access route rehabilitation: 100 drill sites and associated access routes - $10,000

Vegetation Clearance

Will any area of cleared native vegetation be unrehabilitated after the authorised period?

No

Provide a map and description of the vegetation present in the application area, the extent of any proposed vegetation clearance and the likelihood of the presence of threatened flora.

N/A

State the estimated quantum of significant environmental benefit (SEB) to be gained in exchange for the proposed native vegetation clearance and describe how the SEB will be provided.

N/A

System

Tenement Name ↑	Tenement Holder	Teneement Operators	Grant Date	Expiry Date	Tenement Type	Location Description	Tenement Area	Tenement Status	Shape Identifier
EL 5873	Havilah Resources Limited	Benagerie Gold & Copper Pty Ltd; Koba Resources Limited	13/10/2016	12/10/2027	Exploration Licence	Benagerie area approximately 90km north of Olary	585.00	Active	10008177-0000
EL 6415	Havilah Resources Limited		30/09/2019	29/09/2030	Exploration Licence	Eurinilla area approximately 100km north of Olary	70.00	Active	10011510-0000
EL 6659	Havilah Resources Limited		18/01/2021	17/01/2032	Exploration Licence	Mooleulooloo area approximately 60km north of Olary	958.00	Active	10013019-0001
EL 6660	Havilah Resources Limited	Koba Resources Limited	24/02/2021	23/02/2026	Exploration Licence	Mulyungarie area approximately 90km northeast of Olary	606.00	Active	10013037-0001

Management of Environmental Impacts

Applicable environmental aspects and potential impacts

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
Minor	Rare	Soil	Soil	Disturbance to the soil profile and topography, and accelerated soil erosion caused by exploration activities (e.g. construction of sumps, new tracks and drill pads; ground compaction at laydown areas and camps).	• A loader with raised blade will be used for preparation of drill sites and any track works to prevent permanent disturbance to topsoil profile or topography. • Rehabilitation of each site will be finalised by replacing topsoil and raking or lightly scarifying to promote seed germination and new vegetation growth. • Heavy vehicle		Where soil disturbance occurs as a result of exploration activities, ensure that: • topsoil quality and quantity is maintained • the soil profile and topography is reinstated to original conditions • there is no accelerated soil erosion.	Maintain before, during and after photographic evidence of all excavations, drillsites, camps, laydown areas and new tracks demonstrating that: • The soil profile and topography is reinstated to original conditions and is consistent with natural surroundings within 3 months of the expiry of the PEPR approval (for PEPRs approved for a period of 12 months), or 3 months after the expiry of a program notification (for PEPRs

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					overland access routes will be scarified. • The land surface will be returned to its original profile. • All sample material and spoil from the sumps will be backfilled into the sumps. • Topsoil from sumps will be stockpiled separately, spread back over the filled in sumps and lightly scarified to minimise wind and water erosion and			approved for an ongoing period), unless otherwise authorised. • Where required, sufficient topsoil is removed (depending on soil profile), stored separately from subsoil and reinstated (in the correct order) within 3 months of the expiry of the PEPR approval (for PEPRs approved for a period of 12 months), or 3 months after the expiry of a program notification (for PEPRs approved for an ongoing period), unless otherwise authorised. • There are no signs of accelerated soil erosion during and post

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					promote seed germination and plant regrowth. • If water does have to be carted for diamond drilling, truck movements will be kept to a minimum and access routes will be rehabilitated as described above. Tracks can be watered down if required. • Where possible, water will be carted to tanks located on existing station tracks and			rehabilitation of disturbed sites. Representative photos to be included within the annual exploration compliance report. Provide the information requested within the 'Rehabilitation' section of the annual exploration compliance report.</p>

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					piped from there to the drill site, to minimise track powdering and rutting.			

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
Minor	Unlikely	Stakeholders	Stakeholders	Interference to: • existing or permissible land use (includes loss of income, noise, dust, light and other emissions). • buildings, structures, existing tracks or other infrastructure. • aesthetic values of an area. Noncompliance with legislative requirements.	• Issue Form 21B – Notice of Entry on Land to: Native Title Claimants SANTS Station owners • Speed limits will be signposted and adhered to minimise dust disturbance and stock interference. • Station tracks will not be used after rain to ensure no damage is done to tracks. • Mining Native Title Agreements pursuant		Stakeholders are fully informed and satisfied with the proposed methods used to conduct exploration activities on their land, and all prescribed forms are served and agreements obtained in accordance with the Mining Act.	Provide the information requested within the ‘Complaints’ section of the annual exploration compliance report demonstrating that all reasonable complaints from stakeholders are resolved to the satisfaction of both parties prior to and ongoing during the course of exploration program, without the involvement of DEM. Provide the information requested within the ‘Landowner details and liaison’ section of the annual exploration

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					to Part 9B in place and registered with DEM. • Dog Fence Board.			compliance report demonstrating that prescribed forms were served and agreements obtained in accordance with the Mining Act prior to the commencement of exploration activities.</p>

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
Major	Unlikely	Fire	Community/landowners	Damage to infrastructure and loss of income through fire.	• No fires are lit during the summer months, and only at other times if there is a clear area surrounding and fire danger is minimal (e.g. lack of burnable material and no fire ban period) • Fire management procedures in place, including policy for “extreme fire danger rating”. • Firefighting equipment/ extinguisher are always available	High	No loss of infrastructure or income through fire as a result of exploration activities.	Provide a statement within the ‘Compliance with approved programs’ section of the annual exploration compliance report confirming that no uncontrolled fires* occurred. Alternatively, provide a report on the independent investigation of all uncontrolled fires* demonstrating that the licensee could not have reasonably prevented the fire through the implementation of precautionary measures.

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					. *Risk is high as with all controls			

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
Minor	Unlikely	General Public	General Public	Injury or death to members of the public as a result of exploration activities.	• Given the remote locality of the program, it is extremely unlikely for members of the public to access the drill site. However, the following mitigation measures will be employed: □ Restricting access to only Company personnel as far as possible, and only to others (e.g., Contractors) who have had induction. □	Low	No accidents involving the public that could have been reasonably prevented by the licensee.	Provide a statement within the 'Compliance with approved programs' section of the annual exploration compliance report confirming no accidents occurred involving the public during and after the exploration program. If an accident involving the public did occur, provide a copy of the independent investigation report within the annual exploration compliance report demonstrating that the licensee could not have reasonably prevented the accident

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					Enforcing best practice OHS measures. Appropriate danger signs erected. *Risk is high as with all controls in place, if an incident was to occur the outcome could be catastrophic.			through the implementation of precautionary measures. </p>

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
Minor	Unlikely	Native Vegetation	Flora and fauna and their habitats; includes Commonwealth and state scheduled species.	Loss/ modification of native vegetation and associated habitats through the clearance of vegetation.	• The placement of drill sites and access routes will be selected to avoid areas of substantial native vegetation. • All drill pads will be levelled using a loader with raised blade to stockpile topsoil for post drilling rehabilitation. • Drill sites and access routes are rehabilitated in such a way as to promote regrowth of native vegetation. • Vehicles are	Low	No permanent loss/modification of native flora and fauna populations and their habitats through: • clearance • fire • other unless prior approval under the relevant legislation is obtained.	Maintain before, during and after photographic evidence of all exploration sites (e.g. drillsites, new track exit/entry points off existing tracks, costeans, campsites) demonstrating that: • The area and method of disturbance is consistent with that described in the PEPR. • No uncontrolled fires* occurred as a result of exploration activities. Representative photos to be included within the annual exploration compliance report.

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					restricted to a single access track to minimise disturbance to native vegetation. • No fires are to be deliberately lit on any drill sites. • Firefighting equipment/ fire extinguisher will always be available. • Compliance with Fire Ban ratings, which is checked daily (CFS website), and a risk assessment of the prevailing conditions is complete			

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					d and communicated each morning. When CFS Fire rating is Low-Very High – work will continue, and conditions/risks will be monitored. If Fire rating is Severe – work will continue based on risk assessment if winds are low and the prevailing conditions are assessed as acceptable to continue work. Where Fire rating is Extreme-Catastrophic –			

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					work will cease, and crew will remain on standby until the fire rating is reduced. All equipment is inspected at the start and end of each day to ensure air filters are clean, and any build-up of grass or other plant matter in the undercarriage is cleared away. This is designed to lower the fire risk and preserve operating equipment.			

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
Insignificant	Rare	Other	N/A	N/A	N/A	Low	N/A	N/A

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
Minor	Unlikely	Contamination	Soil/vegetation/fauna	Soil/vegetation contamination (e.g. hydrocarbons, rubbish, drill samples/cuttings, ablutions, other sources)	• All external waste material is removed from site to an approved waste facility. • Unwanted drill samples are emptied into sumps/pits, which are back filled, covered with topsoil, and lightly scarified to promote seed germination. The empty plastic bags are removed from site. • The drilling rig and ancillary equipment are properly	Low	No contamination of soil and vegetation as a result of exploration activities.	Demonstrate that all domestic or industrial waste (includes general rubbish and hydrocarbons) is disposed of in accordance with the Environment Protection Act 1993 within 3 months of the expiry of the PEPR approval (for PEPRs approved for a period of 12 months), or 3 months after the expiry of a program notification (for PEPRs approved for an ongoing period), and that all fuel and chemicals are stored in accordance with EPA requirements,

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					maintained and regularly inspected to ensure there are no diesel or oil leaks. • Stored fuel correctly bunded, spill kits used, contaminated soil immediately removed off site to an approved waste facility.			by providing: • The name, location and contact details of the authorised waste disposal facility. • A statement within the 'Compliance with approved programs' section of the annual exploration compliance report confirming domestic and industrial waste was removed from all exploration sites and disposed of at an authorised waste disposal facility. • Photographic evidence within the annual exploration compliance report demonstrating that all fuel and chemical storage facilities were managed in accordance with EPA

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
								requirements. Maintain photographs of all exploration sites and provide representative photos within the annual exploration compliance report demonstrating that drill cuttings are: • removed from site and disposed of at a licensed facility • buried under a minimum of 30 cm of soil, or in accordance with EPA guideline, Radiation protection guidelines on mining in South Australia: mineral exploration, available on the EPA website, or • backfilled down the drillhole, within 3 months of the expiry of the

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
								PEPR approval (for PEPRs approved for a period of 12 months), or 3 months after the expiry of a program notification (for PEPRs approved for an ongoing period), unless otherwise authorised. Provide the information requested within the ‘Rehabilitation’ section of the annual exploration compliance report.</p>

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
Insignificant	Rare	Groundwater users	Groundwater users	Interference to existing water users when extracting water from existing dams, water bores or mineral drillholes.	• Where water is required for drilling, water will be sourced from existing water supplies at Kalkaroo.		No public nuisance impacts resulting from the extraction of water for exploration purposes, unless prior approval under the relevant legislation is obtained.	Provide the information requested within the 'Complaints' section of the annual exploration compliance report demonstrating that all reasonable complaints from stakeholders were resolved to the satisfaction of both parties, prior to and ongoing during the course of the exploration program without the involvement of DEM. Where permits are required for the extraction and/or usage of groundwater, provide copies of the licence or

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
								permit within the annual exploration compliance report.</p>

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
Minor	Unlikely	Groundwater	Groundwater/aquifer	Groundwater contamination: • contamination of aquifers through entry of pollutants from the surface • interconnection between aquifers • degradation of natural hydrostatic conditions (maintain pre-drilling pressures).	• Understanding of the hydrogeology of the prospect areas indicates multiple aquifers and confined aquifers are unlikely in these areas. • Drilling experience in the region indicates saprolite and Namba Formation strata are self-sealing and will close the hole soon after drilling ceases. • All holes will be abandoned in accordance with	Low	Drillholes restored to controlling geological conditions that existed before the hole was drilled or, where it is intended to re-enter the hole, the hole must be completed with casing of adequate strength and the casing cemented so that all aquifers are isolated to prevent the movement of any fluids behind the casing.	Maintain evidence demonstrating that drillholes are decommissioned in accordance with Earth Resources Information Sheet M21, Mineral exploration drillholes – general specifications for construction and backfilling, and/or specific conditions from DEW (Groundwater) within 3 months of the expiry of the PEPR approval (for PEPRs approved for a period of 12 months), or 3 months after the expiry of a program notification

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					M21 Guidelines. • Groundwater chemistry confirms the basement and overlying saturated d Namba Formation are one continuous low permeability unconfined aquifer: o Backfill the drillhole to the extent practicable with drill cuttings. o Cut the PVC collar 50 cm below surface and cap, then bury with topsoil and restore surface			(for PEPRs approved for an ongoing period), unless otherwise authorised. Provide the information requested within the 'Groundwater' section of the annual exploration compliance report.</p>

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					ground conditions consistent with surroundings. • Namba Formation and basement groundwater chemistry indicates they are different aquifers: o Plug the drillhole at the basement – Namba interface. o Grout back to a minimum of 15 m into the Namba Formation as per M21 guidelines. o Cut the PVC collar 50 cm below surface and cap, then			

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					bury with topsoil and restore surface ground conditions consistent with surroundings. • No groundwater encountered in RC drill hole: o Backfill the drillhole to the extent practicable with drill cuttings. o Cut the PVC collar (through surficial sediments to top of Namba Formation strata) 50 cm below surface and cap, then bury with topsoil			

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					and restore surface ground conditions consistent with surroundings. • A regional groundwater sampling program is being implemented to characterise water chemistry in different formations, in particular saturated strata in basement and overlying Eyre Clay and/or Namba Formation where these form one continuous low permeability			

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					saturated zone. Currently (May 2026) the search continues for groundwater wells screened in these formations and accessible for sampling. The sampling and analysis will include: o Identify existing registered groundwater wells / bores or open vertical exploration drillholes screened or open in either basement or Namba			

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					Formation / Eyre Clay water bearing zones. o Using drilling or well construction data, the downhole interval open to water-bearing strata will be identified using well construction or drilling logs for the hole. o Measure groundwater SWL with a Water Level Meter before sampling. o Discrete groundwater samples will be collected using a			

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					passive, no-purge methodology (such as HydraSleeve water samplers) from the undisturbed water column within the screened or open hole section of the bore / exploration drill hole. o Groundwater discharged during exploration drilling will be sampled, where possible, from drill holes where sustained groundwater			

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					discharge occurs at the outflow from the drill collar. Samples will be collected directly into laboratory prepared containers. o Groundwater samples will be transferred from the sample collection device to laboratory prepared containers at the well / drill hole location. Containers will be labelled and stored in a laboratory provided cooler			

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					suitable for transport. o NATA certified laboratory analysis will be by Australian Laboratory Services and include: □ EC □ pH □ Major Anions □ Major Cations o All methods, results, and interpretation will be documented in the compliance report. On prospects where saturated Namba Formation strata are intersected, a drill			

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					site will be selected at random to repeat the Namba Self Sealing Test using the methods described in Appendix 2.			

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
Minor	Unlikely	Weeds and Pathogens	All flora and fauna, especially listed species.	Loss/ modification of the environment (biological, social and economic) through the introduction of weeds and pathogens.	• Vehicles are to be kept clean and free of mud on entering drill sites. • Inspection of drill sites on completion and after rehabilitation to check for any introduced species and removal if found.	Low	No introduction of new species of weeds and plant pathogens, nor increase in abundance of existing weeds species.	Provide a statement within the 'Compliance with approved programs' section of the annual exploration compliance report, confirming that: • Vehicle logs were kept during the exploration program, demonstrating that all vehicles are clean and free of plant and mud material prior to entering properties† within the tenement areas, unless otherwise agreed to with the relevant landowners. • Photographic evidence before and during exploration

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
								operations and after rehabilitation of disturbed sites was captured, demonstrating that no new weeds and plant pathogens were introduced, nor an increase in abundance of existing weeds recorded.</p>

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
Minor	Unlikely	Aboriginal heritage	Aboriginal heritage sites	Disturbance to Aboriginal heritage	• An Aboriginal Heritage Clearance Survey is to be conducted with the traditional owners to clear the drill sites and access prior to commencement of drilling. • Site inductions to be completed and avoidance of any known sites – these will be marked on GPS and on-ground (star-pickets, flagging). • If an Aboriginal site (previously	Low	No disturbance to Aboriginal artefacts or sites of significance unless prior approval under the relevant legislation is obtained.	Maintain a database and provide a statement within the 'Compliance with approved programs' section of the annual exploration compliance report demonstrating that: • Heritage sites were not impacted during the conduct of the exploration program, unless prior approval was obtained under the appropriate legislation • Work ceased on discovery of a significant site and recommenced only after authorisation. • Aboriginal heritage sites identified

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					unknown) is accidentally disturbed, all work must cease immediately and not recommence. • Report any sites as soon as practicable			during the exploration program were appropriately recorded and reported to authorities, if not previously known.</p>

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
Minor	Unlikely	Ground water	Soil/ vegetation/fauna	Discharge of ground water into the surrounding environment.	• Understanding of the hydrogeology of the prospect areas indicates multiple aquifers and confined aquifers are unlikely in these areas. • Drilling experience in the region indicates saprolite and Namba Formation strata are self-sealing and will close the hole soon after drilling ceases. • All holes will be abandoned in accordance with	Low	No discharge of groundwater outside of the exploration site (e.g. drillsite) into the surrounding environment and no discharge of water into a watercourse, unless prior approval under the relevant legislation is obtained.	Maintain photographic evidence of all drillsites demonstrating that groundwater was not discharged into the surrounding environment, unless water affecting activity permits were obtained allowing the discharge of groundwater into watercourses and/or lakes. Representative photos and water affecting activity permits (where applicable) to be included within the annual exploration compliance report.

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					M21 Guidelines. • Namba Formation does not self-seal and groundwater chemistry confirms the basement and overlying saturated Namba Formation are one continuous low permeability unconfined aquifer: o Backfill the drillhole to the extent practicable with drill cuttings. o Cut the PVC collar 50 cm below surface and cap, then			

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					bury with topsoil and restore surface ground conditions consistent with surroundings. • Namba Formation and basement groundwater chemistry indicates they are different aquifers, and the Namba Formation does not self-seal: o Plug the drillhole at the basement – Namba interface. o Grout back to a minimum of 15 m into the Namba Formation as per			

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					M21 guidelines. o Cut the PVC collar 50 cm below surface and cap, then bury with topsoil and restore surface ground conditions consistent with surroundings. • No groundwater encountered in RC drill hole: o Backfill the drillhole to the extent practicable with drill cuttings. o Cut the PVC collar (through surficial sediments to top of			

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					Namba Formation strata) 50 cm below surface and cap, then bury with topsoil and restore surface ground conditions consistent with surroundings. • A regional groundwater sampling program is being implemented to characterise water chemistry in different formations, in particular saturated strata in basement and overlying Eyre Clay and			

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					/or Namba Formation where these form one continuous low permeability saturated zone. Currently (May 2026) the search continues for groundwater wells screened in these formations and accessible for sampling. The sampling and analysis will include: o Identify existing registered groundwater wells / bores or open vertical			

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					exploration drillholes screened or open in either basement or Namba Formation / Eyre Clay water bearing zones. o Using drilling or well construction data, the downhole interval open to water-bearing strata will be identified using well construction or drilling logs for the hole. o Measure groundwater SWL with a Water Level Meter			

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					before sampling. o Discrete groundwater samples will be collected using a passive, no-purge methodology (such as HydraSleeve water samplers) from the undisturbed water column within the screened or open hole section of the bore / exploration drill hole. o Groundwater discharged during exploration drilling will be			

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					sampled, where possible, from drill holes where sustained groundwater discharge occurs at the outflow from the drill collar. Samples will be collected directly into laboratory prepared containers. o Groundwater samples will be transferred from the sample collection device to laboratory prepared containers at the well / drill hole location.			

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					Containers will be labelled and stored in a laboratory provided cooler suitable for transport. o NATA certified laboratory analysis will be by Australian Laboratory Services and include: □ EC □ pH □ Major Anions □ Major Cations o All methods, results, and interpretation will be documented in the compliance report.			

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					On prospects where saturated Namba Formation strata are intersected, a drill site will be selected at random to repeat the Namba Self Sealing Test using the methods described in Appendix 2.			

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
Minor	Unlikely	Third party access	Soil/ vegetation/fauna	Degradation of rehabilitated access tracks caused by third party access (includes previously closed and rehabilitated access tracks).	• No new access tracks to be cleared. • Access drill sites by driving vehicles cross country from existing station tracks in most direct route avoiding vegetation where possible. • Minimise disturbance by confining heavy equipment to a single access track. • Rectify any significant residual compaction along the overland access routes, if	Low	Rehabilitated access tracks remain permanently closed, unless prior approval under the relevant legislation is obtained.	Maintain before and after photographic evidence demonstrating that all tracks are closed and rehabilitated within 3 months of the expiry of the PEPR approval (for PEPRs approved for a period of 12 months), or 3 months after the expiry of a program notification (for PEPRs approved for an ongoing period), unless otherwise authorised. Representative photos are to be included within the annual exploration compliance report. Provide the

Severity of consequence (CQ)	Likelihood of consequence (LH)	Environmental Aspect	Receptor	Potential Impact	Control Strategies	Risk	Outcomes	Outcome Measurement Criteria
					necessary, by light scarifying.			information requested within the ‘Rehabilitation’ section of the annual exploration compliance report.</p>

Supporting Information

Photos

Upload Photos ⓘ

Expand/Collapse

File Name	File Size (Mb)	Created On	Download
EPEPR2024-015_Photos 1-6.pdf	1.24 Mb	27-03-2026 13:49:34	Download (MERS/EPR-04096/Supporting information/Photos/EPEPR2024-015_Photos 1-6_2026-03-27T03-19-35.937Z.pdf)

Site identification	Date taken	Photo number & PEPR section reference	Easting (GDA94)	Northing (DGA94)	Zone	Details and comments	Document ID
Northern Area – Birksgate Prospect (EL5873)	28/08/2023	Photo 1, Description of Environment	442040	6537690	54	BKRC001 drill site, shows general area of the Birksgate Prospect, and drill rig set-up onsite.	

Supporting Maps

Upload Maps

Expand/Collapse

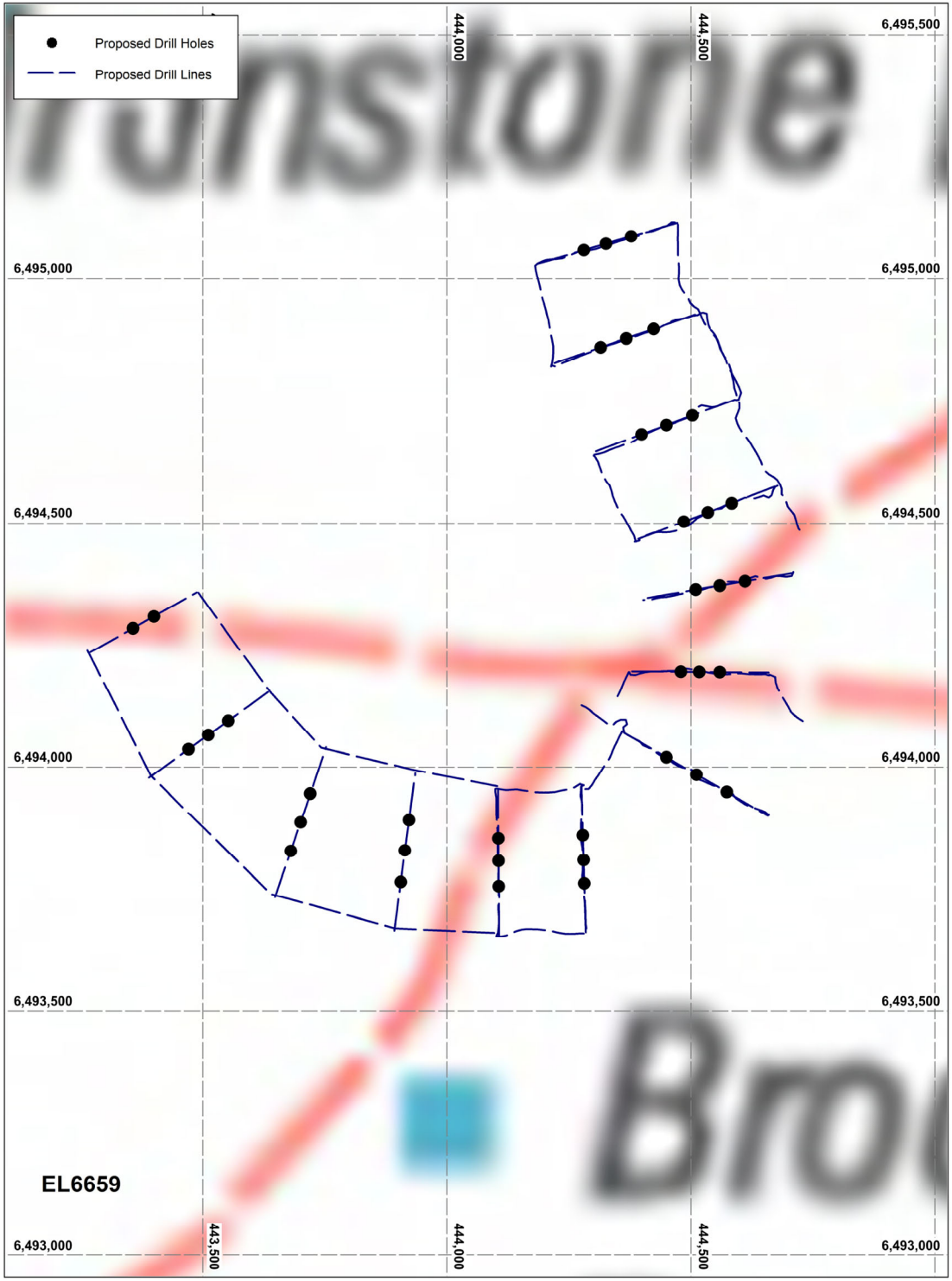
File Name	File Size (Mb)	Created On	Download
Brooks Dam Proposed Drilling.jpg	1.1 Mb	14-05-2026 15:47:33	Download (MERS/EPR-04096/Supporting information/Maps/Brooks Dam Proposed Drilling_2026-05-14T06-17-41.904Z.jpg)
EPEPR2024-015_Maps 1-9.pdf	1.68 Mb	27-03-2026 13:51:08	Download (MERS/EPR-04096/Supporting information/Maps/EPEPR2024-015_Maps 1-9_2026-03-27T03-21-08.920Z.pdf)

Figure Description	Document ID
Maps 1 - 9	

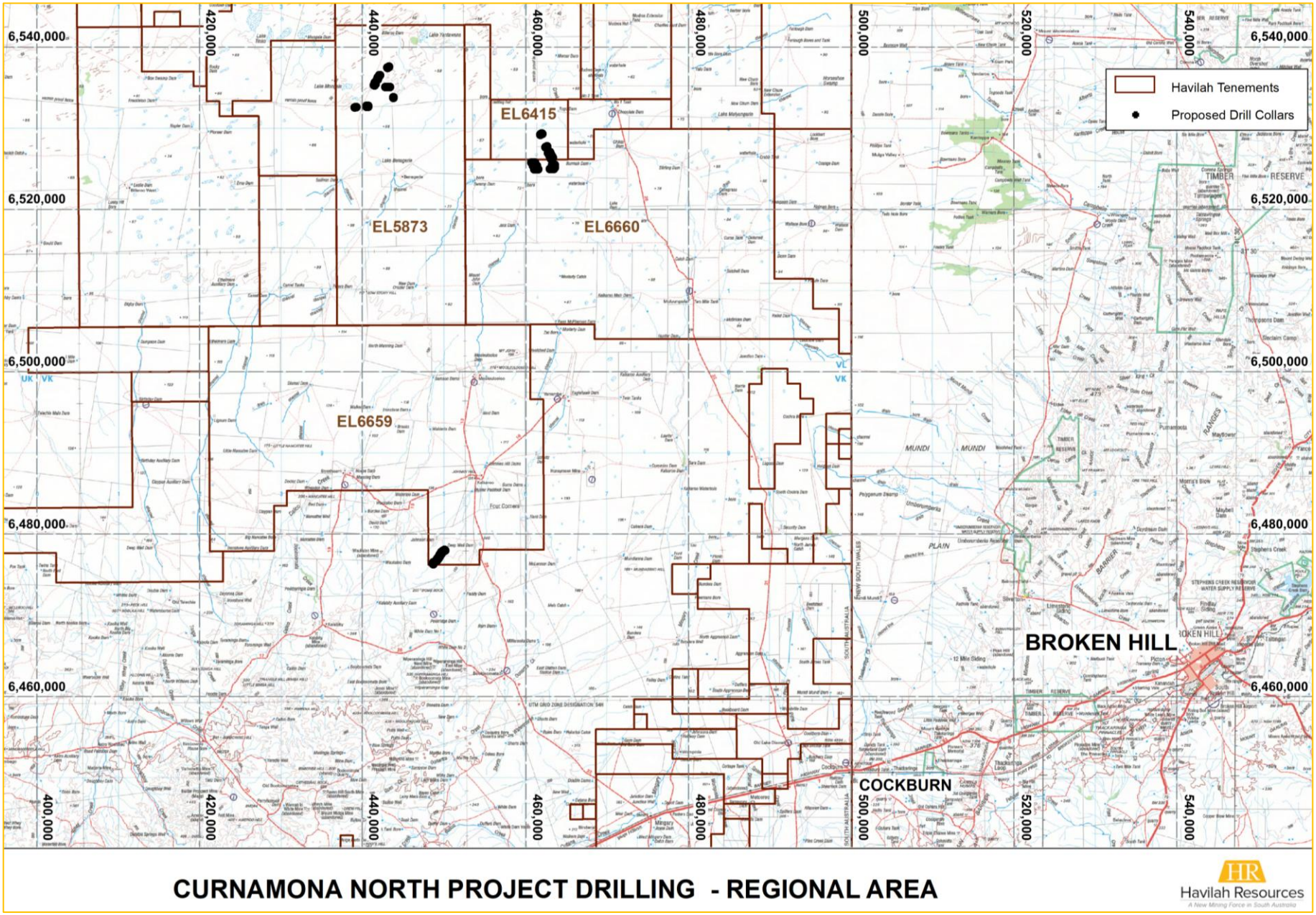
Additional Information

List any other supporting information and/or documents submitted with the application, including land access approvals/permits required to conduct the proposed exploration program.

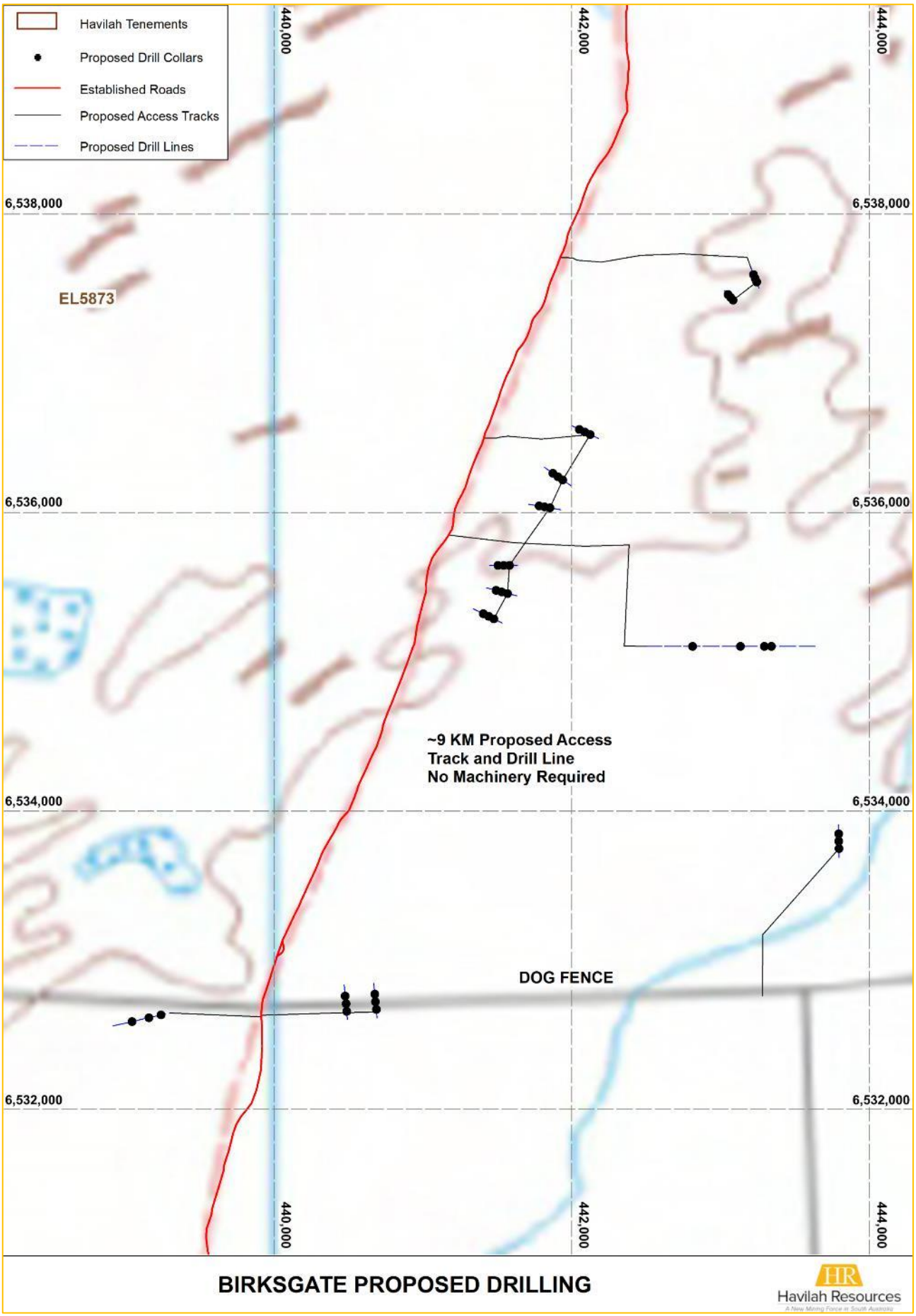
N/A



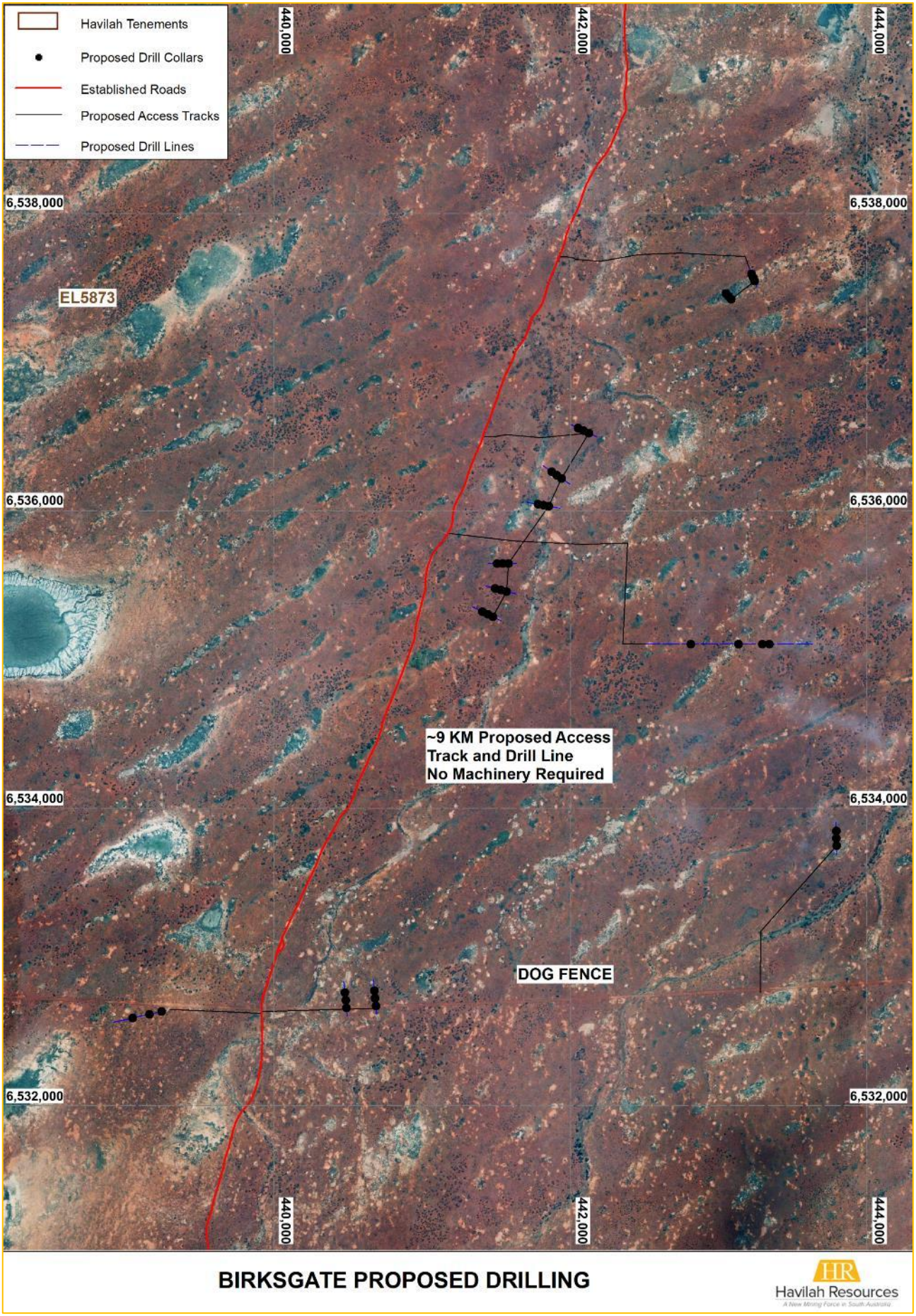
Curnamona North PEPR - Brooks Dam



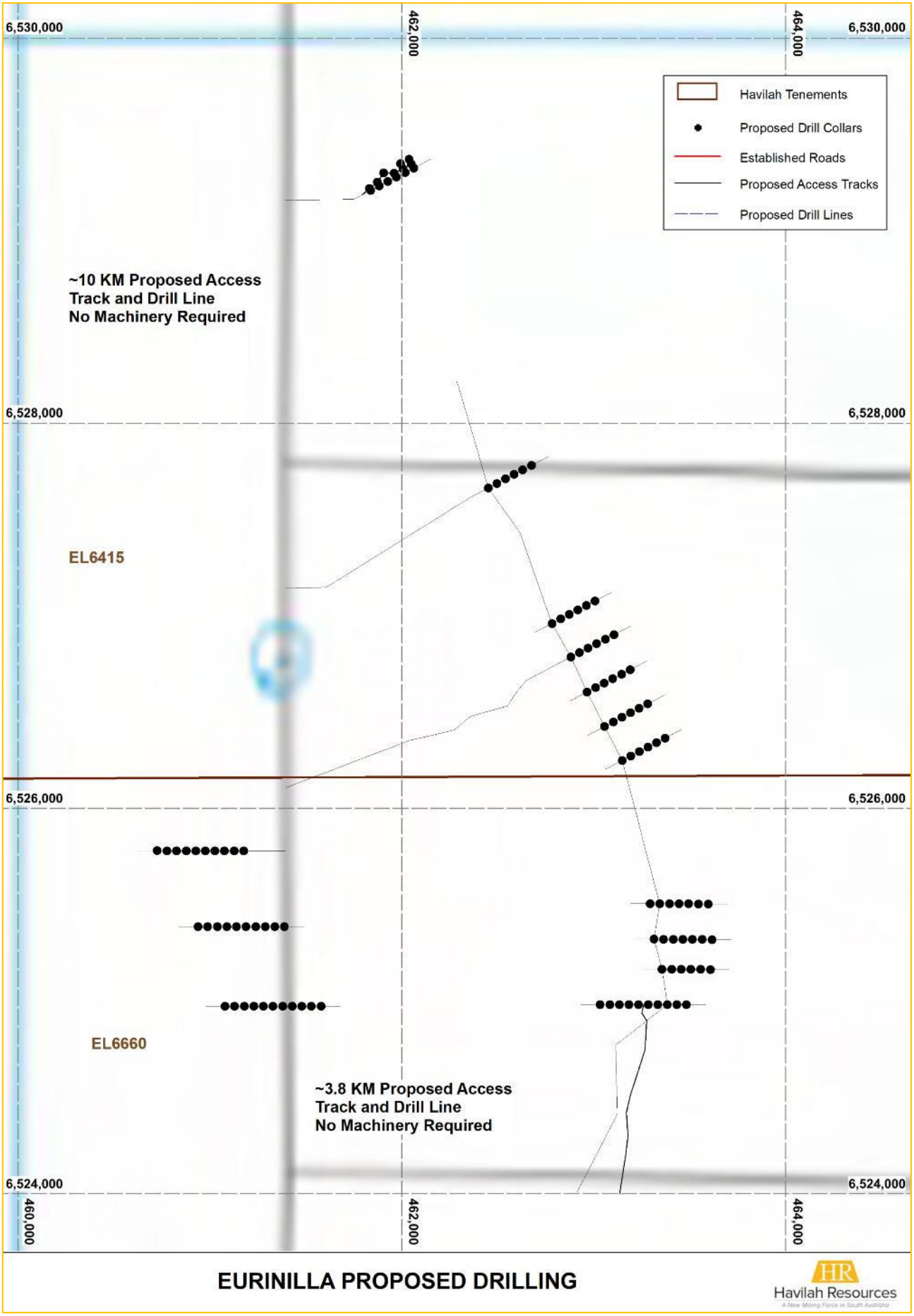
Map 1: Tenement Location – Regional.



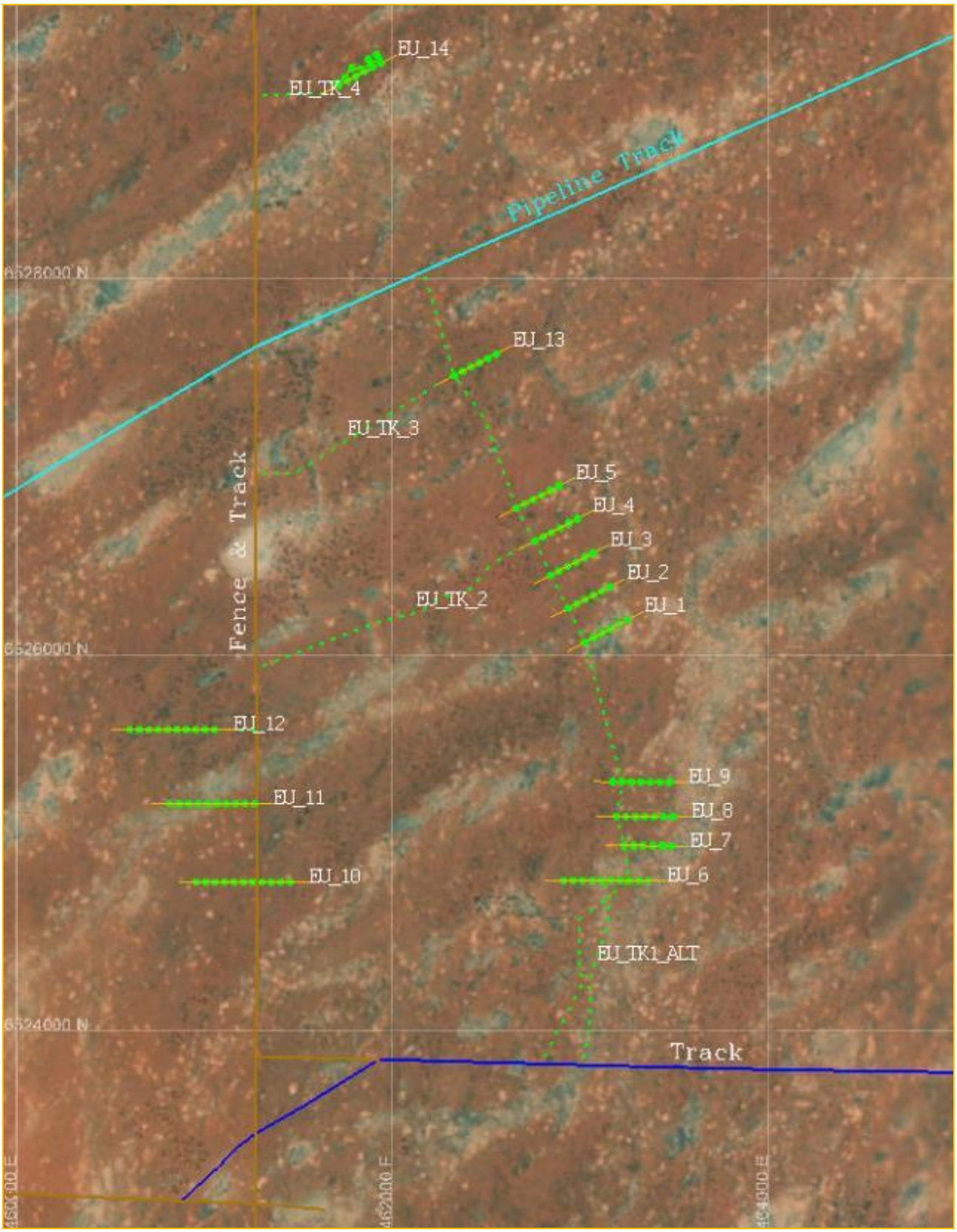
Map 2: Birksgate Proposed Drilling – Topography.



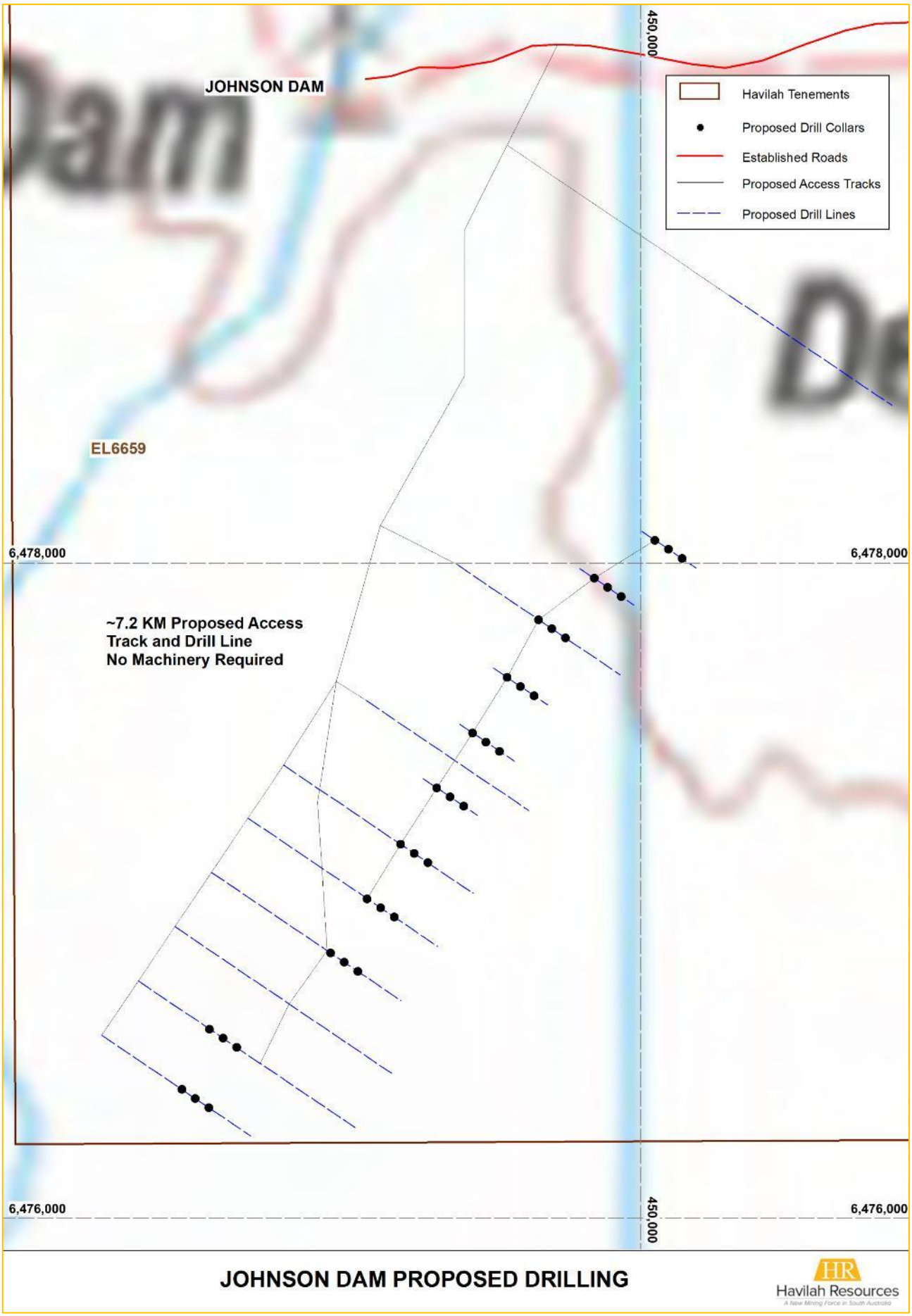
Map 3: Birksgate Proposed Drilling – Satellite Image.



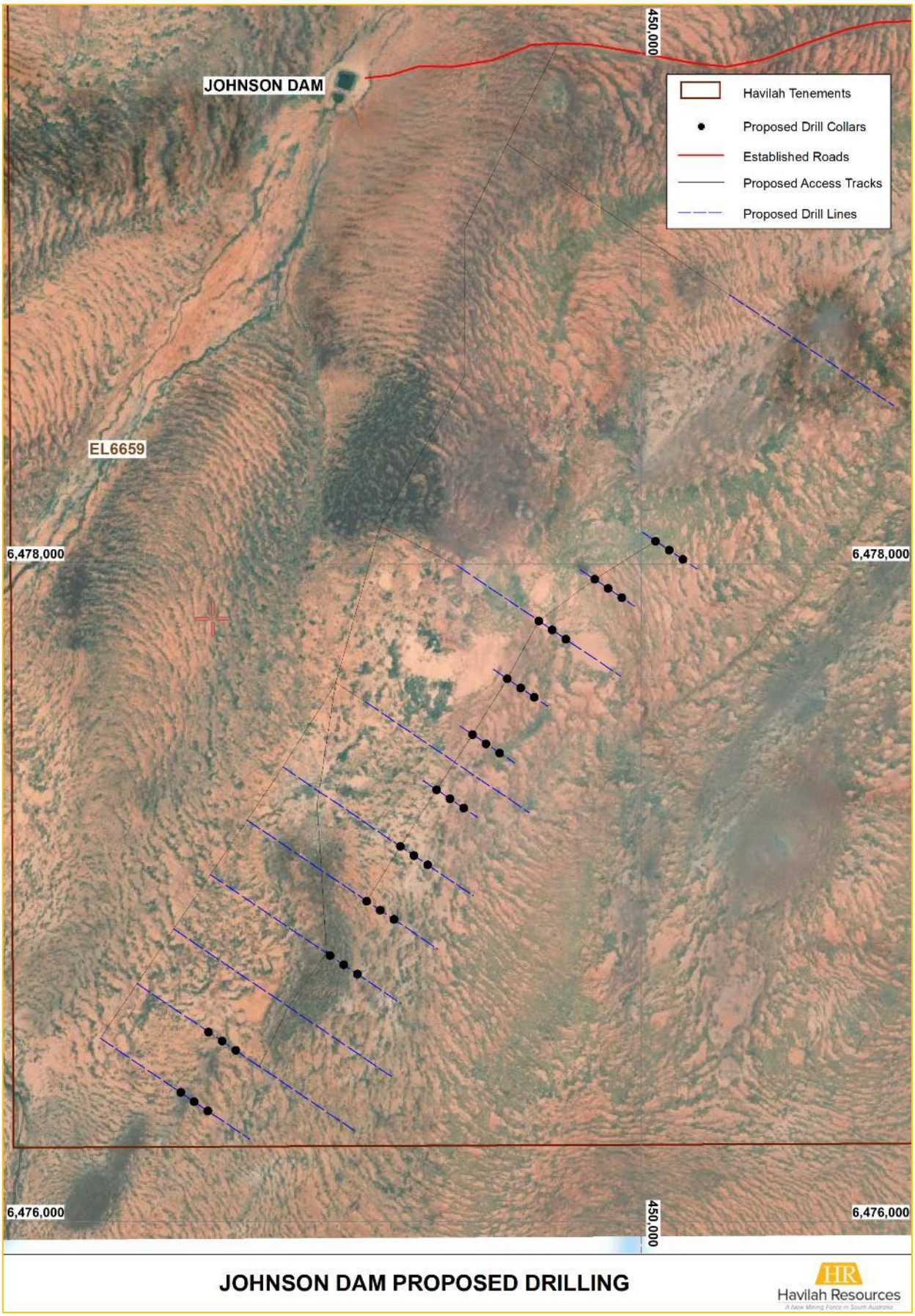
Map 4: Eurinilla Proposed Drilling – Topography.



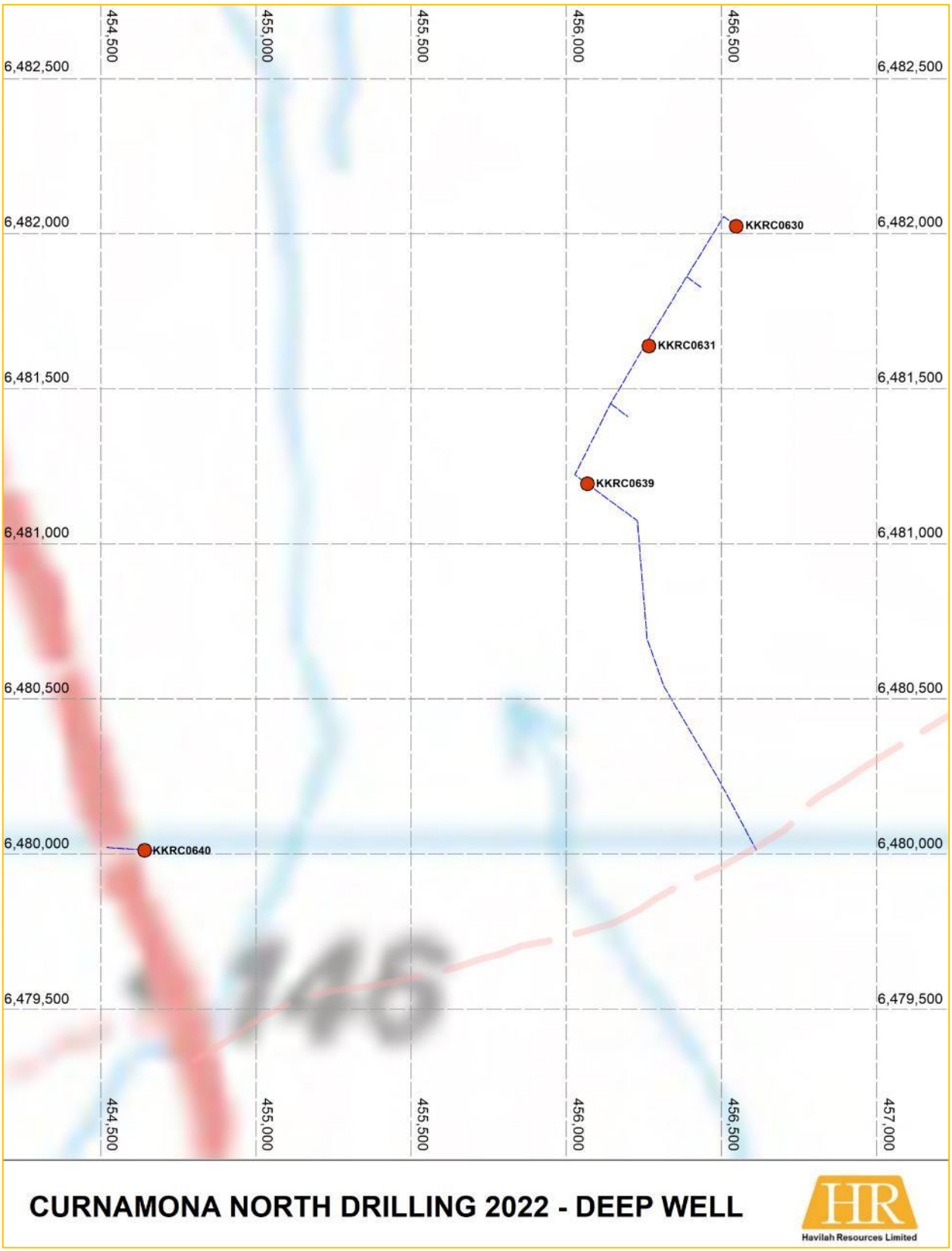
Map 5: Eurinilla Proposed Drilling – Satellite Image.



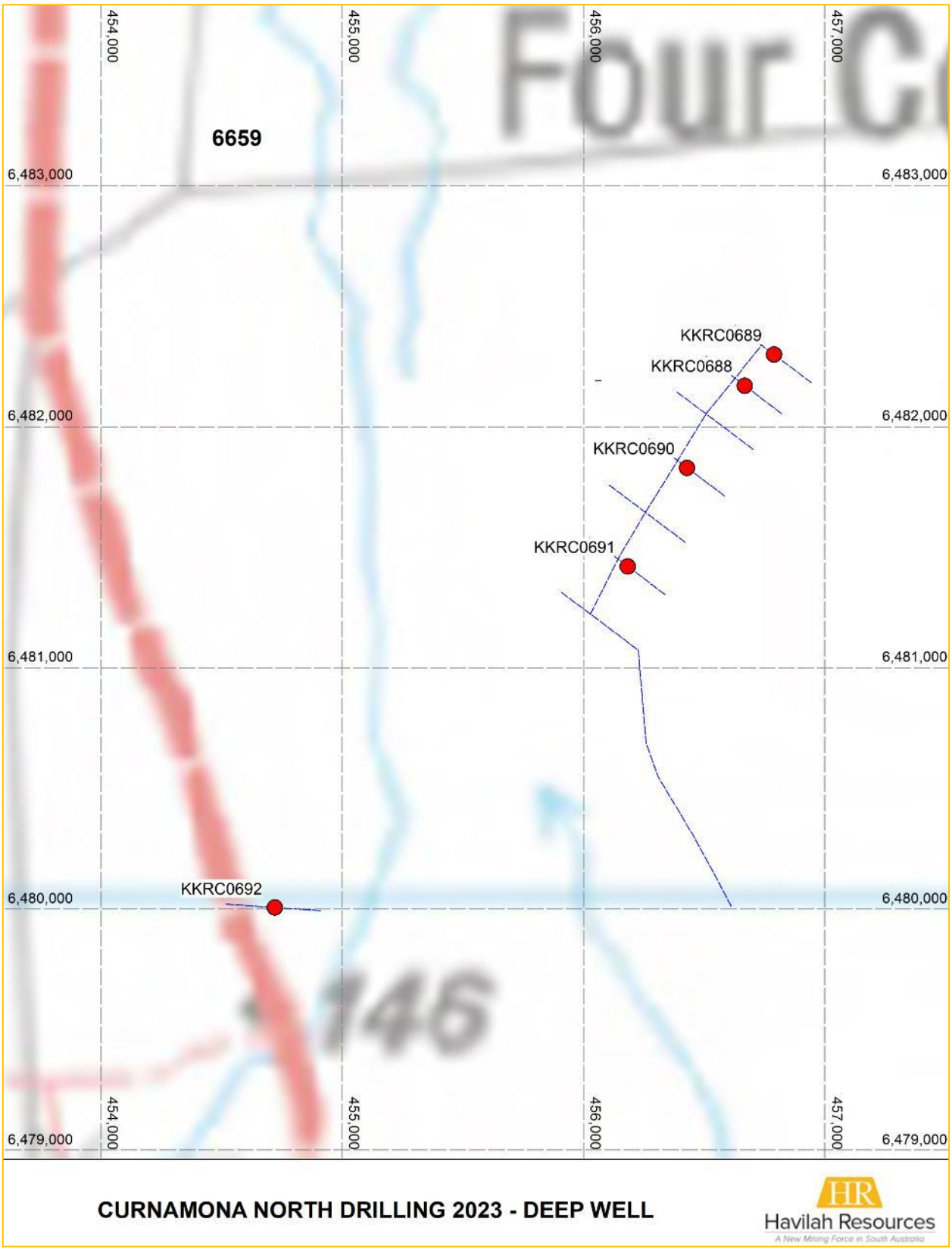
Map 6: Johnson Dam Proposed Drilling – Topography.



Map 7: Johnson Dam Proposed Drilling – Satellite Image.



Map 8: Deep Well Previous Drilling – possible diamond tail location to be decided.



Map 9: Deep Well Previous Drilling – possible diamond tail location to be decided.

Havilah Resources
Strategic Minerals in South Australia

Technical Memorandum

Date:	12 March 2026
From:	Geoff Borg MSc in Hydrogeology and Groundwater Management *Principal Environmental Advisor*
To:	Chris Giles *Technical Director* Amy Jacka *Tenement Manager* Traviss Just *Senior Geologist*
Subject:	Central Curnamona Hardrock Metal Prospects Hydrogeology

This memorandum is a review of the hydrogeology of mineral exploration hard rock metal prospects of the Central Curnamona region (Figure 1) to inform drillhole decommissioning in accordance with M21 for EPEPR submissions. Published reports, SA Water Connect Groundwater Data, historic exploration drilling data and observations by Havilah and others, and technical groundwater and geotechnical studies for Portia and Kalkaroo mining leases inform this review.

The Central Curnamona region as defined by the Exploration Licences (ELs) depicted in Figure 1. The priority (for future drilling) prospects identified are representative of the region for the purpose this review. South to north, these prospects are:

- Johnson Dam
- Kalkaroo North Dome (continuation of Kalkaroo Copper Project)
- Croziers
- Benagerie
- Eurinilla
- Birksgate (Prescribed Wells area, not intersecting Great Artesian Basin aquifers)
- Lake Charles (Prescribed Wells area, not intersecting Great Artesian Basin aquifers)

Future drilling on other prospects in this region will encounter groundwater conditions comparable to those discussed in this review.

The region is on the southern margin of the Lake Eyre Basin and extends, south to north, from outcropping to sub-cropping basement strata with onlapping Tertiary strata (Figure 2). Surface water and regional groundwater movement through the region is generally from south, Olary Ranges, to north – north west toward Lake Frome.

The northern extent is within the administrative boundary of the Northern Prescribed Wells Area and on the margins of the Great Artesian Basin (GAB) (Figure 3) but does not intersect basin aquifers.

The region is transected by Tertiary palaeovalleys eroded into basement strata (Figure 1). Palaeovalleys typically contain groundwater bearing sandy and gravelly strata hosting secondary uranium mineralisation, e.g. Honeymoon Uranium Mine. Consideration of such mineralisation is outside the scope of this review.

Geology of Target Metal Mineralisation

Target metal mineralisation occurs in fractured basement rock and overlying weathering profile (saprolite and saprock) of the Willyama Supergroup (Figure 2). Figure 2 provides a schematic illustration of the typical stratigraphy. In summary:

- Basement strata typically consist of folded Palaeoproterozoic Willyama Supergroup metasediments with a highly variable weathering profile consisting of saprolite over saprock. They are intruded by the Mesoproterozoic Ninnere Supersuite granites and unconformably overlain by the comagmatic Benagerie Volcanics in the north. In a few areas to the north, west and east metasediments are also directly overlain by Neoproterozoic (Adelaidean) and Cambrian strata (siltstone, shale, and conglomerate) strata, also with a variable, but generally much thinner weathering profile of saprolite and saprock.
- The top of the saprolite is unconformably overlain by two Cenozoic sequences, namely the Eyre Formation that is usually only preserved as erosional remnants in hollows and palaeochannels and the Namba Formation (up to 60 m thickness of interbedded sands and clays). These are invariably capped by Quaternary to Recent sands and minor gravels with gypsum & calcrete nodules (hardpan) (typically 5 - 15m thick) to the surface.

Regional Hydrogeology

Evans *et al* (2024) identifies the Central Curnamona area as being towards the southern limits of the Callabonna Sub-basin within the Kati Thanda – Lake Eyre Basin (Figure 3). The southern margin of the basin is defined by outcropping metasediments and igneous formations of the Willyama Supergroup that form the Olary Ranges. There is a decades long history of mineral exploration drilling and mining in the Central Curnamona (Attachment 1).

Evans *et al* (2024) describes "the main hydrostratigraphic units of the Callabonna Sub-basin are the (Cenozoic) Eyre, Namba, and Willawortina formations, and the undifferentiated Pliocene–Quaternary sediments…[form] a stacked aquifer–aquitard system with the Namba Formation acting as the regional aquitard that separates the deeper Eyre Formation aquifer from the near-surface aquifers of the Willawortina Formation and Pliocene–Quaternary sediments". In the Central Curnamona prospect areas the near surface Willawortina Formation and Pliocene sediments are not observed, presumably because of the distance from the Flinders Ranges source area. Evans *et al* (2024) describes the Namba Formation as an aquitard confining groundwater in underlying Eyre Formation aquifers.

In the Central Curnamona region prospect areas Eyre Formation aquifers have not been intersected by historic mineral exploration drilling. Localised intersections of thin and discontinuous Eyre Formation clay dominated strata, sometimes occur between Namba Formation and basement strata. Namba Formation strata intersections are typically highly fissured and fractured clay with some discontinuous sandy units. Namba Formation, saprolite,

saprock, unweathered basement typically presents as one continuous low permeability section.

Water Technology (2021) describes the potentiometric water levels in wells across the Kalkaroo Copper Project area as reporting to the same regional water table (Figures 4, 5, 6). This includes wells screened in basement strata (unweathered) and saprock and saprolite. Aqueon (2017) similarly presents data for wells constructed at Portia and screened in unweathered basement or saprolite/ Eyre Clay / Namba Formation as also reporting to a same regional water table. This correlation is confirmed by hundreds of observations by Havilah geologists logging RC drill holes across the Kalkaroo deposit and the broader Central Curnamona region, where the change from unsaturated to saturated conditions, i.e. regional water table, is marked by readily observable changes in moisture content and plasticity of the clays.

Havilah interprets the saturated sections of saprolite and Namba Formation clays as continuous with underlying water bearing strata, namely the Eyre Formation clay strata (where present) the fractured Willyama Supergroup basement rocks). This is supported by consistent groundwater chemistry in basement rocks, and Eyre and Namba Formations in the southern Callabonna Sub-basin (Evans *et al*, 2024) and as consistently observed by Havilah geologists in Havilah RC drillholes.

Evans *et* al (2024) notes "at Portia gold mine in the Callabonna Sub-basin, the shallowest groundwater system occurs in a fractured rock aquifer... This aquifer is naturally confined by the overlying Namba Formation aquitard, with the near-surface sediments of the Callabonna Sub-basin largely unsaturated in this area. When bores near the mine intersect the fractured rock aquifer, the water level naturally rises from the initial intersection depth (usually around 90 m below surface) to levels about 20–30 m below surface following bore completion. Due to missing data, such as depths that groundwater is initially intersected, the degree of confinement is difficult to determine for some bores". This statement is generally correct, but Havilah notes from its experience at Portia and elsewhere, the reason first groundwater is often not recorded in saprolite, or Namba Formation is because of the low permeability of the clays and the slow ingress of water into the borehole. However, as noted above, the regional water table and water saturation can be clearly recognised by the change in moisture content and plasticity of the Namba Formation clays in drill samples (and in the walls of the Portia gold mine open pit).

Groundwater intersections within unweathered basement strata, as observed during reverse circulation (RC) drilling, varies from no water production to, occasionally, sections of continuous (while drilling) water production. This correlates with intersecting strata with:

- Few and / or closed fractures (producing no water), or
- Common and open fractures or fault zones (that are water filled).

Water Technology (2021) characterised the Kalkaroo fault zone (that runs transects the Kalkaroo copper-gold orebody) as a strip aquifer within a regional unconfined aquifer comprising low permeability saturated basement strata, saprock, saprolite, and Namba Formation. This is based on these strata having vertically and laterally comparable low permeability and transmissivity hydraulic properties.

Groundwater quality is typically saline (range: 9,500 to 25,400 mg/L, average: 13,625 mg/L) with a pH range of 6.4 to 7.8 (Water Technology, 2021 and Aqueon, 2017).

Hardrock Metal Prospects Hydrogeology

Basement geology comprises metamorphosed Palaeoproterozoic Willyama Supergroup metasediments, Mesoproterozoic Benagerie Volcanics and Ninnerie Suite granitoids of the Curnamona Province and some Neoproterozoic metasediments. Cenozoic cover strata unconformably overlie basement strata and generally increase in thickness towards the north, excepting over basement topographic highs.

The basement rocks typically have a deeply weathered profile of clay rich saprolite to saprock above fresh unweathered and variably fractured rock. This profile varies locally depending on basement topography, the sulphide content of the original basement strata, and the presence of structural features such as shear zones that can result in deeper weathering or erosion of the profile.

Cenozoic cover includes Eyre Formation, typically preserved as white to grey soapy clays (Eyre Clay) as localised remnants in basement topographic lows. Eyre Formation sands and gravels are limited to incised palaeovalleys in the basement such as the Yarramba Palaeochannel that is host to the Honeymoon Uranium Mine. Cenozoic Namba Formation clays and lesser sands unconformably overlie the Eyre Formation and basement, forming a blanketing cover over much of the Central Curnamona region that is typically capped by Quaternary outwash sediments of the Frome Plains (including frequent hardpan) that in turn are overlain by Holocene aeolian sands with increasing abundance towards the north.

These cover strata are variably developed from place to place, and their thickness is controlled by the Benagerie Ridge basement high and local basement topography. In the south, basement rocks outcrop (Olary Ranges) or are very near surface (Johnson Dam) and they can also subcrop or have minimal cover many kilometres to the north (Croziers, Birksgate, and Lake Charles). More generally, there is significant cover of Namba Formation clays (and more rarely Eyre Clay) lying unconformably on the basement over much of the area (e.g. Kalkaroo North Dome and Eurinilla).

Namba Formation consists predominantly of medium to high plasticity, highly fissured and fractured smectitic clay with occasional thin lenses of clayey sand and silt, typically toward the base of the formation. Eyre Formation may occur locally beneath the Namba Formation and consists of plastic, highly fissured clay and silty clay in this area.

Surficial Quaternary sediments and underlying Cenozoic Namba Formation (where present) and Eyre Formation (where present) strata are clay rich with low permeability. It is important to note that clay rich Cenozoic strata are typically highly fissured with joints and slickensides providing secondary permeability. This was very evident in the walls of the Portia gold mine open pit but is not obvious in pulverised RC drill chips. Basement rocks are generally of low permeability with joints and fractures providing secondary permeability.

Ephemeral perched water tables within Quaternary cover sediments have not been encountered during mineral exploration drilling or in geotechnical studies (Water Technology, 2021 and Mining One, 2017)and the Portia Tailings Storage Facility compliance monitoring of wells screened in these sediments. At the Portia gold mine open pit, which provided a real life case study, no ingress of water was observed from any of the permeable sand layers with the Quaternary and upper Namba Formation above the water table. The sands were invariably completely dry and powdery. This has been the experience of pastoralists in the area who have

drilled numerous water bores into these sands over more than a hundred years, without any notable success, causing them to rely solely on surface water catchment in dams.

Groundwater occurs in a saline low permeability regional unconfined aquifer (water table) with a low but consistent hydraulic gradient indicating flow from south (Olary Ranges – recharge area) to north (toward Lake Frome). This water table is in basement rocks to the south and variably intersects the basement to Namba Formation strata to the north, depending on local relative elevation of the basement - Namba interface. Saturated formations are transmissive and low permeability (Namba Formation, Eyre Clay, and basement – including the highly weathered clay dominated saprolite to saprock to unweathered rock). Groundwater is slow moving with generally increasing salinity with distance away from recharge zones (Olary Ranges). Water quality is typically saline (around 13,625 mg/L) with a pH of around 7.8.

In previous phases of exploration drilling on Havilah's exploration prospects the intersection of regional groundwater has typically been evident as wet or mushy RC (reverse circulation) returns and occasional slugs of saline water suggesting intersection with water filled sedimentary lenses or (in basement) joints or fractures. Intersection with larger water filled structures, such as shear zones or faults, tends to produce initial water discharge that decreases over time as drilling progresses beyond the structure.

Great Artesian Basin aquifers, such as the Cadna-owie Formation, do not occur in the Central Curnamona region prospect areas based on past exploration drill hole logging data.

Far North Prescribed Wells Area (Birksgate Prospect)

Birksgate and Lake Charles hard rock metal prospects are situated wholly or partly within the Far North Prescribed Wells Area, as defined locally by the Dog Fence (Attachment 2).

Historic exploration drilling in these prospect areas has not intersected Great Artesian Basin aquifers of the Cadna-owie Formation (Attachment 2). Normally it is observed that Cenozoic sediments directly overlie the basement rocks (or in some cases Neoproterozoic strata). The impermeable Cretaceous age Bulldog Shale is locally intersected in some uranium exploration drillholes within palaeochannel or blanket sands further north and outside of the northern-most Birksgate and Lake Charles hard rock metal prospect areas.

Mineral Exploration Drillhole Decommissioning Procedure

Drillholes will be decommissioned to restore, as far as feasible, the controlling geological conditions that existed before the hole was drilled.

Groundwater is expected to occur as a single regional saline low permeability unconfined aquifer reporting to a water table that is mostly within basement strata but locally could be in the base of Namba Formation strata, depending on local basement profile relative elevation. While there is potential for localised (ephemeral) perched water tables forming on shallow hard pan (Recent – Quaternary sediments) or top of Namba Formation sandy strata, such perched water tables have never been observed during mineral drilling.

The above observations provide the basis for the drillhole decommissioning method and assessment of restoration of prevailing geological conditions are presented in Table 2.

References

1. Aqueon (2016) *Portia Gold Project – Numerical Model Update and Hydrogeological Review to Support Open Pit Expansion Plans Project Report*. Portia Mine Site ML 6346 Program for Environmental Protection and Rehabilitation submitted by Benagerie Gold and Copper Pty Ltd (https://catalog.sarig.sa.gov.au/dataset/mesac27123/resource/4b6f094f-9fdf-4a57-9c59-1caf767105fd)
2. Department for Energy and Mines (DEM) 2012 *M21 Guidelines for Mineral Exploration: Mineral Exploration Drillholes – General specifications for construction and backfilling* (M21). (https://catalog.sarig.sa.gov.au/dataset/2019d003020/resource/cbd408d4-7812-496c-8a7e-ec29ac4b2627)
3. Evans TJ, Bishop C, Symington NJ, Halas L, Hansen JWH, Norton CJ, Hannaford C and Lewis SJ (2024) *Cenozoic geology, hydrogeology, and groundwater systems: Kati Thanda – Lake Eyre Basin*, Record 2024/05, Geoscience Australia, Canberra, http://dx.doi.org/10.26186/147422.
4. Havilah (2026) *Namba Formation Self-Sealing Test Report*
5. Water Technology (2021) *DRAFT Groundwater Impact Assessment Kalkaroo Copper-Gold Mine*. Report prepared for Havilah Resources Limited to accompany the Kalkaroo PEPR.

Tables

Table 1 Central Curnamona Hydrogeological Summary

Johnson Dam					
Formation age and/or stratigraphic unit	**Stratigraphic intervals (depth range) (m)**	**Aquifer formation name**	**Aquifer interval/thickness (from–to) (m)**	**Type of aquifer(s) intersected**	**Provide aquifer salinity, depth to water level and any other relevant comments**
Quaternary sediments	largely absent, if present, up to 2 m	NA	NA	NA	NA
Basement: Weathered profile (saprolite and saprock) Willyama Supergroup – Palaeoproterozoic	Surface to beyond limit of drilling	Regional low permeability water bearing zone	From ~45 m to beyond limit of drilling	Unconfined	Saline groundwater (TDS ~13,625 mg/L, pH ~ 7.8)
Kalkaroo North Dome and Eurinilla					
Formation age and/or stratigraphic unit	**Stratigraphic intervals (depth range) (m)**	**Aquifer formation name**	**Aquifer interval/thickness (from–to) (m)**	**Type of aquifer(s) intersected**	**Provide aquifer salinity, depth to water level and any other relevant comments**
Quaternary sediments	0 - 14	NA	NA	NA	NA
Namba Formation – Early-Mid Miocene	14 - 56	NA	NA	N/A	NA
		Regional low permeability water bearing zone	From ~30 m to beyond limit of drilling	Unconfined	Saline groundwater (TDS ~13,625 mg/L, pH ~ 7.8).
Eyre Formation – Eocene	56 – 66 (where present)				
Basement: Weathered profile (saprolite and saprock) Willyama Supergroup – Palaeoproterozoic	66 – beyond limit of drilling				
Croziers, Benagerie, Birksgate and Lake Charles					
Formation age and/or stratigraphic unit	**Stratigraphic intervals (depth range) (m)**	**Aquifer formation name**	**Aquifer interval/thickness (from–to) (m)**	**Type of aquifer(s) intersected**	**Provide aquifer salinity, depth to water level and any other relevant comments**
Quaternary sediments	0 - 6	NA	NA	NA	NA
Namba Formation – Early-Mid Miocene	6 - 16	NA	NA	N/A	NA
Basement: Weathered profile (saprolite and saprock) Adelaidean strata – Neoproterozoic (where present) Willyama Supergroup – Palaeoproterozoic	16 – beyond limit of drilling	Regional low permeability water bearing zone	From ~30 m to beyond limit of drilling	Unconfined	Saline groundwater (TDS ~13,625 mg/L, pH ~ 7.8)

Table 2 Drillhole Decommissioning

Risks	**Decommissioning Method**	**Geological Condition on Completion**
Contamination of aquifers through entry of pollutants from the surface	Backfilled PVC collar cut below ground level, capped, and bury with topsoil and restore surface ground conditions consistent with surroundings	Restored – no potential for contaminants to enter the drillhole from the surface
Interconnection between aquifers Flow of pressurised water to the surface or into dry 'thief' zones Degradation of natural hydrostatic conditions (maintain pre-drilling pressures)	No artesian or confined aquifers PVC collar isolates potential ephemeral perched water tables from the regional basement aquifer Natural sealing (swelling)* of Namba Formation (where present) reactive clay strata closes the drillhole Note: * refer Havilah (2026) for Namba Formation Self Sealing Test Report Backfill drillhole void with cuttings	Restored – regional aquifer isolated from surface and potential shallow ephemeral perched water tables
Any physical hazard resulting from an open hole Any environmental hazard resulting from an open hole which could become a trap for small animals or be hazardous to stock	Backfill drillhole void with cuttings Backfilled PVC collar cut below ground level, capped, and bury with topsoil and restore surface ground conditions consistent with surroundings	Restored – no drillhole void and no potential for access to drillhole from surface

Figures

*Figure 1 Priority Havilah Central Curnamona hard rock metal prospects relative to inferred Tertiary palaeovalleys transecting the region. (**Notes**: The full extent of the Havilah exploration licences are not depicted. Kalkaroo Copper MLs and MPLs shown for reference. Base map and image production source: Google Earth)*

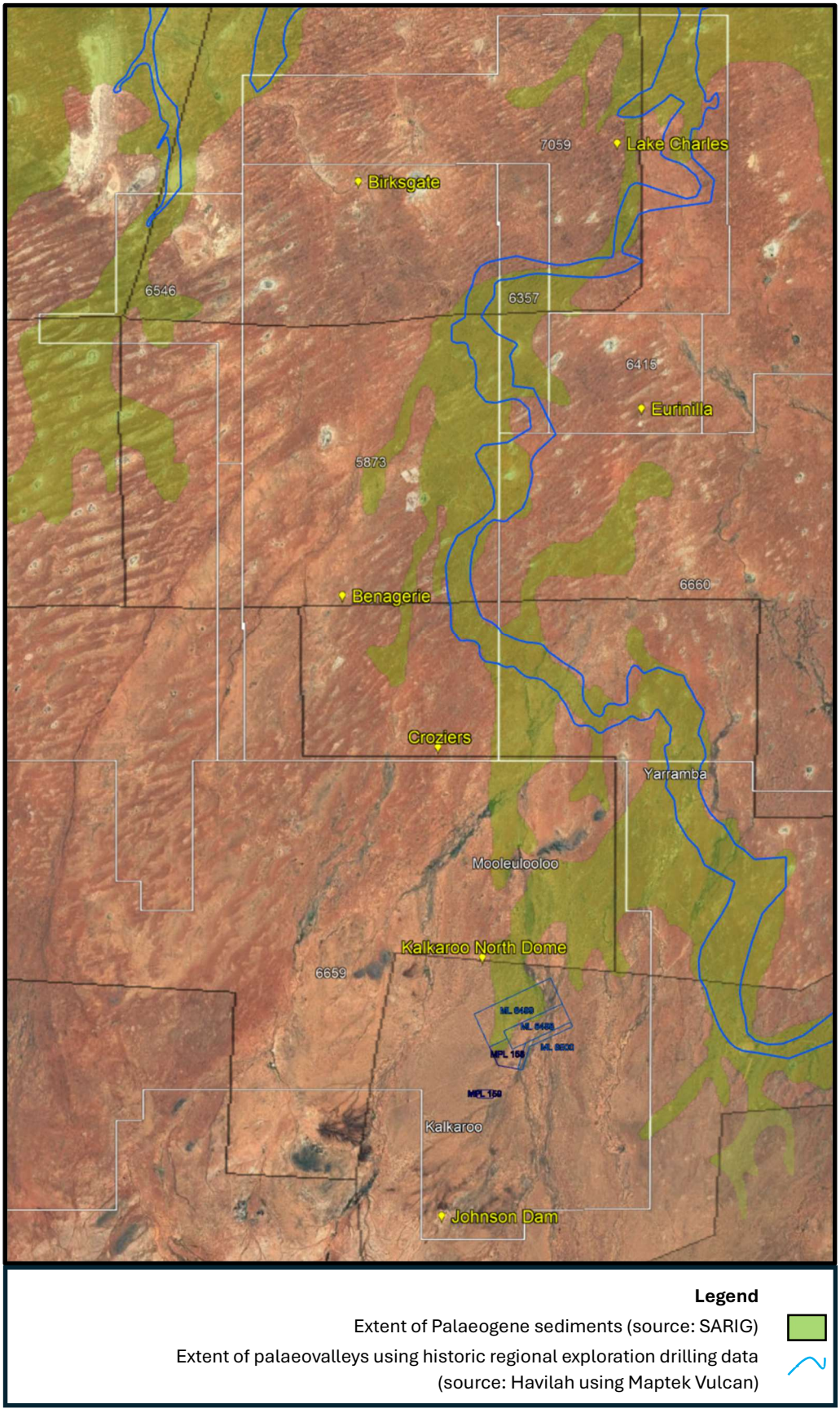


Figure 2 Generalised stratigraphic profile and target mineralisation in the Central Curnamona region.

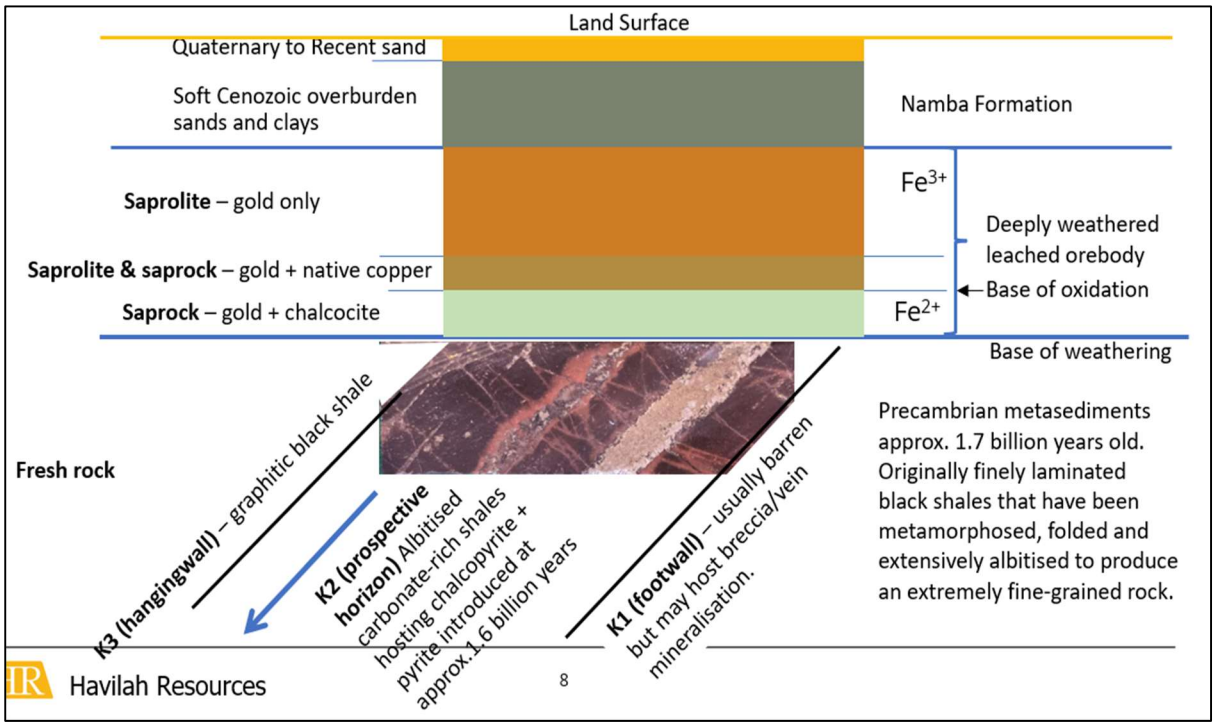


Figure 3 Location of nearby mines Portia, Kalkaroo, and Honeymoon in the Kati Thanda – Lake Eyre Basin (modified from Evans et al (2024).

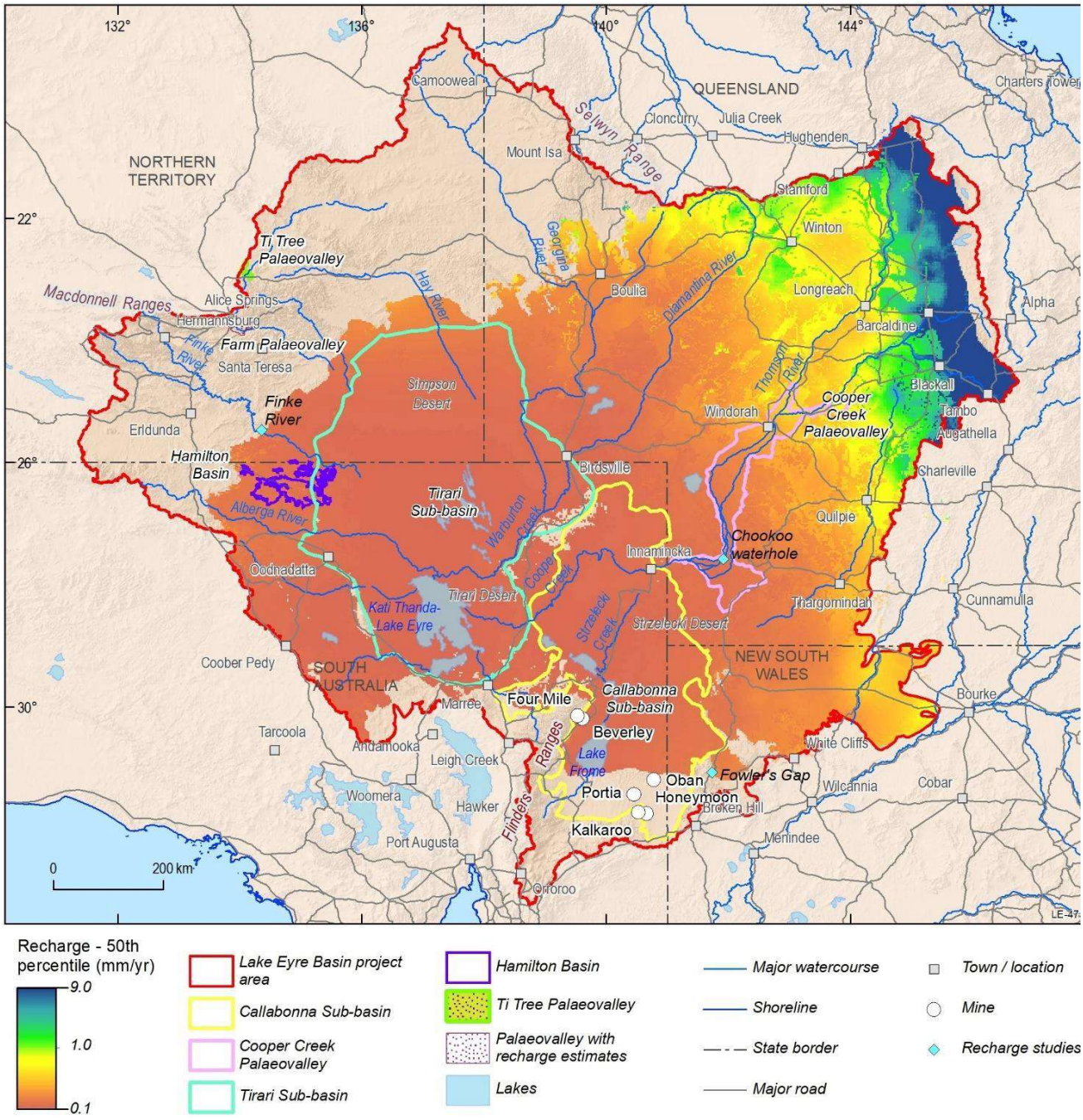


Figure 4 Conceptual hydrogeological model for the Kalkaroo area and applicable throughout most of the region outside of the Tertiary palaeochannels, such as the Yarramba Palaeochannel at the Honeymoon Mine, showing a single regional unconfined aquifer.

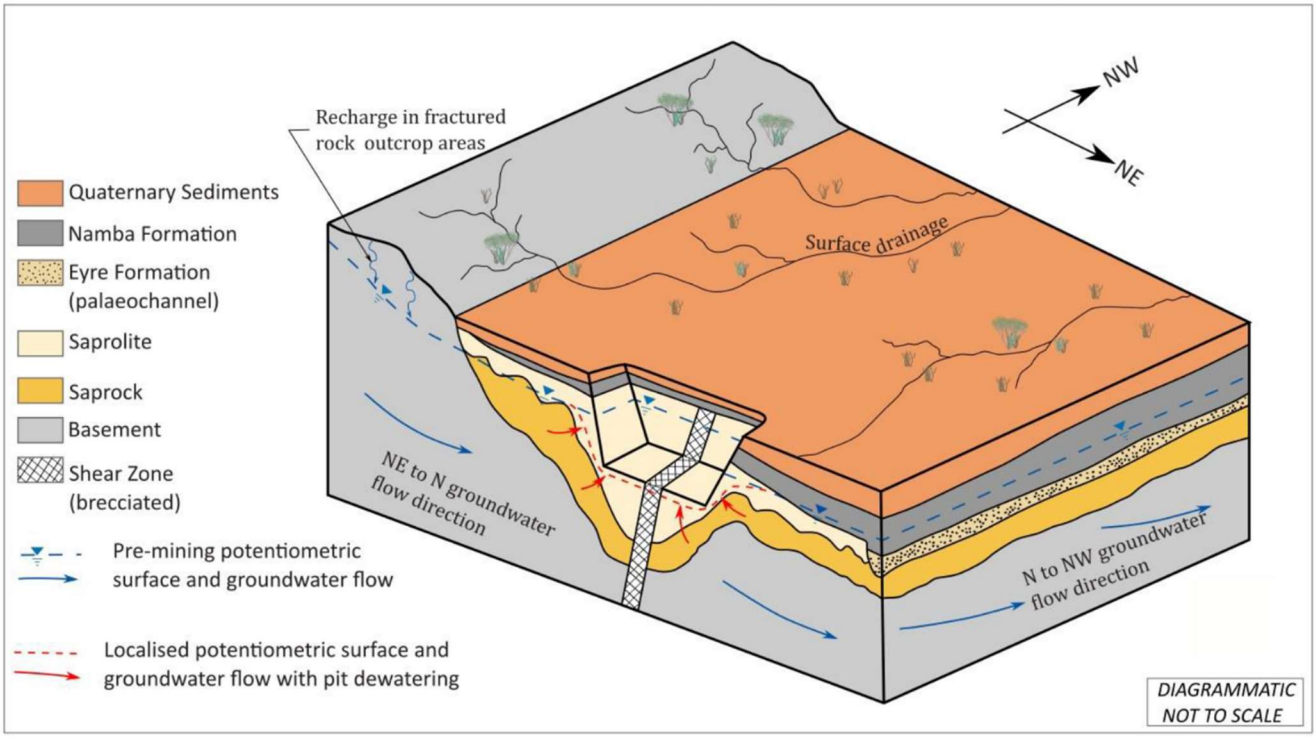


Figure 5 Regional cross section supporting the conceptual hydrogeological model in Figure 4, based on borehole data. It shows a single connected water zone extending through all formations below the water table. While the permeability of the various formations is variable from highly permeable in the Eyre Formation basal sands and gravels to almost impermeable, all formations below the water table are saturated and there is no confined aquifer as such (source: Draft Groundwater Impact Assessment Kalkaroo Copper-Gold Mine, report prepared for Havilah Resources by Water Technology 1 December 2021).

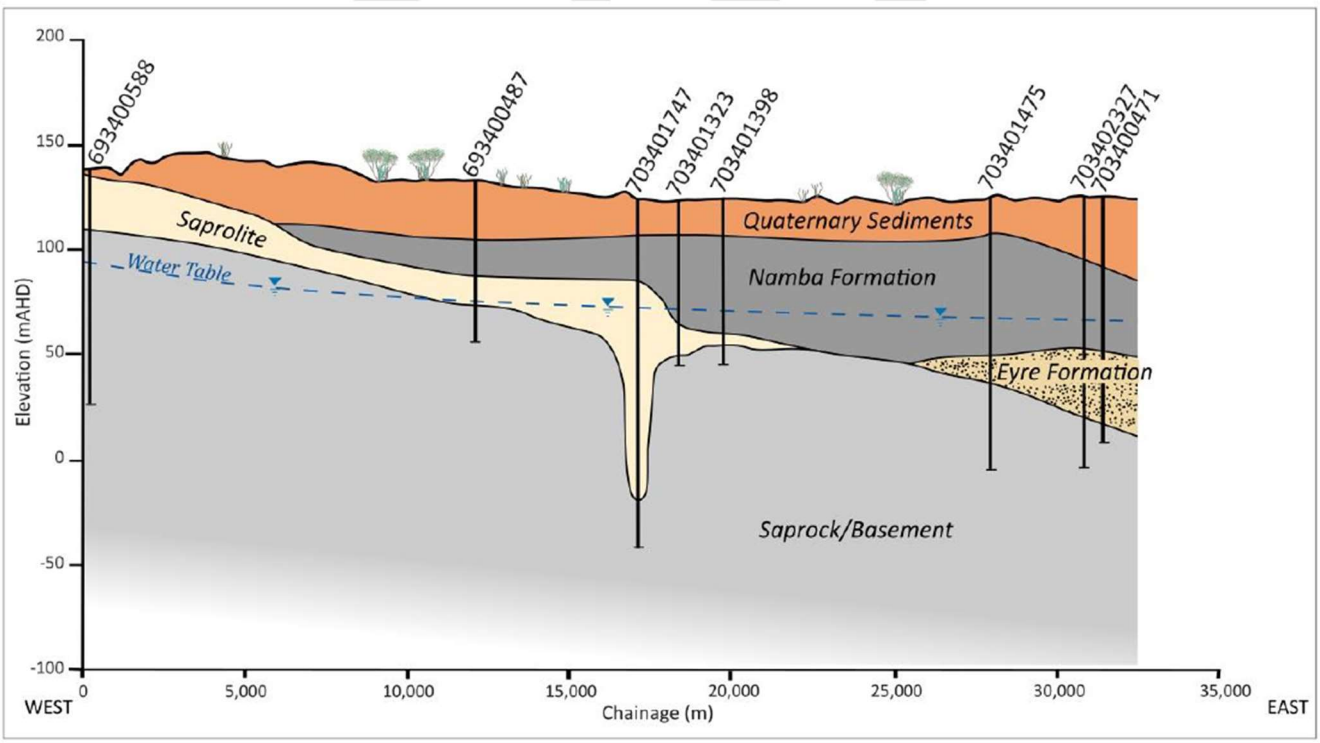
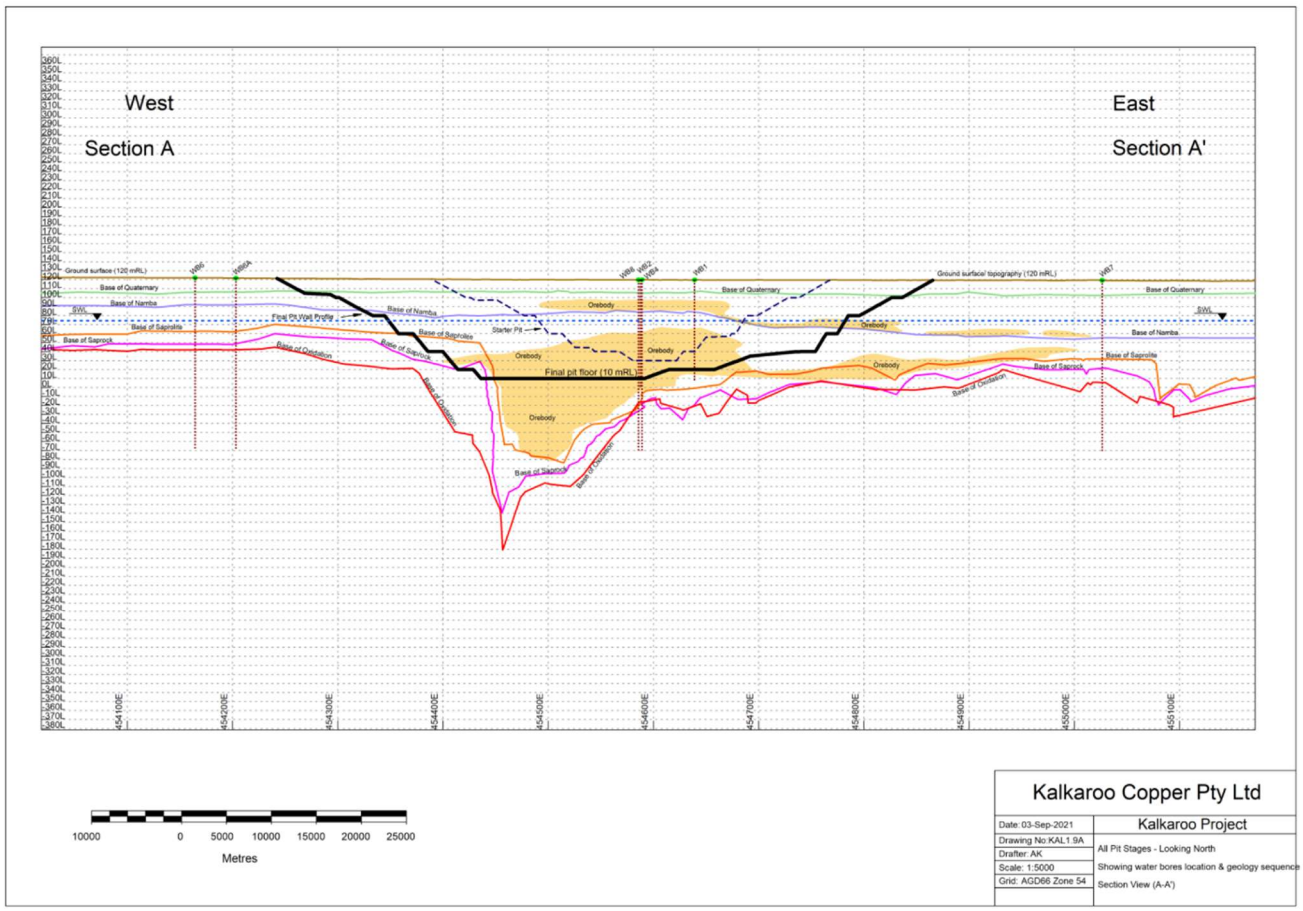
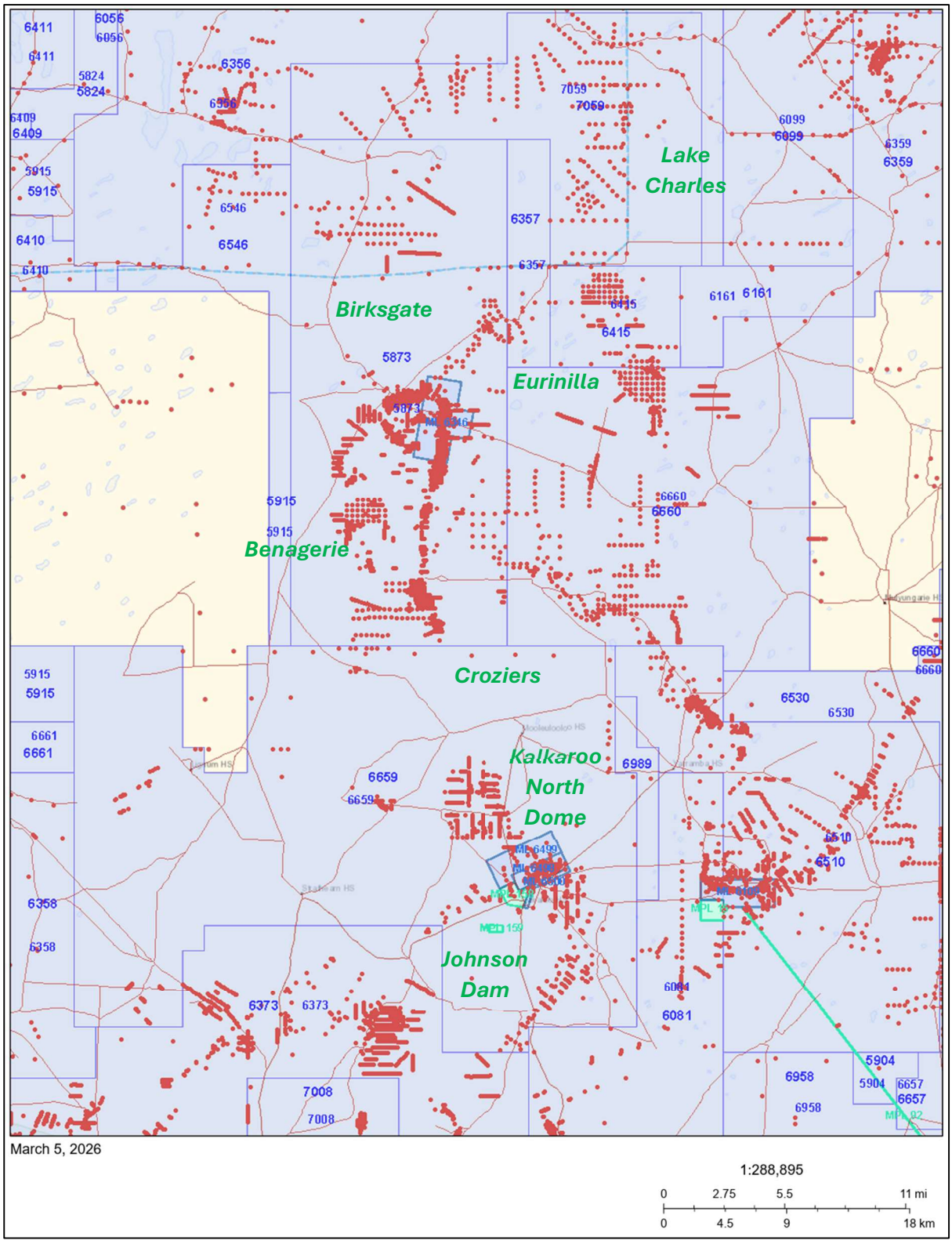


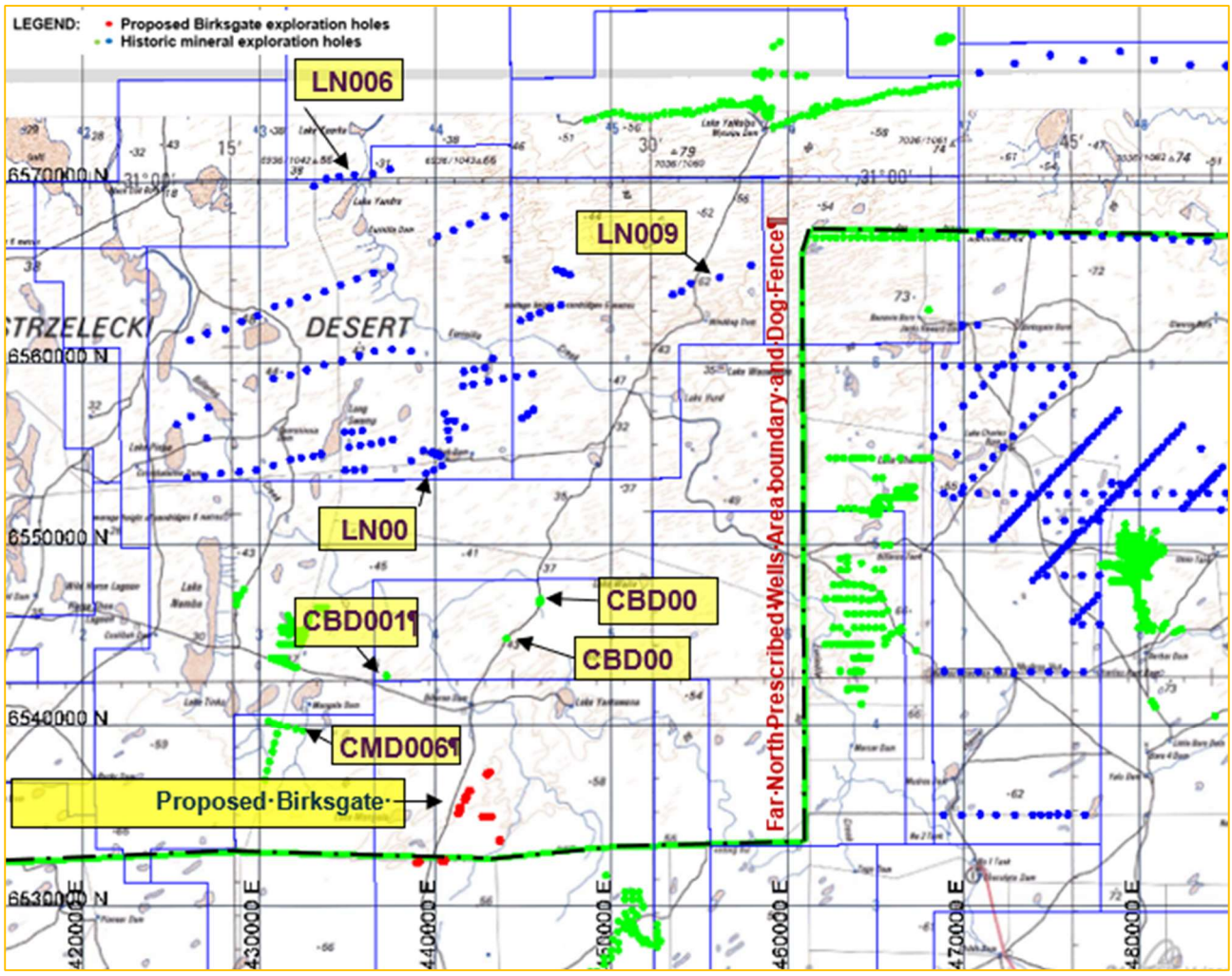
Figure 6 Cross section through the Kalkaroo orebody and conceptual open pit showing how the water table (SWL – blue dashed line) extends from the saprolite basement rocks into the Namba Formation, based on detailed hydrological studies. Both formations are of low permeability and are water saturated. The Eyre Formation is absent in this case (source: Draft Groundwater Impact Assessment Kalkaroo Copper-Gold Mine, report prepared for Havilah Resources by Water Technology 1 December 2021).



Attachment 1: SARIG print of historic drill holes and mining leases in the Central Curnamona area.



Attachment 2: Selected geological logs for historic mineral exploration drill holes in the Birksgate and Lake Charles areas.



Location of proposed Birksgate exploration drillholes relative to the Far North Prescribed Wells Area (and Dog Fence) boundary and historic selected exploration drill hole geological logs (see below).

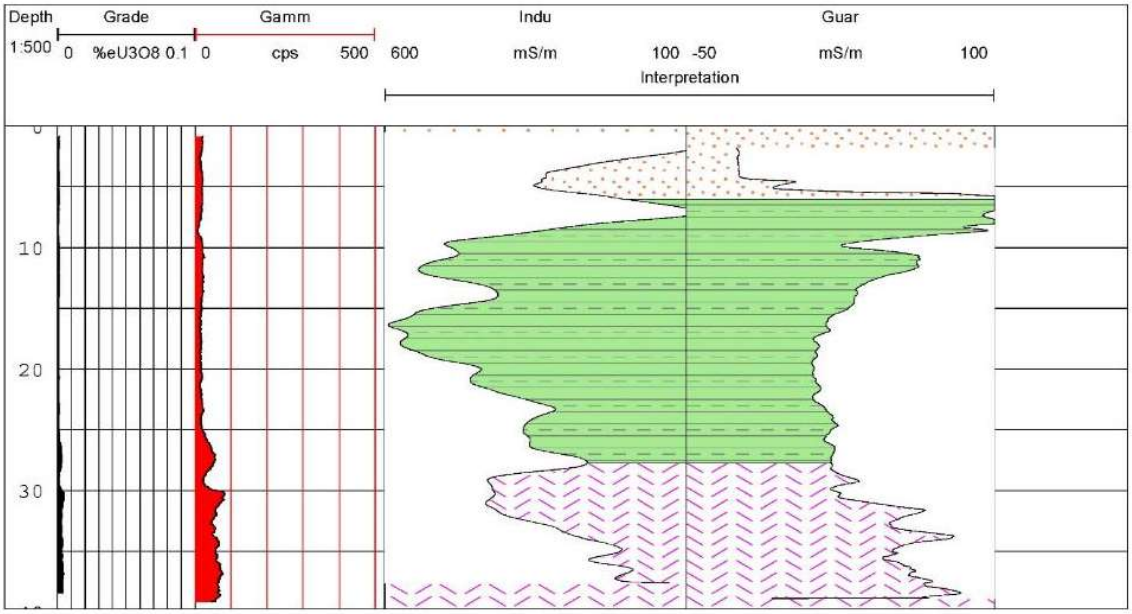
Tenement: 3151

Co-ords (AGD66)437248E 6542751N

Date: 24/11/+2006

Geologist: MHR

Hole ID	CBD001



Tenement: 3151

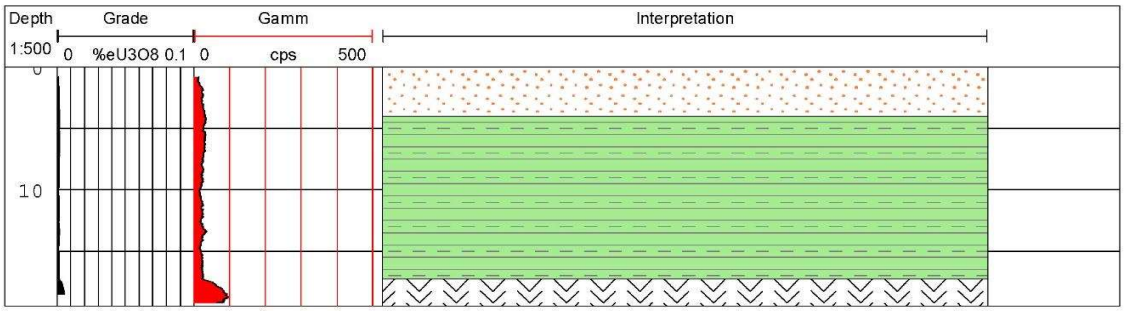
Co-ords (AGD66) 444048E 6544802N

Date: 26/11/2006

Geologist: MHR

Hole ID	CBD002

Quaternary Sand Namba Clay Willyama Rock



Tenement: 3151

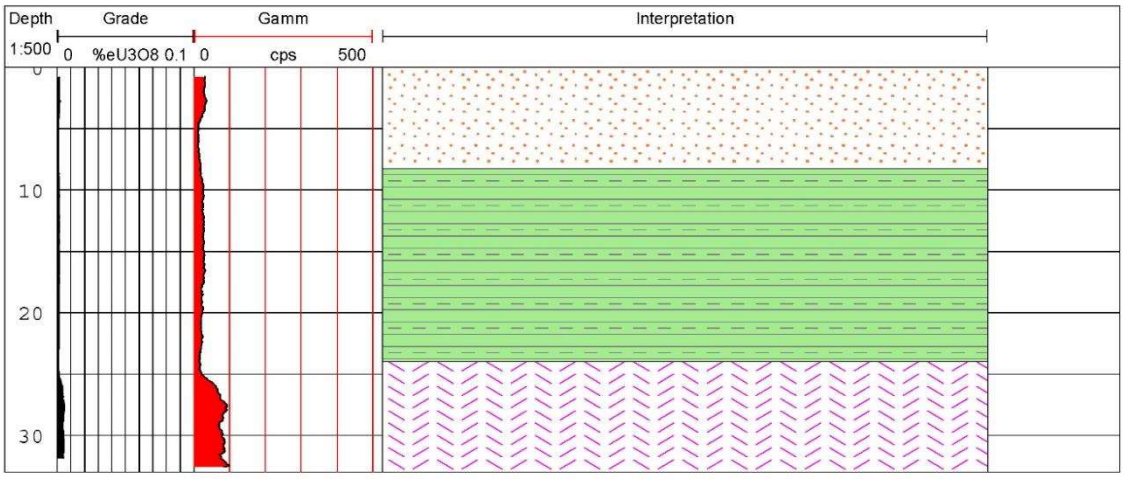
Co-ords (AGD66) 445981E 6546985N

Date: 26/11/2006

Geologist: MHR

Hole ID	CBD004

Quaternary Sand Namba Clay Willyama Saprolite



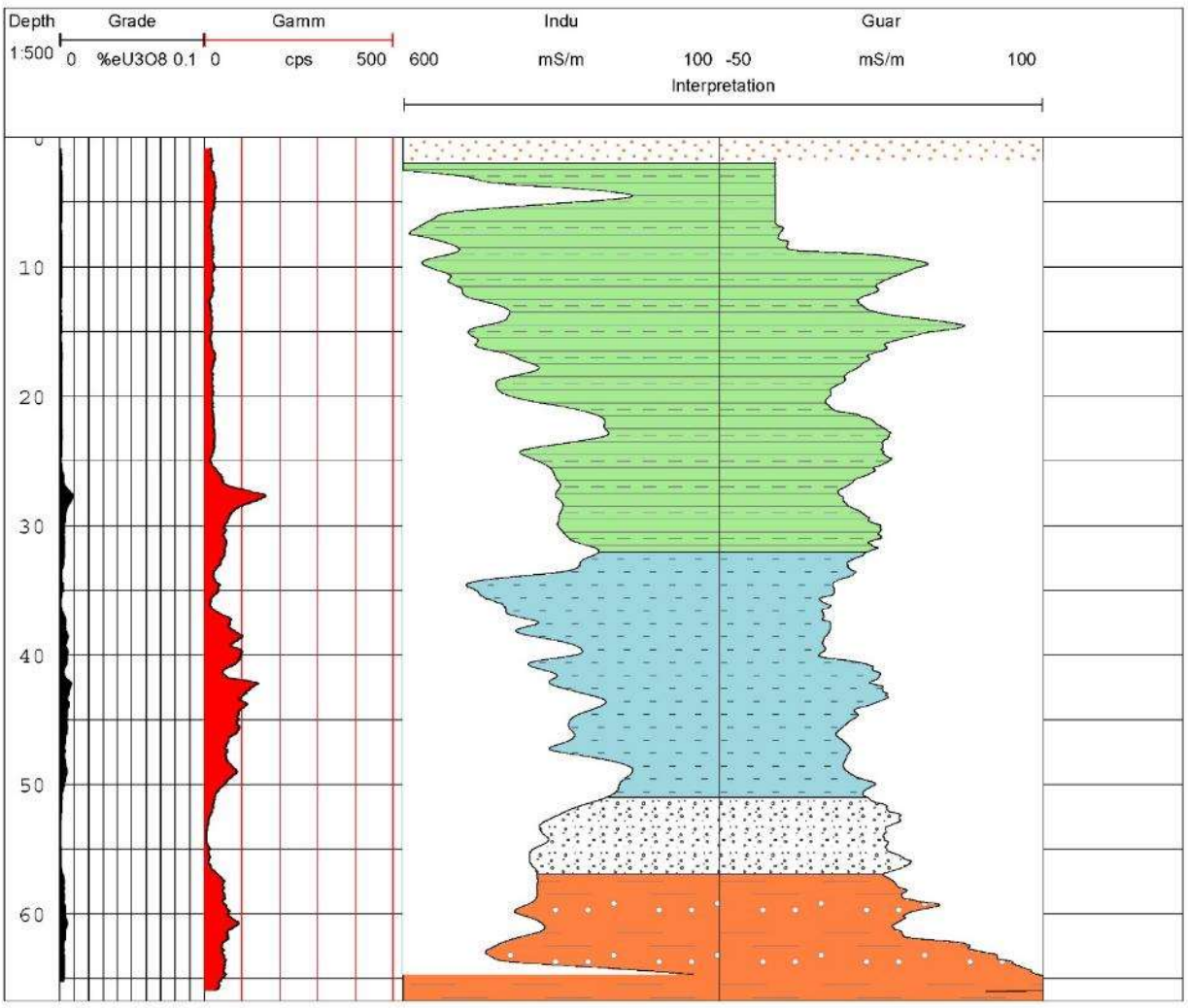
Tenement: 3299

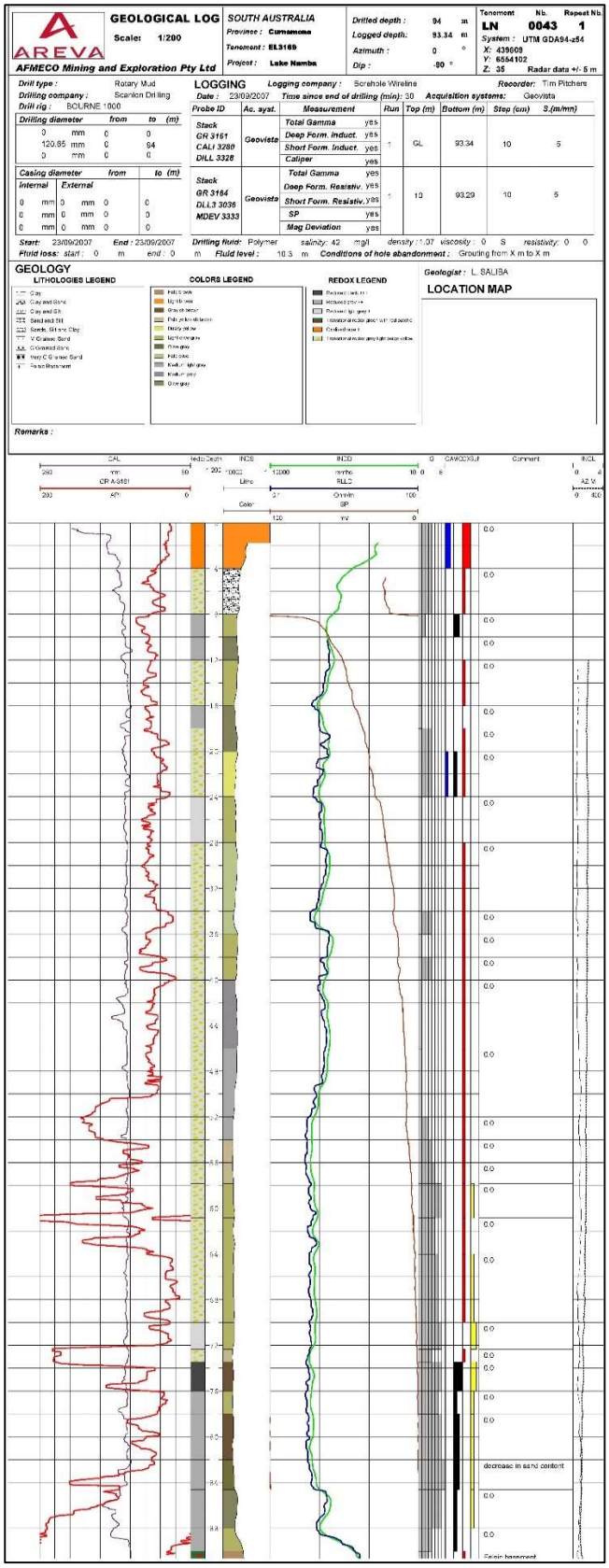
Co-ords (AGD66) 432473E 6539682N

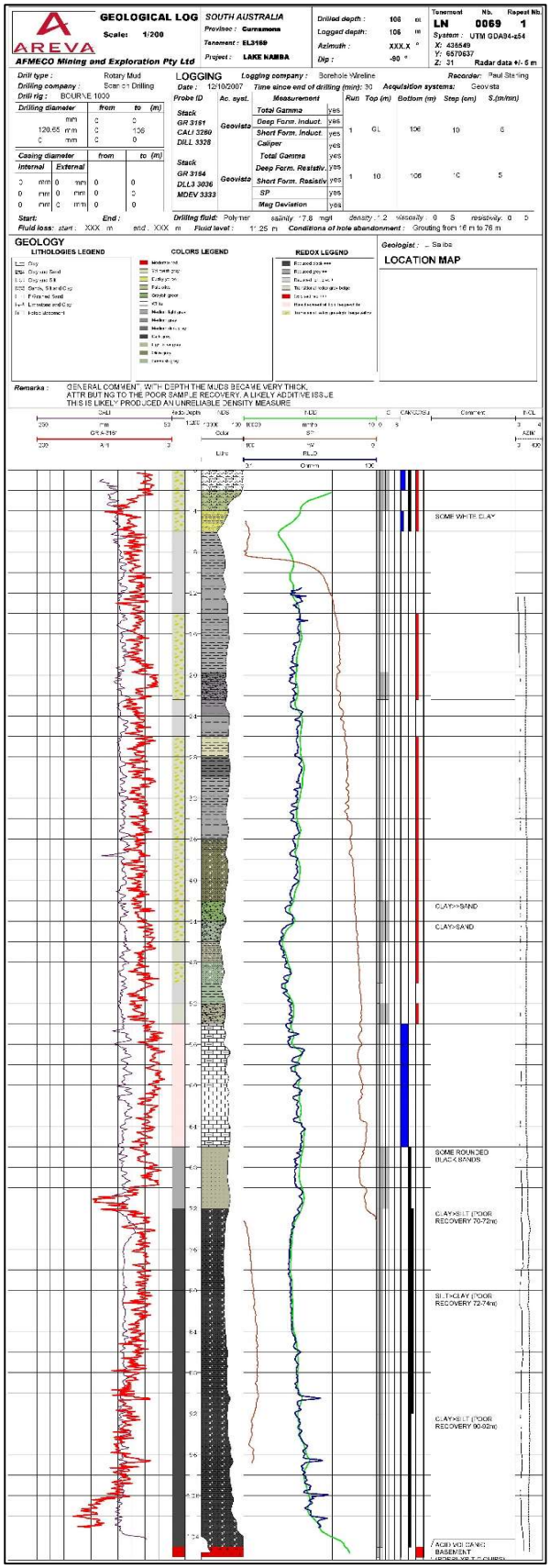
Date: 29/11/2006

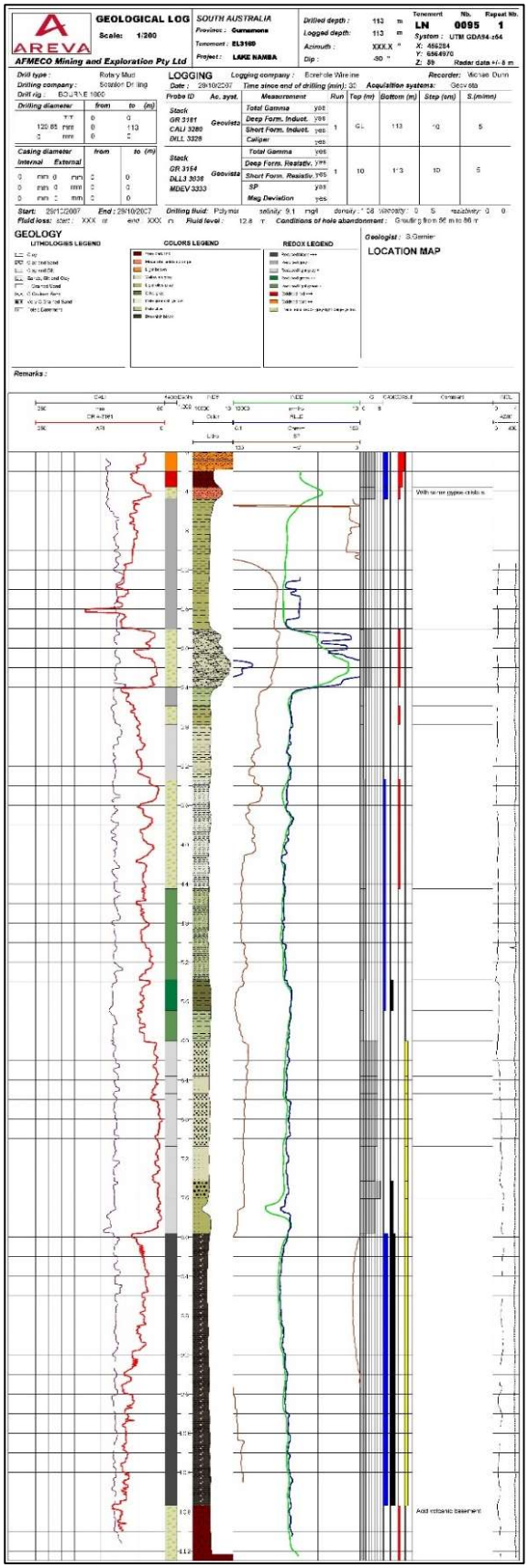
Geologist: MHR

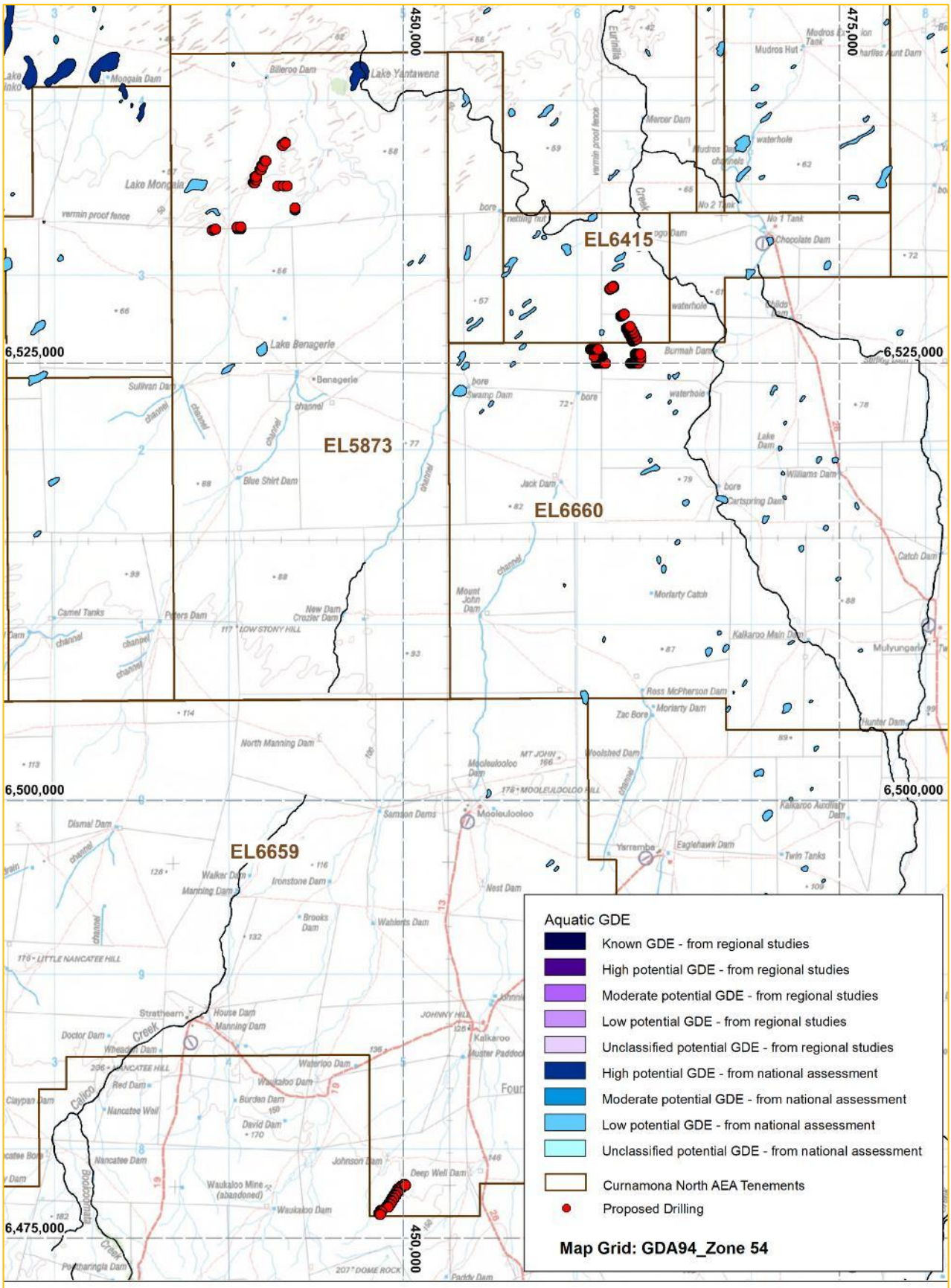
Hole ID	CMD006



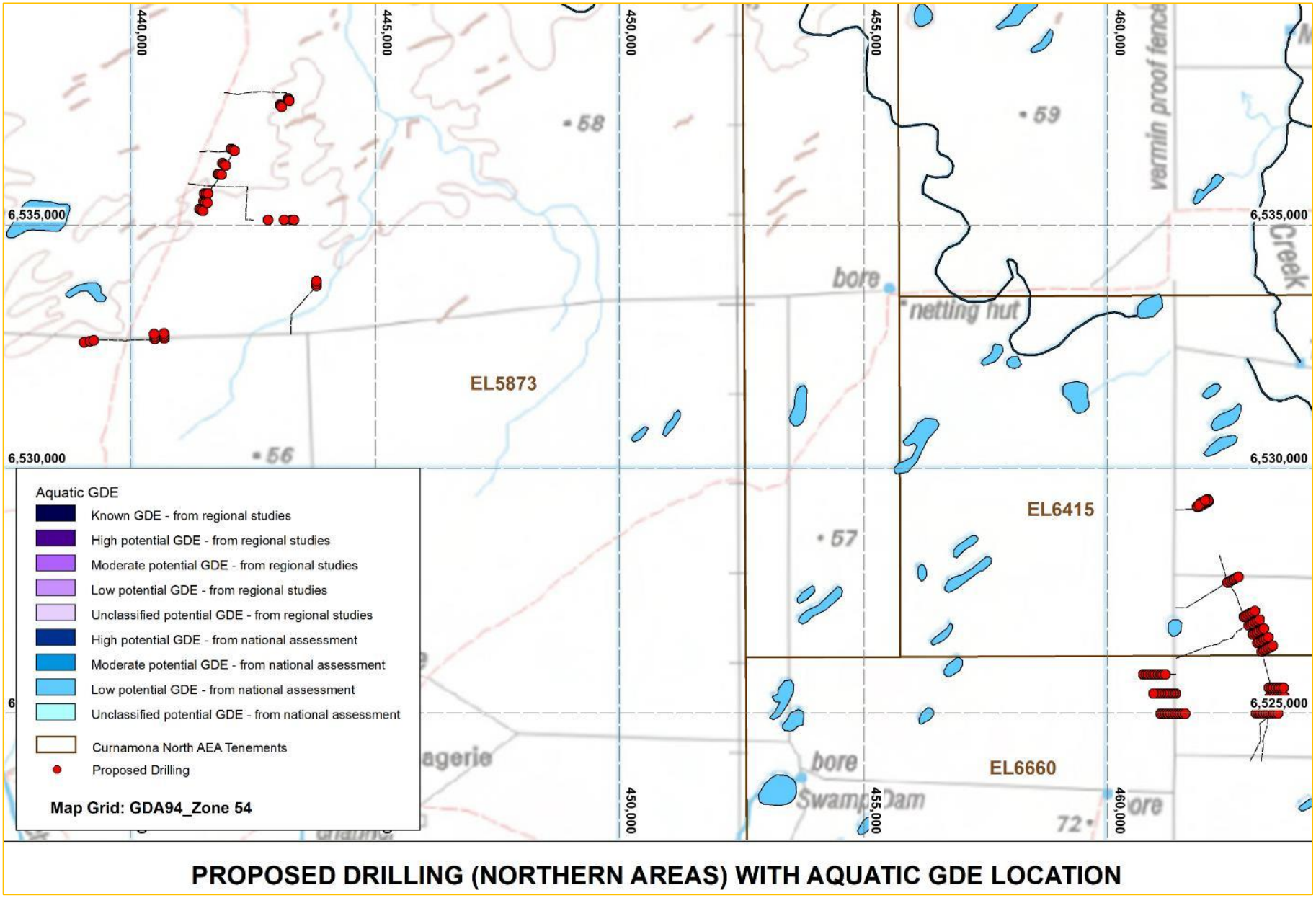

GEOLOGICAL LOG
Scale: 1/200
AREVA
AFMECO Mining and Exploration Pty Ltd
SOUTH AUSTRALIA
Province : Curnamona
Tenement : EL3169
Project : Lake Namba
Drilled depth : 94 m
Logged depth: 93.34 m
Azimuth : 0 °
Dip : -90 °
Tenement Nb. LN 0043
Repeat Nb. 1
System : UTM GDA94-z54
X: 439608
Y: 6554102
Z: 35 Radar data +/- 5 m
Drill type : Rotary Mud
Drilling company : Scanlon Drilling
Drill rig : BOURNE 1000
LOGGING
Logging company : Scrahole Wireline
Recorder: Tim Pitchers
Date : 23/09/2007
Time since end of drilling (min): 30
Acquisition systems: Geovista
Probe ID | Ac. syst. | Measurement | Run | Top (m) | Bottom (m) | Step (cm) | S.(m/mn)
Stack GR 3151 CALI 3280 DILL 3328 | Geovista | Total Gamma yes; Deep Form. Induct. yes; Short Form. Induct. yes; Caliper yes | 1 | GL | 93.34 | 10 | 5
Stack GR 3184 DLL3 3036 MDEV 3333 | Geovista | Total Gamma yes; Deep Form. Resistiv. yes; Short Form. Resistiv. yes; SP yes; Mag Deviation yes | 1 | 10 | 93.29 | 10 | 5
Drilling diameter from to (m)
0 mm 0 0
120.65 mm 0 94
0 mm 0 0
Casing diameter from to (m)
Internal External
0 mm 0 mm 0 0
0 mm 0 mm 0 0
0 mm 0 mm 0 0
Start: 23/09/2007 End : 23/09/2007
Fluid loss: start : 0 m end : 0 m
Drilling fluid: Polymer salinity: 42 mg/l density : 1.07 viscosity : 0 S resistivity: 0 0
Fluid level : 10.5 m
Conditions of hole abandonment : Grouting from X m to X m
GEOLOGY
LITHOLOGIES LEGEND
COLORS LEGEND
REDOX LEGEND
Geologist : L. SALIBA
LOCATION MAP
Remarks :
CAL
GR 3151
INCB
INCD
RLLD
SP
Comment
INCL
decrease in sand content


GEOLOGICAL LOG
SOUTH AUSTRALIA
Province : Gurnamma
Tenement : EL3169
Project : LAKE NAMBA
Scale: 1/200
AREVA
AFMECO Mining and Exploration Pty Ltd
Drilled depth : 108 m
Logged depth: 106 m
Azimuth : XXX.X °
Dip : -90 °
Tenement Nb. 0069 Repeat Nb. 1
LN
System : UTM GDA94-z54
X: 436549
Y: 6970937
Z: 31 Radar data +/- 5 m
Drill type : Rotary Mud
Drilling company : Scarr on Drilling
Drill rig : BOURKE 1000
LOGGING
Logging company : Borehole Wireline
Recorder: Paul Stirling
Date : 12/10/2007
Time since end of drilling (min): 30
Acquisition systems: Geovista
Drilling diameter
from to (m)
120.65 mm 0 106
Casing diameter
Internal External
from to (m)
Probe ID
Ac. syst.
Measurement
Run Top (m) Bottom (m) Step (cm) S.(m/mn)
Stack
GR 3161
CALI 3269
DILL 3328
Geovista
Total Gamma yes
Deep Form. Induct. yes
Short Form. Induct. yes
Caliper yes
Stack
GR 3154
DLL3 3036
MDEV 3333
Geovista
Total Gamma yes
Deep Form. Resistiv. yes
Short Form. Resistiv. yes
SP yes
Mag Deviation yes
1 GL 106 10 6
1 10 106 10 5
Start: End :
Fluid loss: start : XXX m end : XXX m
Drilling fluid: Polymer salinity : 7.8 mg/l density : 1.2 viscosity : 0 S resistivity : 0 Ω
Fluid level : 11.25 m Conditions of hole abandonment : Grouting from 16 m to 78 m
GEOLOGY
LITHOLOGIES LEGEND
COLORS LEGEND
REDOX LEGEND
Geologist : L. Saliba
LOCATION MAP
Remarks : GENERAL COMMENT: WITH DEPTH THE MUDS BECAME VERY THICK, ATTR BUTING TO THE POOR SAMPLE RECOVERY. A LIKELY ADDITIVE ISSUE TH S IS LIKELY PRODUCED AN UNRELIABLE DENSITY MEASURE
SOME WHITE CLAY
CLAY>>SAND
CLAY>SAND
SOME ROUNDED BLACK BANDS
CLAY>SILT (POOR RECOVERY 70-72m)
SILT>CLAY (POOR RECOVERY 72-74m)
CLAY>SILT (POOR RECOVERY 90-92m)
AGID VOLCANIC BASEMENT


GEOLOGICAL LOG
Scale: 1:200
AREVA
AFMECO Mining and Exploration Pty Ltd
SOUTH AUSTRALIA
Province : Gumsmore
Tenement : EL3160
Project : LAKE NAMBA
Drilled depth : 113 m
Logged depth: 113 m
Azimuth : XXX.X °
Dip : -90 °
Tenement LN
Nb. 0095
Repeat Nb. 1
System : UTM GDA94 z54
X: 466284
Y: 6564976
Z: 89
Radar data +/- 8 m
LOGGING
Logging company : Borehole Wireline
Recorder: Michael Dunn
Date : 29/10/2007
Time since end of drilling (min): 30
Acquisition systems: Geovista
Drill type : Rotary Mud
Drilling company : Scallon Drilling
Drill rig : BOURKE 1000
Drilling diameter
from to (m)
127 mm 0 0
120.65 mm 0 113
0 mm 0 0
Casing diameter
Internal External
from to (m)
0 mm 0 mm 0 0
0 mm 0 mm 0 0
0 mm 0 mm 0 0
Probe ID Ac. syst.
Stack
GR 3161 Geovista
CALI 3280
DILL 3328
Measurement Run Top (m) Bottom (m) Step (cm) S.(mm)
Total Gamma yes
Deep Form. Induct. yes
Short Form. Induct. yes
Caliper yes
1 GL 113 10 5
Stack
GR 3154 Geovista
DLL3 3036
MDEV 3333
Total Gamma yes
Deep Form. Resistiv. yes
Short Form. Resistiv. yes
SP yes
Mag Deviation yes
1 10 113 10 5
Start: 29/12/2007 End : 29/10/2007
Drilling fluid : Polymer
Fluid loss: start : XXX ml end XXX ml
Fluid level : 12.8 m
Conditions of hole abandonment : Grouting from 56 m to 56 m
GEOLOGY
LITHOLOGIES LEGEND
COLORS LEGEND
REDOX LEGEND
Geologist : S.Garnier
LOCATION MAP
Remarks :
With some oxidation
Acid volcanic basement



Map 11: EL5873, EL6415, EL6659, and EL6660 Aquatic GDE location and rating.



Map 12: EL5873, EL6415, and EL6660 Aquatic GDE location and rating.

Havilah Resources
Strategic Minerals in South Australia

Technical Memorandum

Date:	12 March 2026
From:	Geoff Borg MSc in Hydrogeology and Groundwater Management *Principal Environmental Advisor*
To:	Chris Giles *Technical Director* Amy Jacka *Tenement Manager* Traviss Just *Senior Geologist*
Subject:	Central Curnamona Hardrock Metal Prospects Hydrogeology

This memorandum is a review of the hydrogeology of mineral exploration hard rock metal prospects of the Central Curnamona region (Figure 1) to inform drillhole decommissioning in accordance with M21 for EPEPR submissions. Published reports, SA Water Connect Groundwater Data, historic exploration drilling data and observations by Havilah and others, and technical groundwater and geotechnical studies for Portia and Kalkaroo mining leases inform this review.

The Central Curnamona region as defined by the Exploration Licences (ELs) depicted in Figure 1. The priority (for future drilling) prospects identified are representative of the region for the purpose this review. South to north, these prospects are:

- Johnson Dam
- Kalkaroo North Dome (continuation of Kalkaroo Copper Project)
- Croziers
- Benagerie
- Eurinilla
- Birksgate (Prescribed Wells area, not intersecting Great Artesian Basin aquifers)
- Lake Charles (Prescribed Wells area, not intersecting Great Artesian Basin aquifers)

Future drilling on other prospects in this region will encounter groundwater conditions comparable to those discussed in this review.

The region is on the southern margin of the Lake Eyre Basin and extends, south to north, from outcropping to sub-cropping basement strata with onlapping Tertiary strata (Figure 2). Surface water and regional groundwater movement through the region is generally from south, Olary Ranges, to north – north west toward Lake Frome.

The northern extent is within the administrative boundary of the Northern Prescribed Wells Area and on the margins of the Great Artesian Basin (GAB) (Figure 3) but does not intersect basin aquifers.

The region is transected by Tertiary palaeovalleys eroded into basement strata (Figure 1). Palaeovalleys typically contain groundwater bearing sandy and gravelly strata hosting secondary uranium mineralisation, e.g. Honeymoon Uranium Mine. Consideration of such mineralisation is outside the scope of this review.

Geology of Target Metal Mineralisation

Target metal mineralisation occurs in fractured basement rock and overlying weathering profile (saprolite and saprock) of the Willyama Supergroup (Figure 2). Figure 2 provides a schematic illustration of the typical stratigraphy. In summary:

- Basement strata typically consist of folded Palaeoproterozoic Willyama Supergroup metasediments with a highly variable weathering profile consisting of saprolite over saprock. They are intruded by the Mesoproterozoic Ninnere Supersuite granites and unconformably overlain by the comagmatic Benagerie Volcanics in the north. In a few areas to the north, west and east metasediments are also directly overlain by Neoproterozoic (Adelaidean) and Cambrian strata (siltstone, shale, and conglomerate) strata, also with a variable, but generally much thinner weathering profile of saprolite and saprock.
- The top of the saprolite is unconformably overlain by two Cenozoic sequences, namely the Eyre Formation that is usually only preserved as erosional remnants in hollows and palaeochannels and the Namba Formation (up to 60 m thickness of interbedded sands and clays). These are invariably capped by Quaternary to Recent sands and minor gravels with gypsum & calcrete nodules (hardpan) (typically 5 - 15m thick) to the surface.

Regional Hydrogeology

Evans *et al* (2024) identifies the Central Curnamona area as being towards the southern limits of the Callabonna Sub-basin within the Kati Thanda – Lake Eyre Basin (Figure 3). The southern margin of the basin is defined by outcropping metasediments and igneous formations of the Willyama Supergroup that form the Olary Ranges. There is a decades long history of mineral exploration drilling and mining in the Central Curnamona (Attachment 1).

Evans *et al* (2024) describes "the main hydrostratigraphic units of the Callabonna Sub-basin are the (Cenozoic) Eyre, Namba, and Willawortina formations, and the undifferentiated Pliocene–Quaternary sediments…[form] a stacked aquifer–aquitard system with the Namba Formation acting as the regional aquitard that separates the deeper Eyre Formation aquifer from the near-surface aquifers of the Willawortina Formation and Pliocene–Quaternary sediments". In the Central Curnamona prospect areas the near surface Willawortina Formation and Pliocene sediments are not observed, presumably because of the distance from the Flinders Ranges source area. Evans *et al* (2024) describes the Namba Formation as an aquitard confining groundwater in underlying Eyre Formation aquifers.

In the Central Curnamona region prospect areas Eyre Formation aquifers have not been intersected by historic mineral exploration drilling. Localised intersections of thin and discontinuous Eyre Formation clay dominated strata, sometimes occur between Namba Formation and basement strata. Namba Formation strata intersections are typically highly fissured and fractured clay with some discontinuous sandy units. Namba Formation, saprolite,

saprock, unweathered basement typically presents as one continuous low permeability section.

Water Technology (2021) describes the potentiometric water levels in wells across the Kalkaroo Copper Project area as reporting to the same regional water table (Figures 4, 5, 6). This includes wells screened in basement strata (unweathered) and saprock and saprolite. Aqueon (2017) similarly presents data for wells constructed at Portia and screened in unweathered basement or saprolite/ Eyre Clay / Namba Formation as also reporting to a same regional water table. This correlation is confirmed by hundreds of observations by Havilah geologists logging RC drill holes across the Kalkaroo deposit and the broader Central Curnamona region, where the change from unsaturated to saturated conditions, i.e. regional water table, is marked by readily observable changes in moisture content and plasticity of the clays.

Havilah interprets the saturated sections of saprolite and Namba Formation clays as continuous with underlying water bearing strata, namely the Eyre Formation clay strata (where present) the fractured Willyama Supergroup basement rocks). This is supported by consistent groundwater chemistry in basement rocks, and Eyre and Namba Formations in the southern Callabonna Sub-basin (Evans *et al*, 2024) and as consistently observed by Havilah geologists in Havilah RC drillholes.

Evans *et* al (2024) notes "at Portia gold mine in the Callabonna Sub-basin, the shallowest groundwater system occurs in a fractured rock aquifer... This aquifer is naturally confined by the overlying Namba Formation aquitard, with the near-surface sediments of the Callabonna Sub-basin largely unsaturated in this area. When bores near the mine intersect the fractured rock aquifer, the water level naturally rises from the initial intersection depth (usually around 90 m below surface) to levels about 20–30 m below surface following bore completion. Due to missing data, such as depths that groundwater is initially intersected, the degree of confinement is difficult to determine for some bores". This statement is generally correct, but Havilah notes from its experience at Portia and elsewhere, the reason first groundwater is often not recorded in saprolite, or Namba Formation is because of the low permeability of the clays and the slow ingress of water into the borehole. However, as noted above, the regional water table and water saturation can be clearly recognised by the change in moisture content and plasticity of the Namba Formation clays in drill samples (and in the walls of the Portia gold mine open pit).

Groundwater intersections within unweathered basement strata, as observed during reverse circulation (RC) drilling, varies from no water production to, occasionally, sections of continuous (while drilling) water production. This correlates with intersecting strata with:

- Few and / or closed fractures (producing no water), or
- Common and open fractures or fault zones (that are water filled).

Water Technology (2021) characterised the Kalkaroo fault zone (that runs transects the Kalkaroo copper-gold orebody) as a strip aquifer within a regional unconfined aquifer comprising low permeability saturated basement strata, saprock, saprolite, and Namba Formation. This is based on these strata having vertically and laterally comparable low permeability and transmissivity hydraulic properties.

Groundwater quality is typically saline (range: 9,500 to 25,400 mg/L, average: 13,625 mg/L) with a pH range of 6.4 to 7.8 (Water Technology, 2021 and Aqueon, 2017).

Hardrock Metal Prospects Hydrogeology

Basement geology comprises metamorphosed Palaeoproterozoic Willyama Supergroup metasediments, Mesoproterozoic Benagerie Volcanics and Ninnerie Suite granitoids of the Curnamona Province and some Neoproterozoic metasediments. Cenozoic cover strata unconformably overlie basement strata and generally increase in thickness towards the north, excepting over basement topographic highs.

The basement rocks typically have a deeply weathered profile of clay rich saprolite to saprock above fresh unweathered and variably fractured rock. This profile varies locally depending on basement topography, the sulphide content of the original basement strata, and the presence of structural features such as shear zones that can result in deeper weathering or erosion of the profile.

Cenozoic cover includes Eyre Formation, typically preserved as white to grey soapy clays (Eyre Clay) as localised remnants in basement topographic lows. Eyre Formation sands and gravels are limited to incised palaeovalleys in the basement such as the Yarramba Palaeochannel that is host to the Honeymoon Uranium Mine. Cenozoic Namba Formation clays and lesser sands unconformably overlie the Eyre Formation and basement, forming a blanketing cover over much of the Central Curnamona region that is typically capped by Quaternary outwash sediments of the Frome Plains (including frequent hardpan) that in turn are overlain by Holocene aeolian sands with increasing abundance towards the north.

These cover strata are variably developed from place to place, and their thickness is controlled by the Benagerie Ridge basement high and local basement topography. In the south, basement rocks outcrop (Olary Ranges) or are very near surface (Johnson Dam) and they can also subcrop or have minimal cover many kilometres to the north (Croziers, Birksgate, and Lake Charles). More generally, there is significant cover of Namba Formation clays (and more rarely Eyre Clay) lying unconformably on the basement over much of the area (e.g. Kalkaroo North Dome and Eurinilla).

Namba Formation consists predominantly of medium to high plasticity, highly fissured and fractured smectitic clay with occasional thin lenses of clayey sand and silt, typically toward the base of the formation. Eyre Formation may occur locally beneath the Namba Formation and consists of plastic, highly fissured clay and silty clay in this area.

Surficial Quaternary sediments and underlying Cenozoic Namba Formation (where present) and Eyre Formation (where present) strata are clay rich with low permeability. It is important to note that clay rich Cenozoic strata are typically highly fissured with joints and slickensides providing secondary permeability. This was very evident in the walls of the Portia gold mine open pit but is not obvious in pulverised RC drill chips. Basement rocks are generally of low permeability with joints and fractures providing secondary permeability.

Ephemeral perched water tables within Quaternary cover sediments have not been encountered during mineral exploration drilling or in geotechnical studies (Water Technology, 2021 and Mining One, 2017)and the Portia Tailings Storage Facility compliance monitoring of wells screened in these sediments. At the Portia gold mine open pit, which provided a real life case study, no ingress of water was observed from any of the permeable sand layers with the Quaternary and upper Namba Formation above the water table. The sands were invariably completely dry and powdery. This has been the experience of pastoralists in the area who have

drilled numerous water bores into these sands over more than a hundred years, without any notable success, causing them to rely solely on surface water catchment in dams.

Groundwater occurs in a saline low permeability regional unconfined aquifer (water table) with a low but consistent hydraulic gradient indicating flow from south (Olary Ranges – recharge area) to north (toward Lake Frome). This water table is in basement rocks to the south and variably intersects the basement to Namba Formation strata to the north, depending on local relative elevation of the basement - Namba interface. Saturated formations are transmissive and low permeability (Namba Formation, Eyre Clay, and basement – including the highly weathered clay dominated saprolite to saprock to unweathered rock). Groundwater is slow moving with generally increasing salinity with distance away from recharge zones (Olary Ranges). Water quality is typically saline (around 13,625 mg/L) with a pH of around 7.8.

In previous phases of exploration drilling on Havilah's exploration prospects the intersection of regional groundwater has typically been evident as wet or mushy RC (reverse circulation) returns and occasional slugs of saline water suggesting intersection with water filled sedimentary lenses or (in basement) joints or fractures. Intersection with larger water filled structures, such as shear zones or faults, tends to produce initial water discharge that decreases over time as drilling progresses beyond the structure.

Great Artesian Basin aquifers, such as the Cadna-owie Formation, do not occur in the Central Curnamona region prospect areas based on past exploration drill hole logging data.

Far North Prescribed Wells Area (Birksgate Prospect)

Birksgate and Lake Charles hard rock metal prospects are situated wholly or partly within the Far North Prescribed Wells Area, as defined locally by the Dog Fence (Attachment 2).

Historic exploration drilling in these prospect areas has not intersected Great Artesian Basin aquifers of the Cadna-owie Formation (Attachment 2). Normally it is observed that Cenozoic sediments directly overlie the basement rocks (or in some cases Neoproterozoic strata). The impermeable Cretaceous age Bulldog Shale is locally intersected in some uranium exploration drillholes within palaeochannel or blanket sands further north and outside of the northern-most Birksgate and Lake Charles hard rock metal prospect areas.

Mineral Exploration Drillhole Decommissioning Procedure

Drillholes will be decommissioned to restore, as far as feasible, the controlling geological conditions that existed before the hole was drilled.

Groundwater is expected to occur as a single regional saline low permeability unconfined aquifer reporting to a water table that is mostly within basement strata but locally could be in the base of Namba Formation strata, depending on local basement profile relative elevation. While there is potential for localised (ephemeral) perched water tables forming on shallow hard pan (Recent – Quaternary sediments) or top of Namba Formation sandy strata, such perched water tables have never been observed during mineral drilling.

The above observations provide the basis for the drillhole decommissioning method and assessment of restoration of prevailing geological conditions are presented in Table 2.

References

1. Aqueon (2016) *Portia Gold Project – Numerical Model Update and Hydrogeological Review to Support Open Pit Expansion Plans Project Report*. Portia Mine Site ML 6346 Program for Environmental Protection and Rehabilitation submitted by Benagerie Gold and Copper Pty Ltd (https://catalog.sarig.sa.gov.au/dataset/mesac27123/resource/4b6f094f-9fdf-4a57-9c59-1caf767105fd)
2. Department for Energy and Mines (DEM) 2012 *M21 Guidelines for Mineral Exploration: Mineral Exploration Drillholes – General specifications for construction and backfilling* (M21). (https://catalog.sarig.sa.gov.au/dataset/2019d003020/resource/cbd408d4-7812-496c-8a7e-ec29ac4b2627)
3. Evans TJ, Bishop C, Symington NJ, Halas L, Hansen JWH, Norton CJ, Hannaford C and Lewis SJ (2024) *Cenozoic geology, hydrogeology, and groundwater systems: Kati Thanda – Lake Eyre Basin*, Record 2024/05, Geoscience Australia, Canberra, http://dx.doi.org/10.26186/147422.
4. Havilah (2026) *Namba Formation Self-Sealing Test Report*
5. Water Technology (2021) *DRAFT Groundwater Impact Assessment Kalkaroo Copper-Gold Mine*. Report prepared for Havilah Resources Limited to accompany the Kalkaroo PEPR.

Tables

Table 1 Central Curnamona Hydrogeological Summary

Johnson Dam					
Formation age and/or stratigraphic unit	**Stratigraphic intervals (depth range) (m)**	**Aquifer formation name**	**Aquifer interval/thickness (from–to) (m)**	**Type of aquifer(s) intersected**	**Provide aquifer salinity, depth to water level and any other relevant comments**
Quaternary sediments	largely absent, if present, up to 2 m	NA	NA	NA	NA
Basement: Weathered profile (saprolite and saprock) Willyama Supergroup – Palaeoproterozoic	Surface to beyond limit of drilling	Regional low permeability water bearing zone	From ~45 m to beyond limit of drilling	Unconfined	Saline groundwater (TDS ~13,625 mg/L, pH ~ 7.8)
Kalkaroo North Dome and Eurinilla					
Formation age and/or stratigraphic unit	**Stratigraphic intervals (depth range) (m)**	**Aquifer formation name**	**Aquifer interval/thickness (from–to) (m)**	**Type of aquifer(s) intersected**	**Provide aquifer salinity, depth to water level and any other relevant comments**
Quaternary sediments	0 - 14	NA	NA	NA	NA
Namba Formation – Early-Mid Miocene	14 - 56	NA	NA	N/A	NA
		Regional low permeability water bearing zone	From ~30 m to beyond limit of drilling	Unconfined	Saline groundwater (TDS ~13,625 mg/L, pH ~ 7.8).
Eyre Formation – Eocene	56 – 66 (where present)				
Basement: Weathered profile (saprolite and saprock) Willyama Supergroup – Palaeoproterozoic	66 – beyond limit of drilling				
Croziers, Benagerie, Birksgate and Lake Charles					
Formation age and/or stratigraphic unit	**Stratigraphic intervals (depth range) (m)**	**Aquifer formation name**	**Aquifer interval/thickness (from–to) (m)**	**Type of aquifer(s) intersected**	**Provide aquifer salinity, depth to water level and any other relevant comments**
Quaternary sediments	0 - 6	NA	NA	NA	NA
Namba Formation – Early-Mid Miocene	6 - 16	NA	NA	N/A	NA
Basement: Weathered profile (saprolite and saprock) Adelaidean strata – Neoproterozoic (where present) Willyama Supergroup – Palaeoproterozoic	16 – beyond limit of drilling	Regional low permeability water bearing zone	From ~30 m to beyond limit of drilling	Unconfined	Saline groundwater (TDS ~13,625 mg/L, pH ~ 7.8)

Table 2 Drillhole Decommissioning

Risks	**Decommissioning Method**	**Geological Condition on Completion**
Contamination of aquifers through entry of pollutants from the surface	Backfilled PVC collar cut below ground level, capped, and bury with topsoil and restore surface ground conditions consistent with surroundings	Restored – no potential for contaminants to enter the drillhole from the surface
Interconnection between aquifers Flow of pressurised water to the surface or into dry 'thief' zones Degradation of natural hydrostatic conditions (maintain pre-drilling pressures)	No artesian or confined aquifers PVC collar isolates potential ephemeral perched water tables from the regional basement aquifer Natural sealing (swelling)* of Namba Formation (where present) reactive clay strata closes the drillhole Note: * refer Havilah (2026) for Namba Formation Self Sealing Test Report Backfill drillhole void with cuttings	Restored – regional aquifer isolated from surface and potential shallow ephemeral perched water tables
Any physical hazard resulting from an open hole Any environmental hazard resulting from an open hole which could become a trap for small animals or be hazardous to stock	Backfill drillhole void with cuttings Backfilled PVC collar cut below ground level, capped, and bury with topsoil and restore surface ground conditions consistent with surroundings	Restored – no drillhole void and no potential for access to drillhole from surface

Figures

*Figure 1 Priority Havilah Central Curnamona hard rock metal prospects relative to inferred Tertiary palaeovalleys transecting the region. (**Notes**: The full extent of the Havilah exploration licences are not depicted. Kalkaroo Copper MLs and MPLs shown for reference. Base map and image production source: Google Earth)*

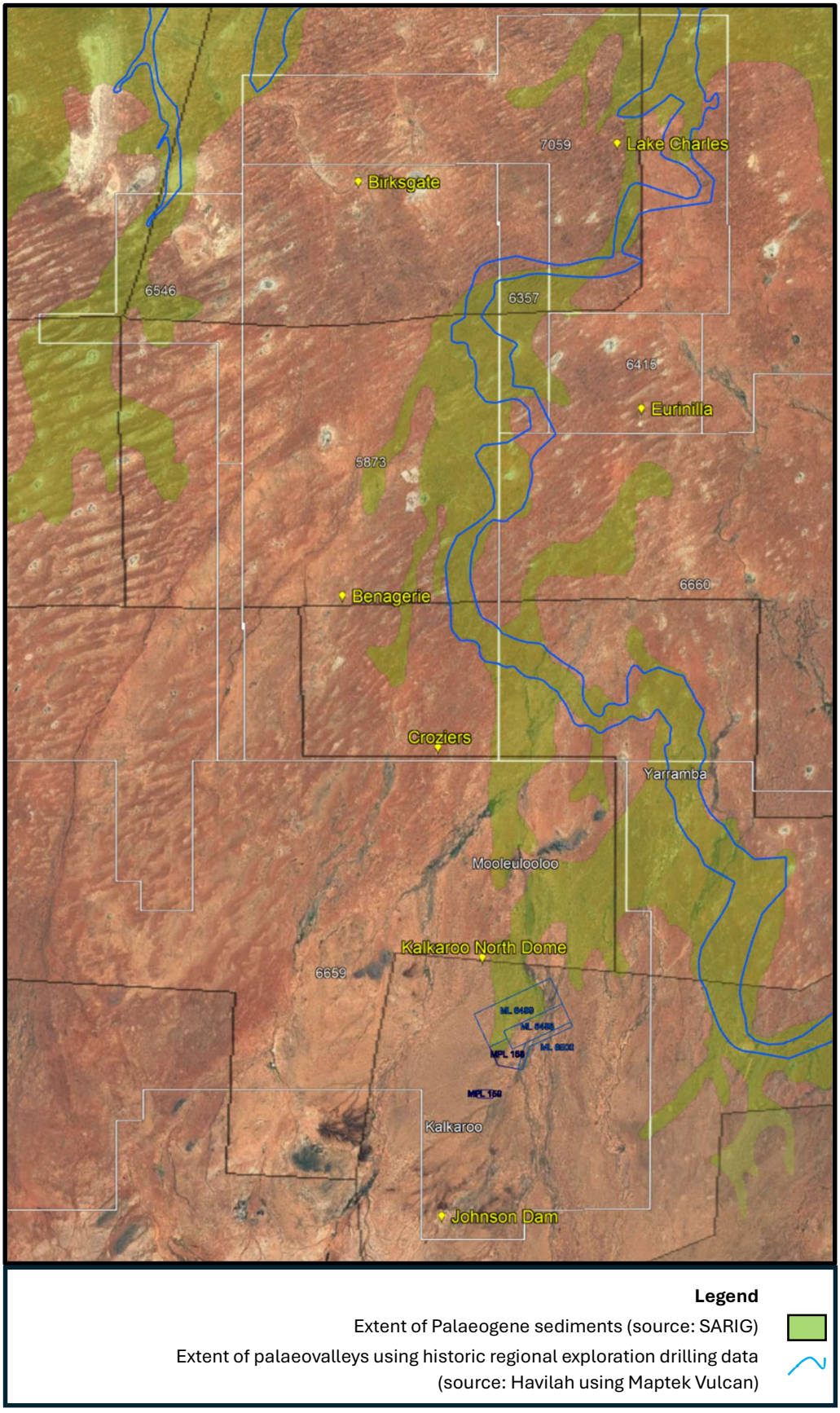


Figure 2 Generalised stratigraphic profile and target mineralisation in the Central Curnamona region.

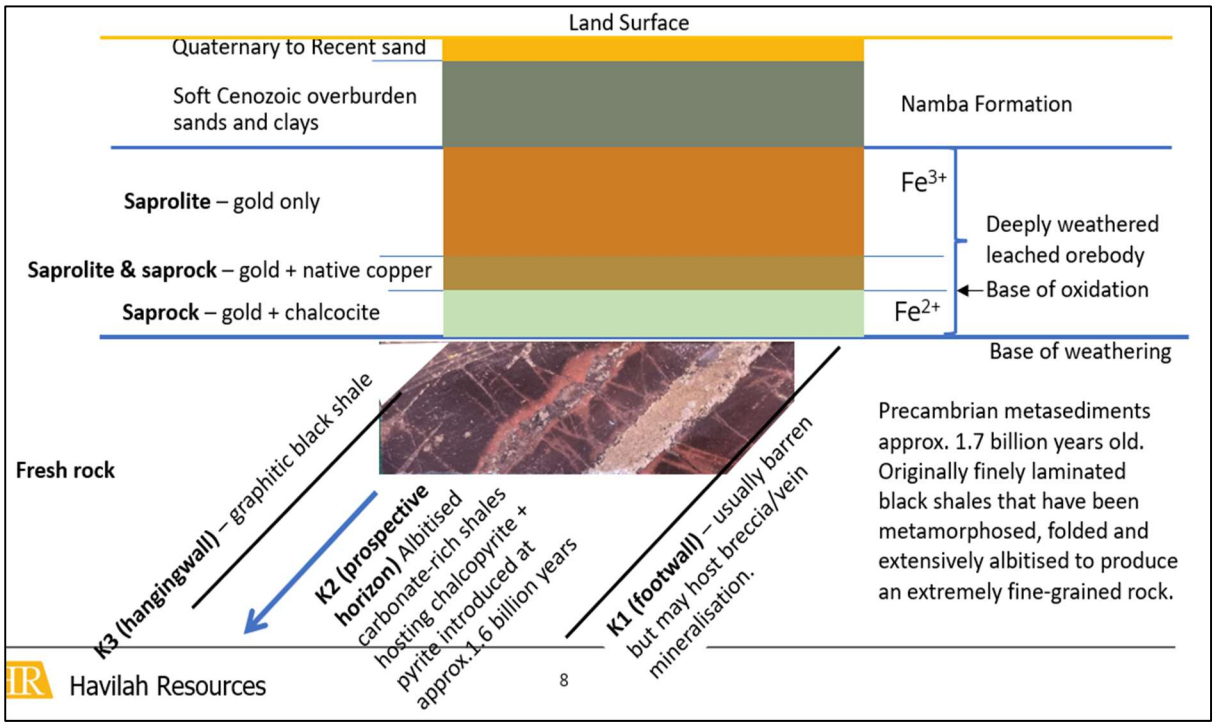


Figure 3 Location of nearby mines Portia, Kalkaroo, and Honeymoon in the Kati Thanda – Lake Eyre Basin (modified from Evans et al (2024).

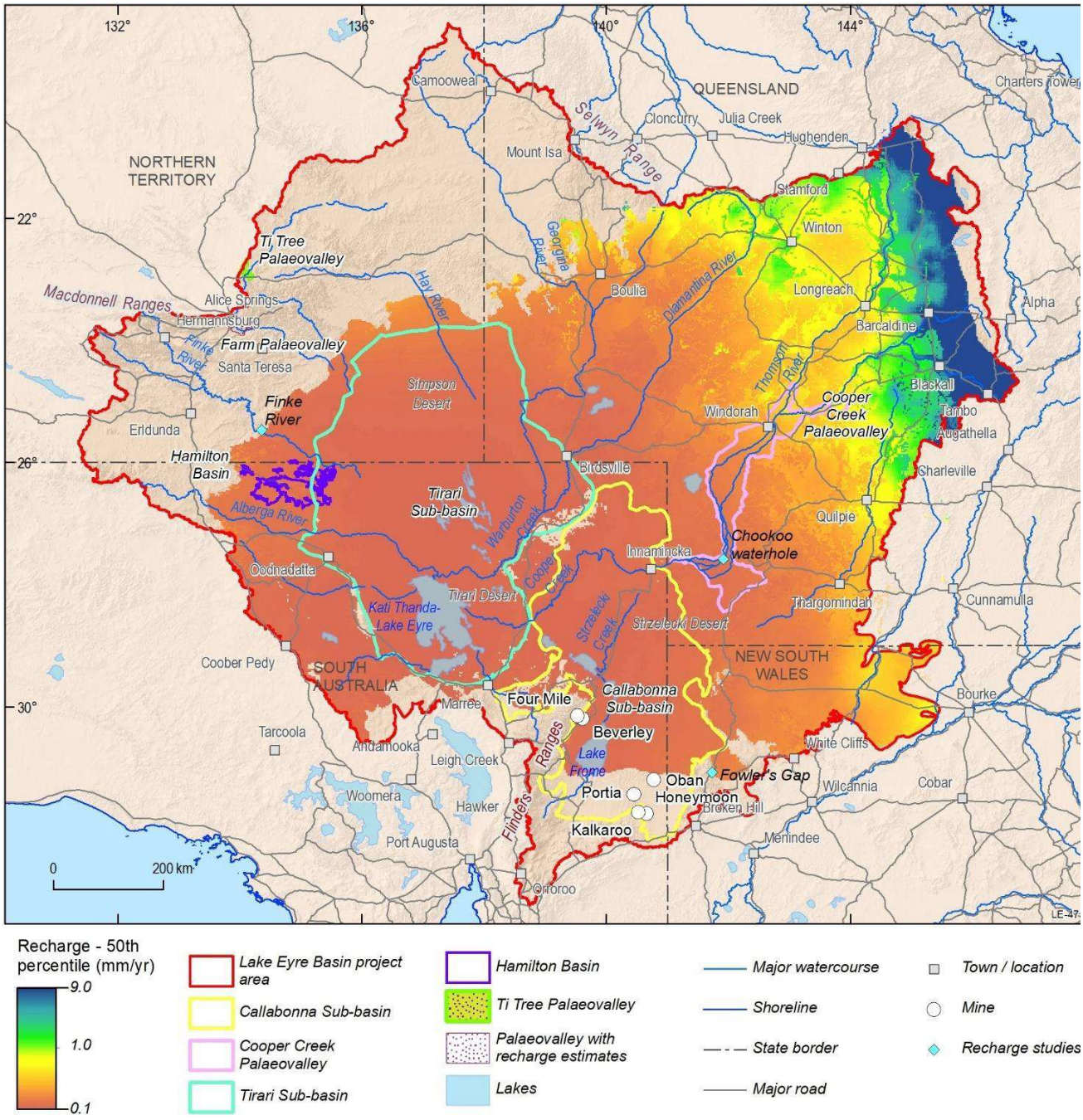


Figure 4 Conceptual hydrogeological model for the Kalkaroo area and applicable throughout most of the region outside of the Tertiary palaeochannels, such as the Yarramba Palaeochannel at the Honeymoon Mine, showing a single regional unconfined aquifer.

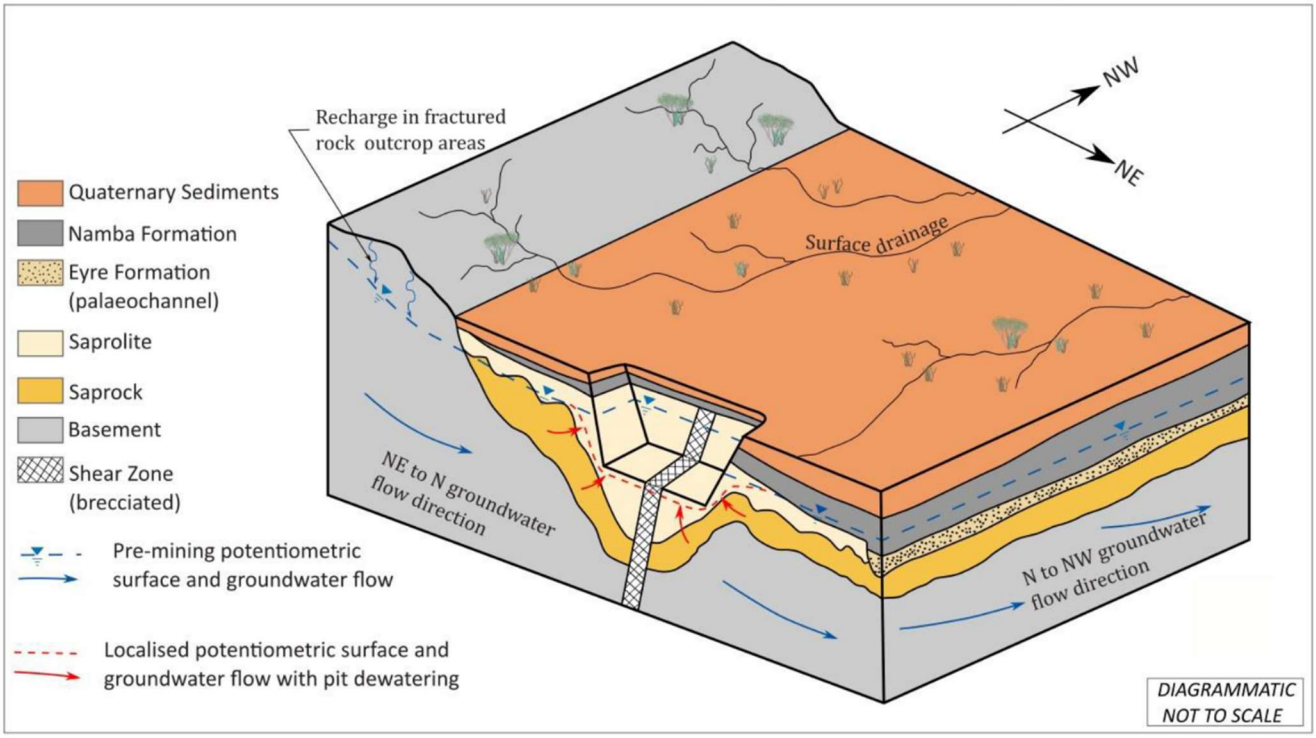


Figure 5 Regional cross section supporting the conceptual hydrogeological model in Figure 4, based on borehole data. It shows a single connected water zone extending through all formations below the water table. While the permeability of the various formations is variable from highly permeable in the Eyre Formation basal sands and gravels to almost impermeable, all formations below the water table are saturated and there is no confined aquifer as such (source: Draft Groundwater Impact Assessment Kalkaroo Copper-Gold Mine, report prepared for Havilah Resources by Water Technology 1 December 2021).

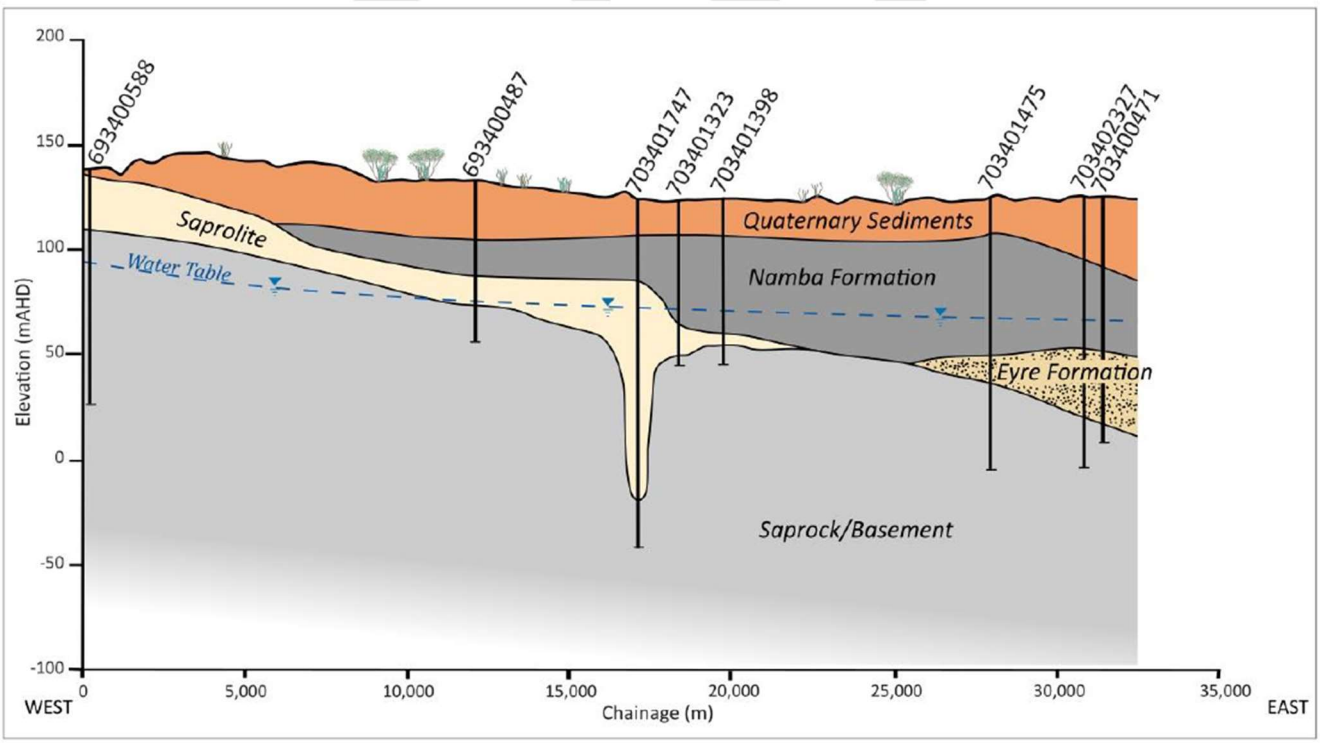
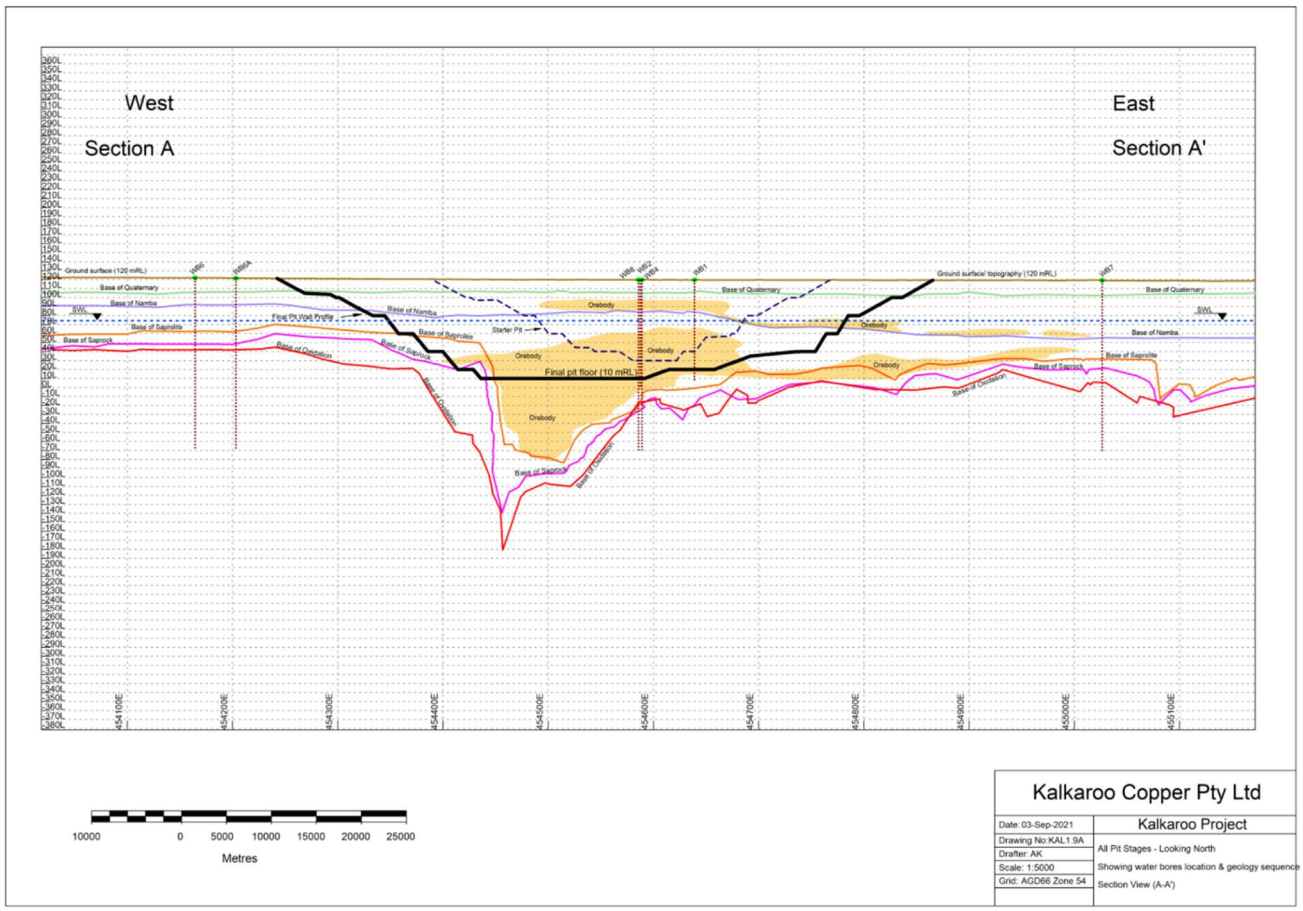
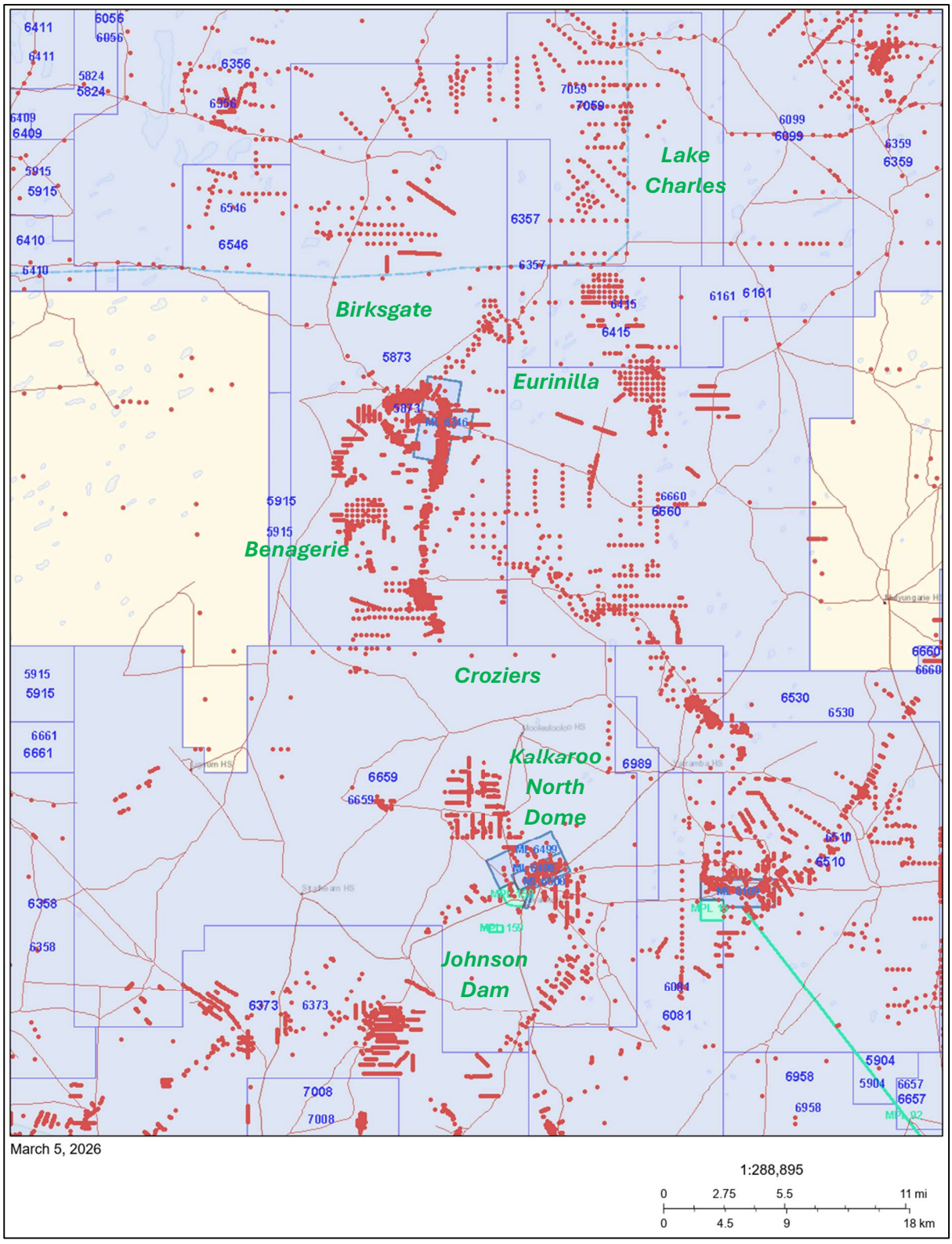


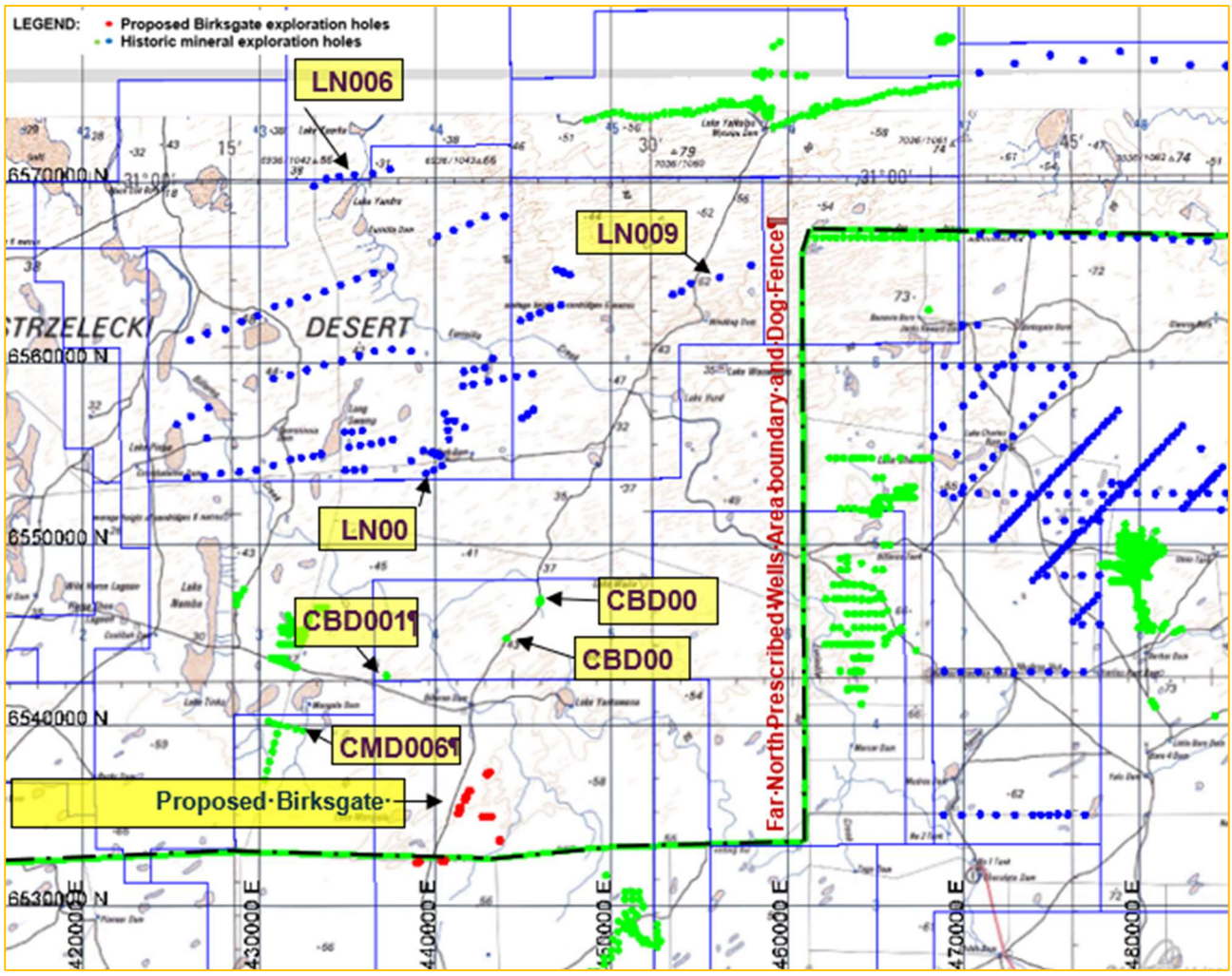
Figure 6 Cross section through the Kalkaroo orebody and conceptual open pit showing how the water table (SWL – blue dashed line) extends from the saprolite basement rocks into the Namba Formation, based on detailed hydrological studies. Both formations are of low permeability and are water saturated. The Eyre Formation is absent in this case (source: Draft Groundwater Impact Assessment Kalkaroo Copper-Gold Mine, report prepared for Havilah Resources by Water Technology 1 December 2021).



Attachment 1: SARIG print of historic drill holes and mining leases in the Central Curnamona area.



Attachment 2: Selected geological logs for historic mineral exploration drill holes in the Birksgate and Lake Charles areas.



Location of proposed Birksgate exploration drillholes relative to the Far North Prescribed Wells Area (and Dog Fence) boundary and historic selected exploration drill hole geological logs (see below).

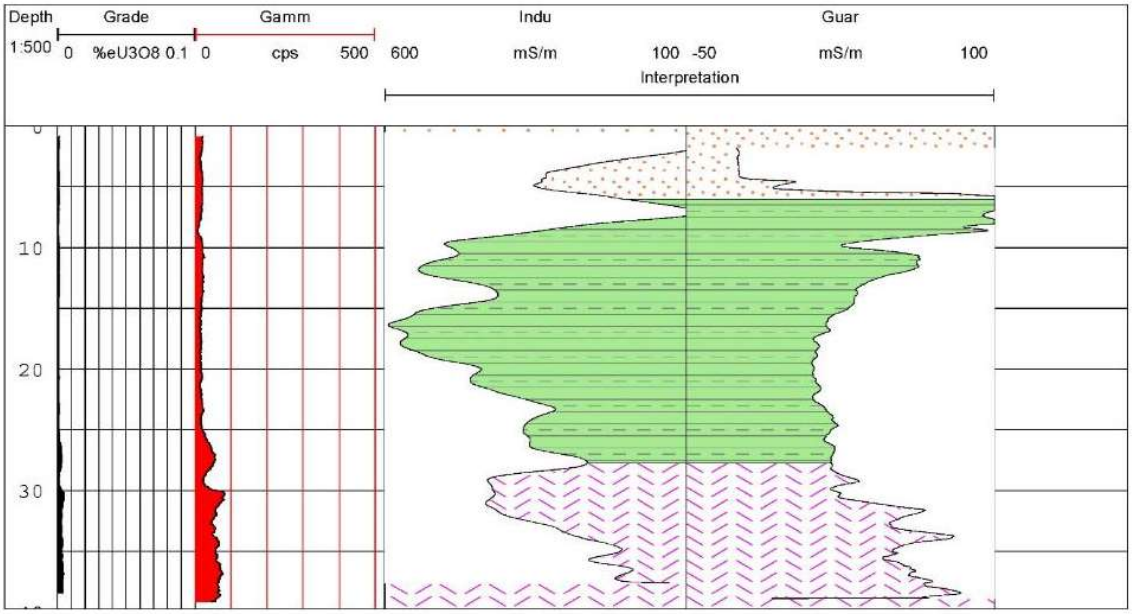
Tenement: 3151

Co-ords (AGD66)437248E 6542751N

Date: 24/11/+2006

Geologist: MHR

Hole ID	CBD001



Tenement: 3151

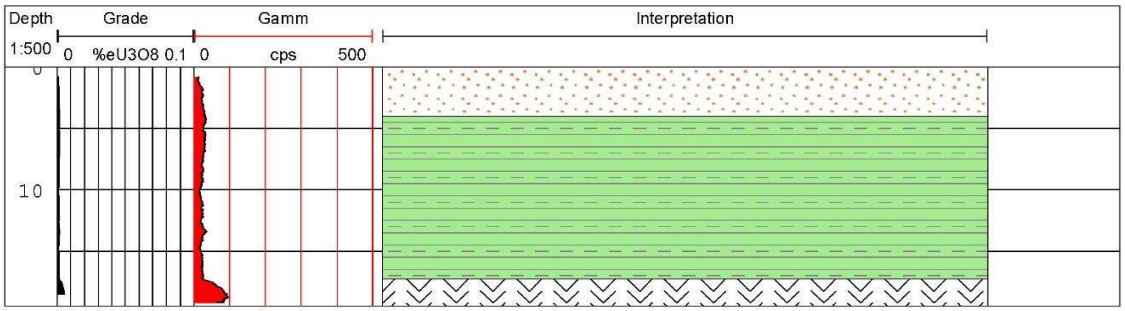
Co-ords (AGD66) 444048E 6544802N

Date: 26/11/2006

Geologist: MHR

Hole ID	CBD002

Quaternary Sand Namba Clay Willyama Rock



Tenement: 3151

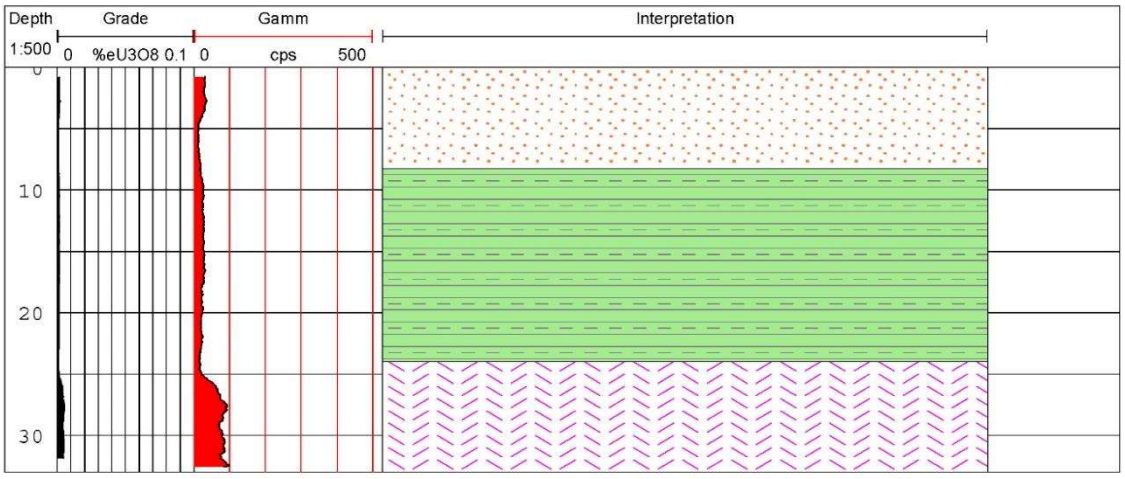
Co-ords (AGD66) 445981E 6546985N

Date: 26/11/2006

Geologist: MHR

Hole ID	CBD004

Quaternary Sand Namba Clay Willyama Saprolite



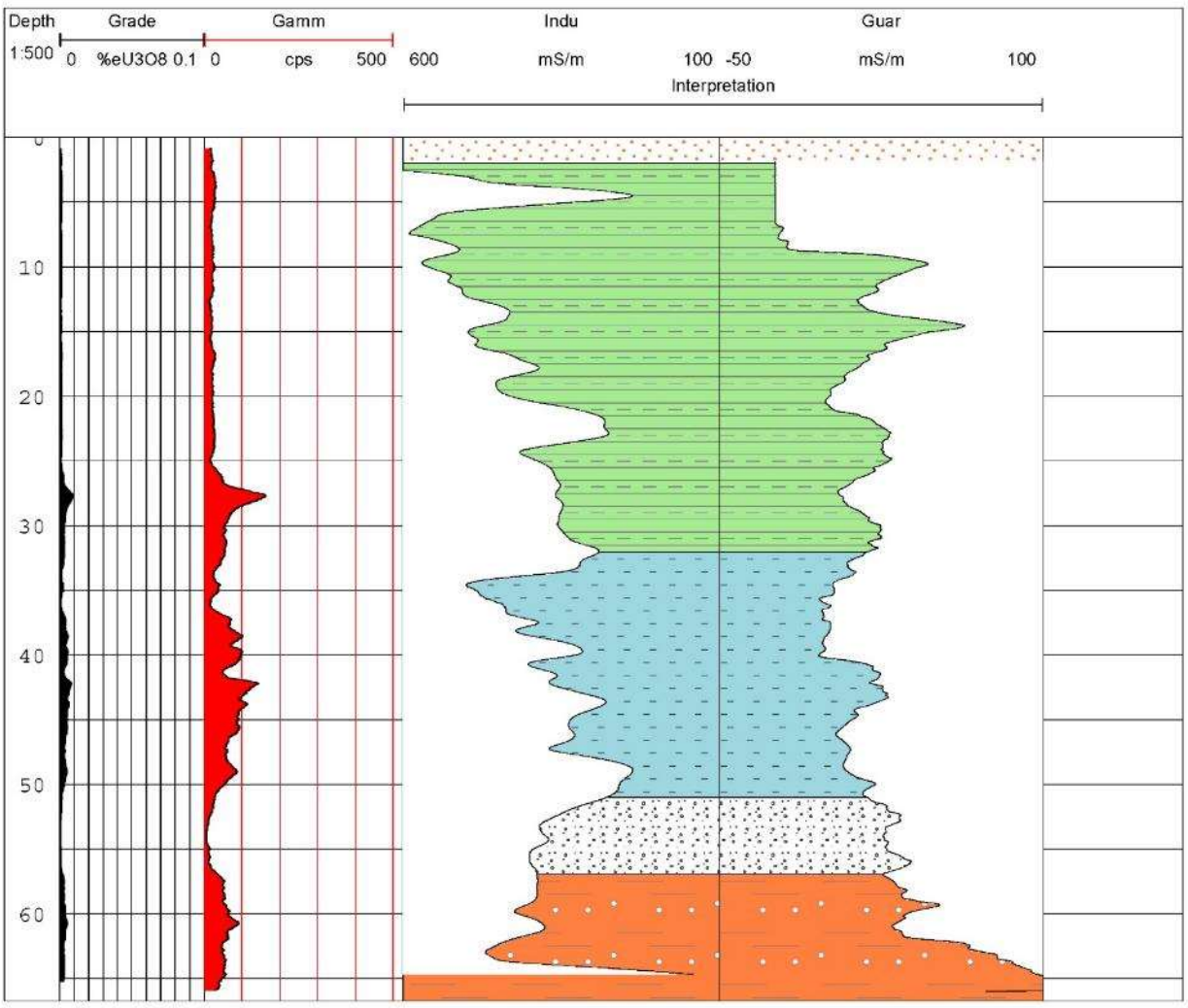
Tenement: 3299

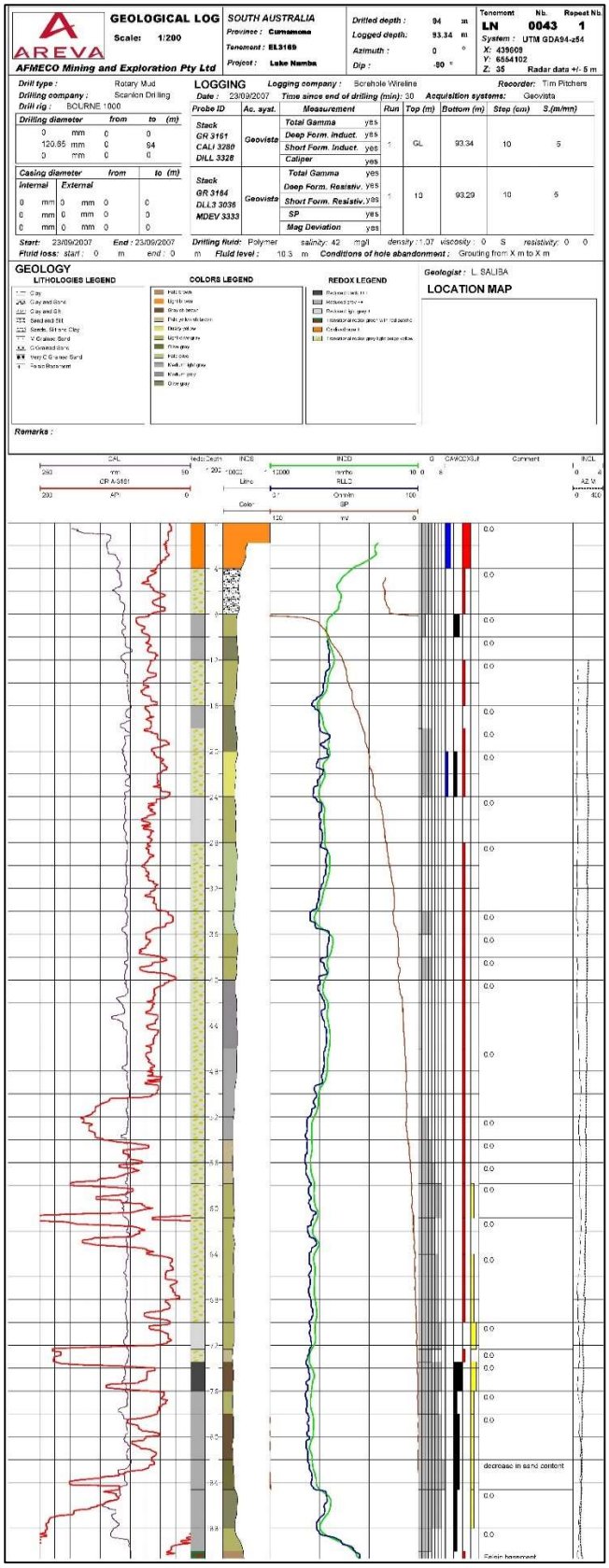
Co-ords (AGD66) 432473E 6539682N

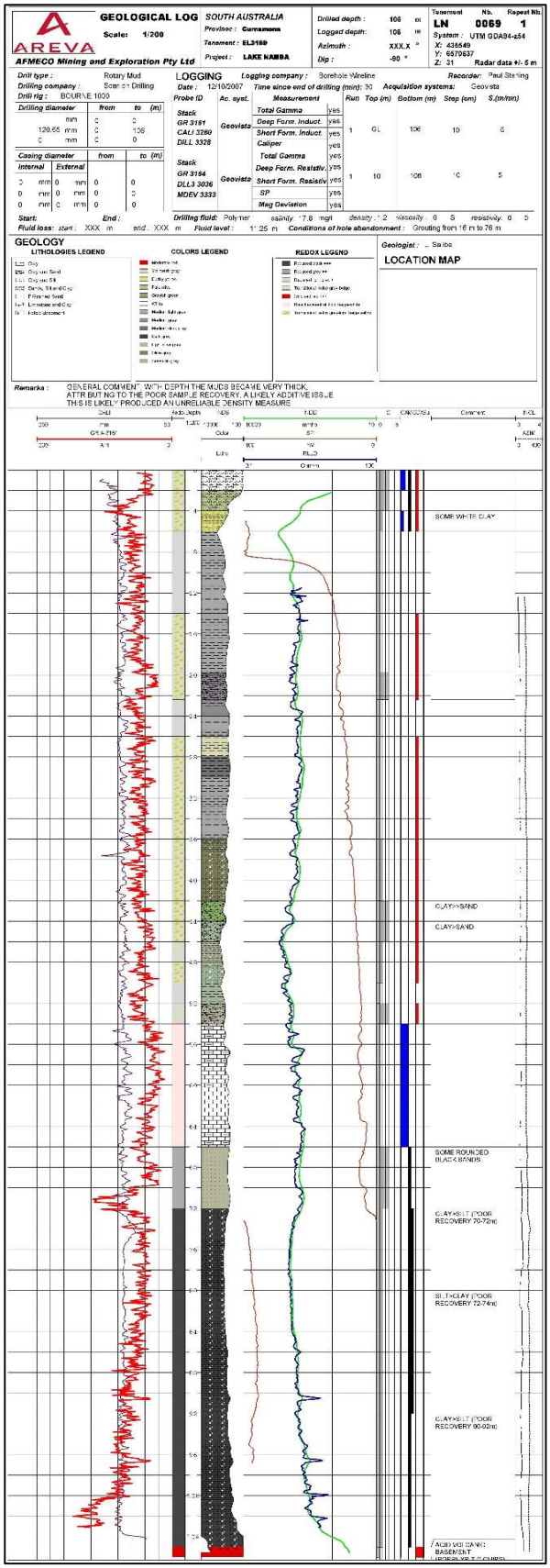
Date: 29/11/2006

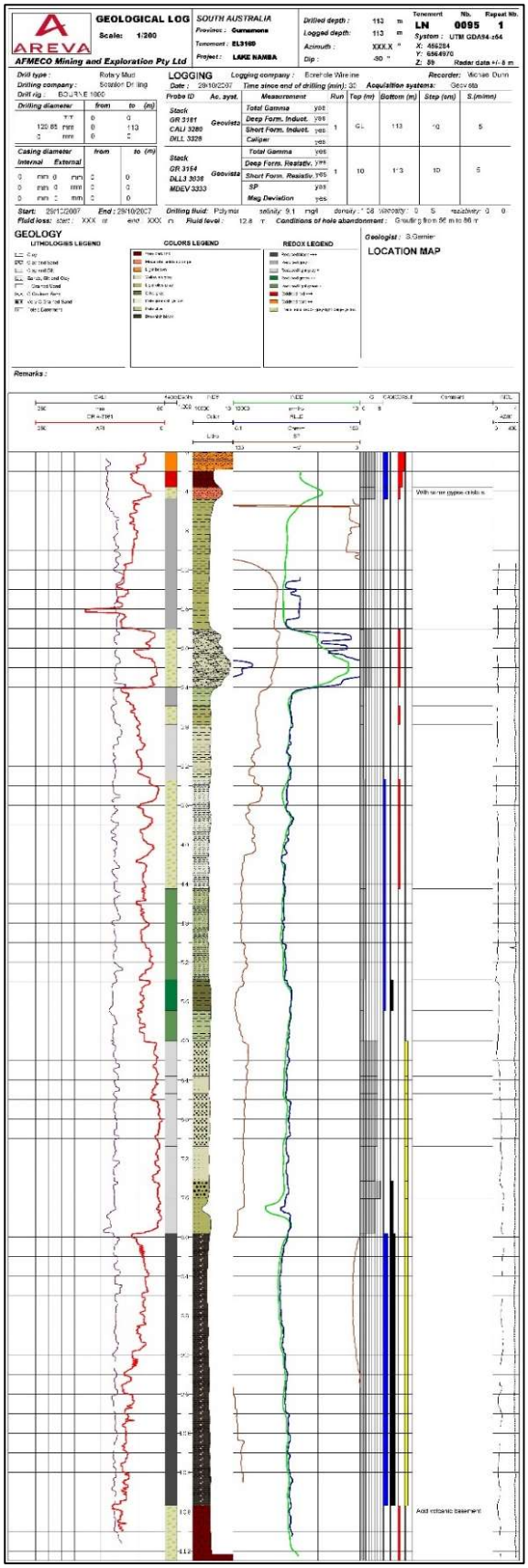
Geologist: MHR

Hole ID	CMD006




GEOLOGICAL LOG
Scale: 1/200
AREVA
AFMECO Mining and Exploration Pty Ltd
SOUTH AUSTRALIA
Province : Curnamona
Tenement : EL3169
Project : Lake Namba
Drilled depth : 94 m
Logged depth: 93.34 m
Azimuth : 0 °
Dip : -90 °
Tenement Nb. LN 0043
Repeat Nb. 1
System : UTM GDA94-z54
X: 439608
Y: 6554102
Z: 35 Radar data +/- 5 m
Drill type : Rotary Mud
Drilling company : Scanlon Drilling
Drill rig : BOURNE 1000
LOGGING
Logging company : Scrahole Wireline
Recorder: Tim Pitchers
Date : 23/09/2007
Time since end of drilling (min): 30
Acquisition systems: Geovista
Probe ID | Ac. syst. | Measurement | Run | Top (m) | Bottom (m) | Step (cm) | S.(m/mn)
Stack GR 3151 CALI 3280 DILL 3328 | Geovista | Total Gamma yes; Deep Form. Induct. yes; Short Form. Induct. yes; Caliper yes | 1 | GL | 93.34 | 10 | 5
Stack GR 3184 DLL3 3036 MDEV 3333 | Geovista | Total Gamma yes; Deep Form. Resistiv. yes; Short Form. Resistiv. yes; SP yes; Mag Deviation yes | 1 | 10 | 93.29 | 10 | 5
Drilling diameter from to (m)
0 mm 0 0
120.65 mm 0 94
0 mm 0 0
Casing diameter from to (m)
Internal External
0 mm 0 mm 0 0
0 mm 0 mm 0 0
0 mm 0 mm 0 0
Start: 23/09/2007 End : 23/09/2007
Fluid loss: start : 0 m end : 0 m
Drilling fluid: Polymer salinity: 42 mg/l density : 1.07 viscosity : 0 S resistivity: 0 0
Fluid level : 10.5 m
Conditions of hole abandonment : Grouting from X m to X m
GEOLOGY
LITHOLOGIES LEGEND
COLORS LEGEND
REDOX LEGEND
Geologist : L. SALIBA
LOCATION MAP
Remarks :
CAL
GR 3151
INCB
INCD
RLLD
SP
Comment
INCL
decrease in sand content


GEOLOGICAL LOG
SOUTH AUSTRALIA
Province : Gurnamma
Tenement : EL3169
Project : LAKE NAMBA
Scale: 1/200
AREVA
AFMECO Mining and Exploration Pty Ltd
Drilled depth : 108 m
Logged depth: 106 m
Azimuth : XXX.X °
Dip : -90 °
Tenement Nb. 0069 Repeat Nb. 1
LN
System : UTM GDA94-z54
X: 436549
Y: 6970937
Z: 31 Radar data +/- 5 m
Drill type : Rotary Mud
Drilling company : Scarr on Drilling
Drill rig : BOURKE 1000
LOGGING
Logging company : Borehole Wireline
Recorder: Paul Stirling
Date : 12/10/2007
Time since end of drilling (min): 30
Acquisition systems: Geovista
Drilling diameter
from to (m)
120.65 mm 0 106
Casing diameter
Internal External
from to (m)
Probe ID
Ac. syst.
Measurement
Run Top (m) Bottom (m) Step (cm) S.(m/mn)
Stack
GR 3161
CALI 3269
DILL 3328
Geovista
Total Gamma yes
Deep Form. Induct. yes
Short Form. Induct. yes
Caliper yes
Stack
GR 3154
DLL3 3036
MDEV 3333
Geovista
Total Gamma yes
Deep Form. Resistiv. yes
Short Form. Resistiv. yes
SP yes
Mag Deviation yes
1 GL 106 10 6
1 10 106 10 5
Start: End :
Fluid loss: start : XXX m end : XXX m
Drilling fluid: Polymer salinity : 7.8 mg/l density : 1.2 viscosity : 0 S resistivity : 0 Ω
Fluid level : 11.25 m Conditions of hole abandonment : Grouting from 16 m to 78 m
GEOLOGY
LITHOLOGIES LEGEND
COLORS LEGEND
REDOX LEGEND
Geologist : L. Saliba
LOCATION MAP
Remarks : GENERAL COMMENT: WITH DEPTH THE MUDS BECAME VERY THICK, ATTR BUTING TO THE POOR SAMPLE RECOVERY. A LIKELY ADDITIVE ISSUE TH S IS LIKELY PRODUCED AN UNRELIABLE DENSITY MEASURE
SOME WHITE CLAY
CLAY>>SAND
CLAY>SAND
SOME ROUNDED BLACK BANDS
CLAY>SILT (POOR RECOVERY 70-72m)
SILT>CLAY (POOR RECOVERY 72-74m)
CLAY>SILT (POOR RECOVERY 90-92m)
AGID VOLCANIC BASEMENT


GEOLOGICAL LOG
Scale: 1:200
AREVA
AFMECO Mining and Exploration Pty Ltd
SOUTH AUSTRALIA
Province : Gumsmore
Tenement : EL3160
Project : LAKE NAMBA
Drilled depth : 113 m
Logged depth: 113 m
Azimuth : XXX.X °
Dip : -90 °
Tenement LN
Nb. 0095
Repeat Nb. 1
System : UTM GDA94 z54
X: 466284
Y: 6564976
Z: 89
Radar data +/- 8 m
LOGGING
Logging company : Borehole Wireline
Recorder: Michael Dunn
Date : 29/10/2007
Time since end of drilling (min): 30
Acquisition systems: Geovista
Drill type : Rotary Mud
Drilling company : Scallon Drilling
Drill rig : BOURKE 1000
Drilling diameter
from to (m)
127 mm 0 0
120.65 mm 0 113
0 mm 0 0
Casing diameter
Internal External
from to (m)
0 mm 0 mm 0 0
0 mm 0 mm 0 0
0 mm 0 mm 0 0
Probe ID Ac. syst.
Stack
GR 3161 Geovista
CALI 3280
DILL 3328
Measurement Run Top (m) Bottom (m) Step (cm) S.(mm)
Total Gamma yes
Deep Form. Induct. yes
Short Form. Induct. yes
Caliper yes
1 GL 113 10 5
Stack
GR 3154 Geovista
DLL3 3036
MDEV 3333
Total Gamma yes
Deep Form. Resistiv. yes
Short Form. Resistiv. yes
SP yes
Mag Deviation yes
1 10 113 10 5
Start: 29/12/2007 End : 29/10/2007
Drilling fluid : Polymer
Fluid loss: start : XXX ml end XXX ml
Fluid level : 12.8 m
Conditions of hole abandonment : Grouting from 56 m to 56 m
GEOLOGY
LITHOLOGIES LEGEND
COLORS LEGEND
REDOX LEGEND
Geologist : S.Garnier
LOCATION MAP
Remarks :
With some oxidation
Acid volcanic basement

Havilah Resources
Strategic Minerals in South Australia

Technical Memorandum

Date:	26 February 2026
From:	Geoff Borg MSc in Hydrogeology and Groundwater Management *Principal Environmental Advisor*
To:	Department for Energy and Mines *EPEPR 2024/015* Chris Giles *Technical Director* Amy Jacka *Tenement Manager* Traviss Just *Senior Geologist*
Subject:	**Namba Formation Strata Self-Sealing Test Report - Update**

This report documents the results of Namba Formation strata self-sealing testing conducted on EL 6659, proximal to Kalkaroo Copper's mining and multipurpose leases (ML and MPL) on Kalkaroo Pastoral Station (Figure 1).

The test procedure (Attachment A) was included in the approved Exploration Program for Environment Protection and Rehabilitation (EPEPR2024-015) EL 5873, EL 6415, EL 6659, EL 6660 (EPEPR).

Purpose

The purpose of the test is to demonstrate that open, unsupported, drillholes in Namba Formation will naturally close (seal) due to the reactive (swelling) nature of the smectite clay rich strata. Such natural sealing of open exploration drillholes effectively reinstates the natural hydraulic conditions between underlying groundwater bearing strata and overlying Quaternary strata, where there may be potential for localised ephemeral perched water tables to develop. (Note: Havilah has not encountered such perched groundwater in three decades of drilling in the area).

Method

As per the test method, time series data was collected from open exploration drill holes completed into Namba Formation strata to enable semi-quantitative assessment of the self-sealing (swelling) properties of exposed sediments. Data collected included drillhole Total Depth (TD) and Standing Water Level (SWL), after a known quantity of water was introduced into a drillhole.

It was decided to vary the test method by completing two identical drillholes on the same drill pad with one hole being left dry and the other having the quantity of water introduced. This enabled measurement and comparison of open holes in Namba Formation with and without exposure to groundwater.

Typical exploration drillholes that penetrate Namba Formation strata also intersect the regional water table resulting in groundwater within the open hole at the end of drilling. Observations from past drilling programs indicate Namba Formation strata in the walls of the drillhole will, depending on the relative depth of the regional water table, either produce groundwater or become saturated by groundwater pushed up the hole during drilling. If left open and unsupported in the presence of groundwater the drillholes naturally seal due to clay rich Namba Formation strata swelling.

Drilling

The drilling method used was to replicate typical exploration drillholes, except for the holes being vertical rather that angled, to enable collection of downhole data using probes on hand operated reels of measuring tape.

Drilling parameters were determined after review of the geological cross section produced from previous exploration drilling data along the same drill line (Figure 2) and the drilling logs as the holes advanced (Figure 3).

The inferred depth to the regional water table was obtained by measuring the SWL of WB-4, an existing groundwater monitoring bore on ML6498, located approximately 1.3 km to the north-northwest of the test holes (Figure 1).

The target total depth (41 m) was determined to achieve the objectives of the test method by terminating the holes above the regional water table and within the target strata.

Two Namba Test Holes **KKNTH01** and **KKNTH02** were completed on a previously rehabilitated exploration drill pad on EL 6659 (Figure 1). These drillholes will be rehabilitated on completion of data collection as per the conditions of the EPEPR 2024-015.

Drillholes were advanced through the upper Quaternary strata from surface to a depth of 17mBGS using a “V” bit. Casing consisting of 150 mm diameter PVC was installed to 17 mBGS, isolating surficial and Quaternary strata and the top 3 to 7 m of Namba Formation strata from the drillhole.

Air core drilling was then used to advance the drillholes to the target TD of 41 mBGS.

KKNTH01 was left open and TD gauged over time to identify potential groundwater accumulation (none expected) and potential changes (closing) of the drillhole (Table 1).

KKNTH02 had approximately 200 L of groundwater introduced to the drillhole resulting in an initial SWL of 17.5 mbTOC. SWL and TD gauging data are provided in Table 2.

Groundwater was sourced from a historic exploration hole on ML6498 maintained for supply of drilling water. This water was from the same water-bearing zone that would be encountered had the test holes intersected the regional water table.

Both holes were left capped after the final gauging event on 30 October 2025. Further gauging events are planned during the next stint for Kalkaroo personnel starting 11 November 2025. Decommissioning and rehabilitation of these holes will be completed as per the conditions of approved EPEPR 2024/015.

Results

Data is summarised in Tables 1 and 2 and illustrated in Figure 4.

KKNTH01 results were within expected ranges for an open drillhole completed above the regional water table in Namba Formation. After 20 hours of the drillhole remaining open and unsupported:

- No appreciable change in TD.
- No accumulation of groundwater.

KKNTH02 results were consistent with past observations of exploration drillholes through the Namba Formation and intersecting the regional water table.

At T = 16:30 hours after the end of drilling and the introduction of approximately 200 L of groundwater into the unsupported hole:

- TD reduced from 41.48 mbTOC to 29 mbTOC indicating the bottom 12 m of the drillhole closed (self-sealed due to swelling clay) due to contact with groundwater.
- SWL remained stable around 17.6 mbTOC after introduction of groundwater indicating introduced water absorbed into swelling clay.

Measurements made from T = 14:17:10 days to 37:07:10 days:

- TD = 28.8 to 28.65 mbTOC
- SWL measurements indicated residual water at TD (i.e. probe indicated the presence of water at total depth) and, on the last measurement, no water presence was indicated.

Data indicates the section of the drillhole KKNTH02 that sealed (closed in) due to the presence of water correlates with carbonaceous strata (Figure 3) within the Namba Formation. The initial water column remaining above the closed in carbonaceous strata (measured at T = 16:30 hours) is anticipated to have absorbed into exposed overlying Namba strata (i.e. drillhole walls) and / or continued to infiltrate down the drillhole and be absorbed into the carbonaceous strata expanding into the drillhole. Based on geotechnical investigations, loss of water into the smectite clay rich Namba strata is expected. Results from this test suggest resulting changes in soil volume can vary as evidenced by that observed in the carbonaceous strata in KKNTH02.

Conclusions

This test has confirmed that open, unsupported, drillholes in Namba Formation naturally close (seal) due to the reactive (swelling) nature of the smectite clay rich strata when exposed to groundwater, e.g. groundwater rising in the drillhole during drilling.

This natural sealing combined with backfilling drillholes effectively reinstates natural geological conditions with respect to isolating groundwater bearing strata below the regional water table from potential (but to date unobserved) ephemeral perched groundwater in Quaternary strata above the Namba Formation.

Tables

Table 1 ***KKNTH01*** *Gauging Data*

Date	Time Elapsed (hr / days)	Total Depth (mbTOC*)
29/10/2025	10:40 0	41
	11:25 45	41
	14:25 03:45	40.35
	19:45 09:15	40.35
30/10/2025	20:50	40.35
13/11/2025	14:*22:10*	40.32
18/11/2025	19:*22:10*	40.26
23/11/2025	25:*09:10*	40.31
5/12/2025	37:*09:10*	40.5

Table 2 ***KKNTH02*** *Gauging Data*

Date	Time (24hr)	Time Elapsed (T) ** (dd:hh:mm)	Standing Water Level (mbTOC)*	Total Depth (mbTOC)*
29/10/2025	14:30			41.48
	14:50	0		
	15:05	0:15	17.5	
	15:20	0:30	18	41.4
	15:50	1:00	17.6***	
	17:40	2:50	17.6	
	19:30	4:40	17.6***	29
30/10/2025	07:20	16:30	17.6	29
13/11/2025	*09:00*	14:17:10	28.89	28.89
18/11/2025	*09:00*	19:17:10	28.84	28.84
23/11/25	20:00	25:*07:10*	28.65	28.65
5/12/2025	*09:00*	37:*07:10*		28.8

Notes:

* *"mbTOC" refers to metres below tope of casing.*

** *Approximately 200 L of groundwater introduced to hole. Groundwater was sourced from an existing exploration drillhole on the Kalkaroo Copper ML. This was selected as a source of water with comparable water chemistry to that which Namba Formation strata naturally contains where it intersects the regional water table or would be brought up though it via penetrating exploration drillholes encountering groundwater in underlying basement strata.*

*** *Measurement confirmed with second probe provided by DEW.*

Figures

Figure 1 Location of Namba Test Holes on EL6659 relative to Kalkaroo Pastoral Station Homestead / Workers Camp, Kalkaroo Copper Mining Leases (ML6499, ML6498, ML6500, MPL158), and monitoring bore WB-4.

Figure 2 Geological Cross Section from 2022 exploration drilling data showing relative location of Namba Test Holes.

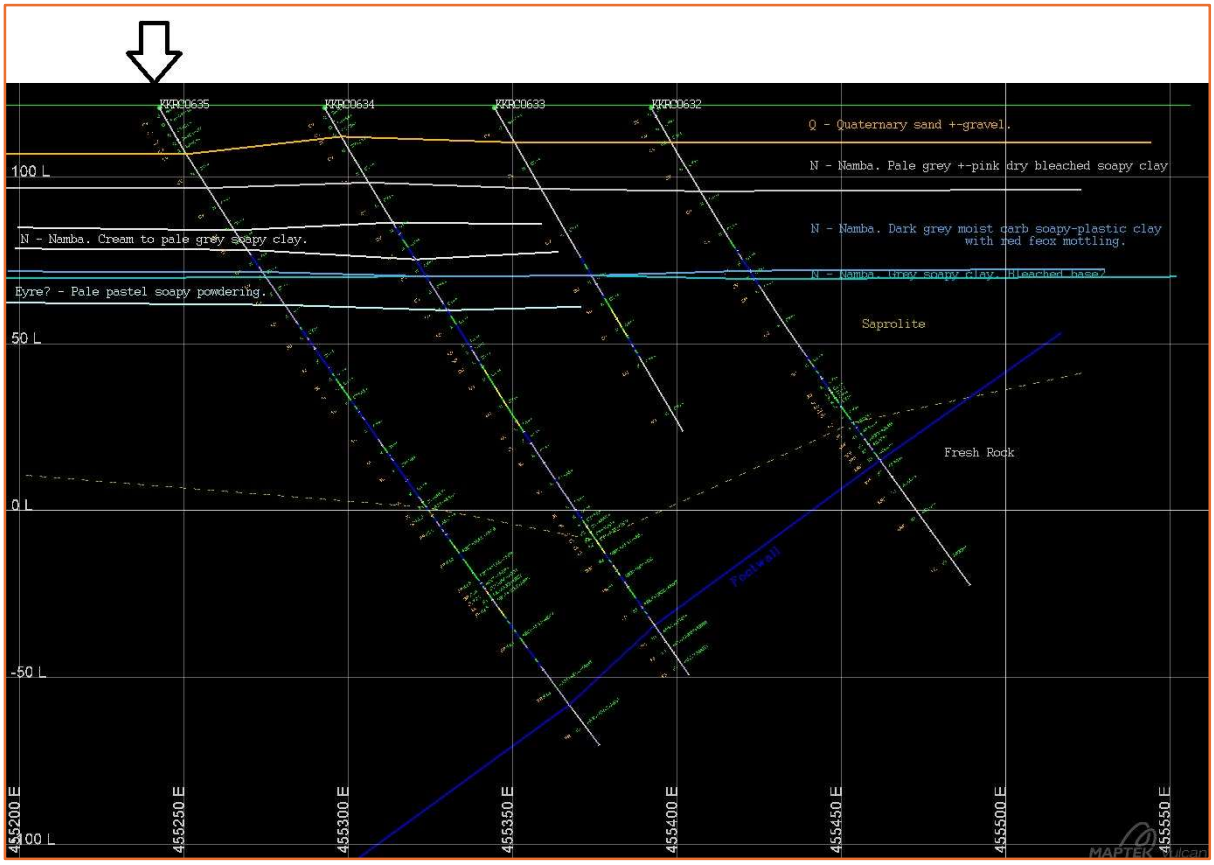


Figure 3 Geological Logs for Namba Test Holes

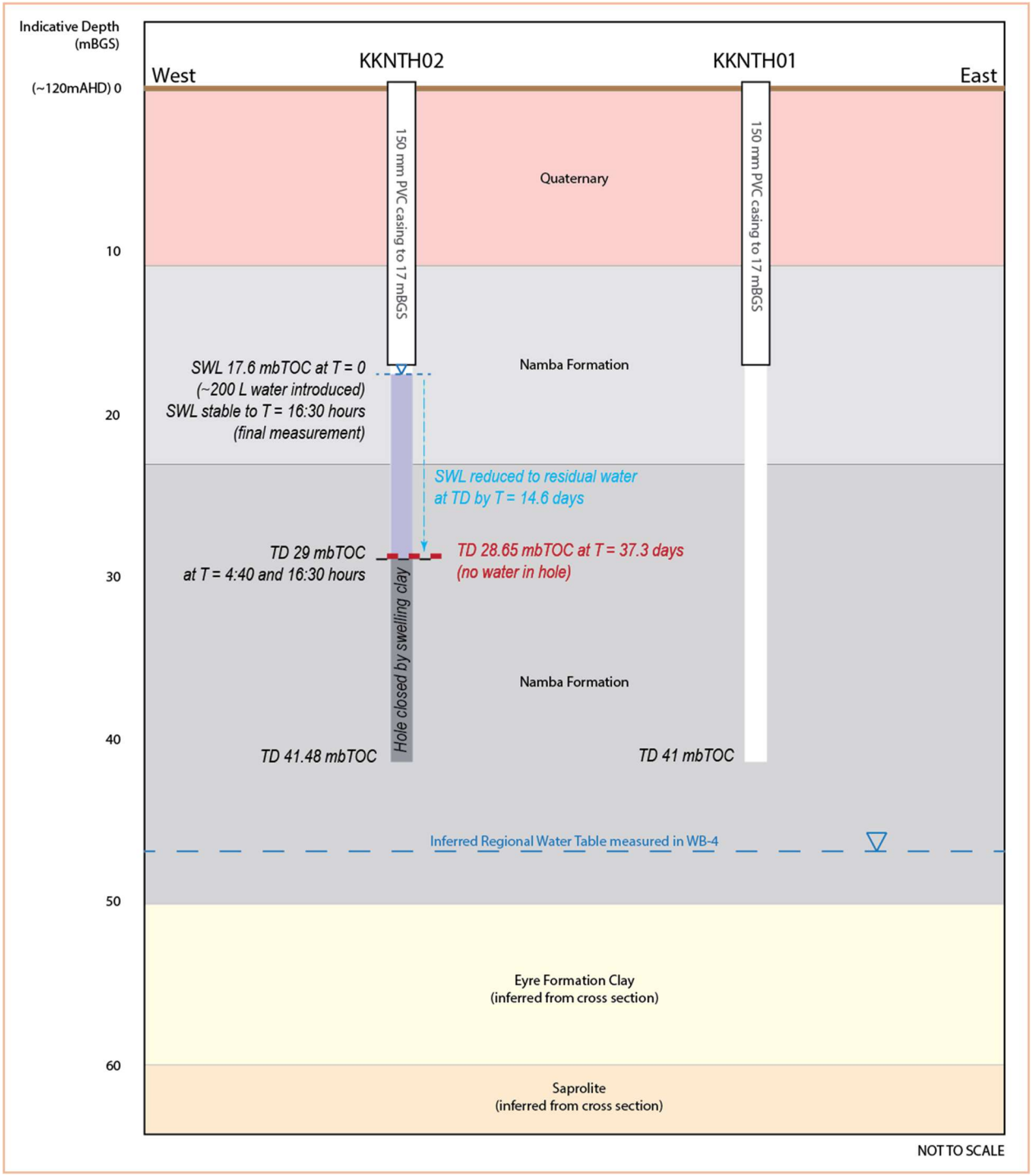
Geological Log: KKNTH01
GDA94: 455326.99 mE 6487776.56 mN
Elevation: 120.65 mAHD

Depth	Formation	Longhand Description
3	Quaternary	Red-brown fine grained ferruginous sand and clay, minor ferruginous pebbles.
6	Quaternary	Red-brown-pink fine grained ferruginous sand and clay. Common gypsum +- calcrete and ferruginous and quartz pebbles.
10	Quaternary	Red-brown-pink-pink-brown fine grained ferruginous clay and sand with common pale khaki-grey sandy soapy clay (ex Namba Formation?). Minor gypsum +- calcrete and ferruginous and quartz pebbles from above.
14	Quaternary / Namba Formation	Pale khaki-grey quite sandy soapy clay with predominantly tan goethite mottling.
18	Namba Formation	Pale grey weakly silty-sandy soapy clay with predominantly pink ferruginous mottling.
20	Namba Formation	Pale grey-grey soapy clay, with moderately pink ferruginous mottling.
25	Namba Formation	Grey soapy clay, with weak pink ferruginous mottling.
27	Namba Formation	Grey-dark grey soapy-plastic weakly carbonaceous? clay with weak red ferruginous mottling.
28	Namba Formation	Dark grey soapy-plastic carbonaceous clay with strong red ferruginous mottling.
33	Namba Formation	Dark grey soapy-plastic weakly carbonaceous clay with weak red ferruginous mottling.
38	Namba Formation	Grey-pale grey weakly silty-sandy soapy clay.
41	Namba Formation	Dark grey soapy-plastic weakly carbonaceous clay with weak red ferruginous mottling.

Geological Log: KKNTH02
GDA94: 455322.19 mE 6487776.51 mN
Elevation: 120.63 mAHD

Depth	Formation	Description
3	Quaternary	Red-brown fine grained ferruginous sand and clay, minor ferruginous pebbles.
5	Quaternary	Red-brown fine grained ferruginous sand and clay, minor fine to medium grained ferruginous pebbles. Common cream gypsum.
10	Quaternary	Red-brown fine grained ferruginous sand and clay, common moist pale khaki-grey soapy clay with angular sand grains, coated in red-brown sand and clay. Poss ex Namba Formation?
14	Namba Formation	Pale khaki-grey weakly goethite mottled soapy clay.
25	Namba Formation	Pale grey weakly goethite mottled soapy clay, with pale pink mottling. Cased 150mm diameter PVC to 17m.
29	Namba Formation	Dark grey weakly carbonaceous soapy-plastic clay with weak red ferruginous mottling. Moist balling.
34	Namba Formation	Grey-dark grey very weakly carbonaceous soapy-plastic clay with very weak red ferruginous mottling. Moist powdering.
37	Namba Formation	Pale pink-grey to grey soapy clay. Powdering.
39	Namba Formation	Grey soapy-plastic clay with very weak red ferruginous mottling. Powdering.
41	Namba Formation	Dark grey weakly carbonaceous soapy-plastic clay. Moist powdering.

Figure 4 Illustration of Namba Formation Self Sealing Test Results



Attachment 1

Namba Formation Strata Self Sealing Test Method

Purpose

Test to collect time series data to provide a semi-quantitative assessment of Namba Formation strata self-sealing (or swelling) properties in unsupported drillholes. Data collected will include drillhole Total Depth (TD) and Standing Water Level (SWL) of a known quantity of water placed into a Reverse Circulation (RC) drillhole completed into Namba Formation strata and terminated above the regional water table.

Method

- Complete one vertical drillhole penetrating at least 20 m into the top of the Namba sediments with PVC collar to seal off surficial Quaternary soil and sediments (**Figure 1**).
- Measure drillhole TD from top of casing to confirm the stability of unsupported strata.
- If TD remains stabilise after completion of drilling, place a known quantity of water into the drillhole. (Note: water to be sourced from local station dams with permission of the landholder.)
- Periodically measure SWL and TD from top of casing.

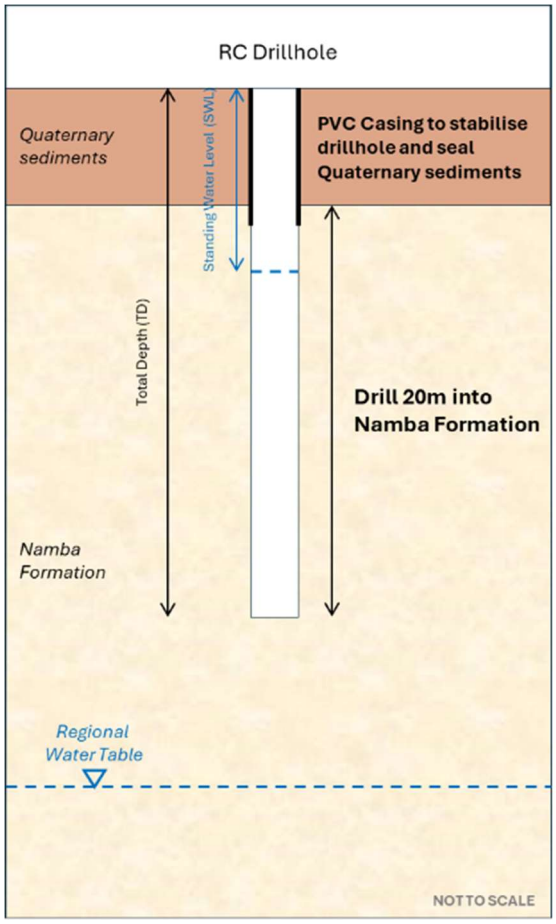


Figure 1 Drillhole details

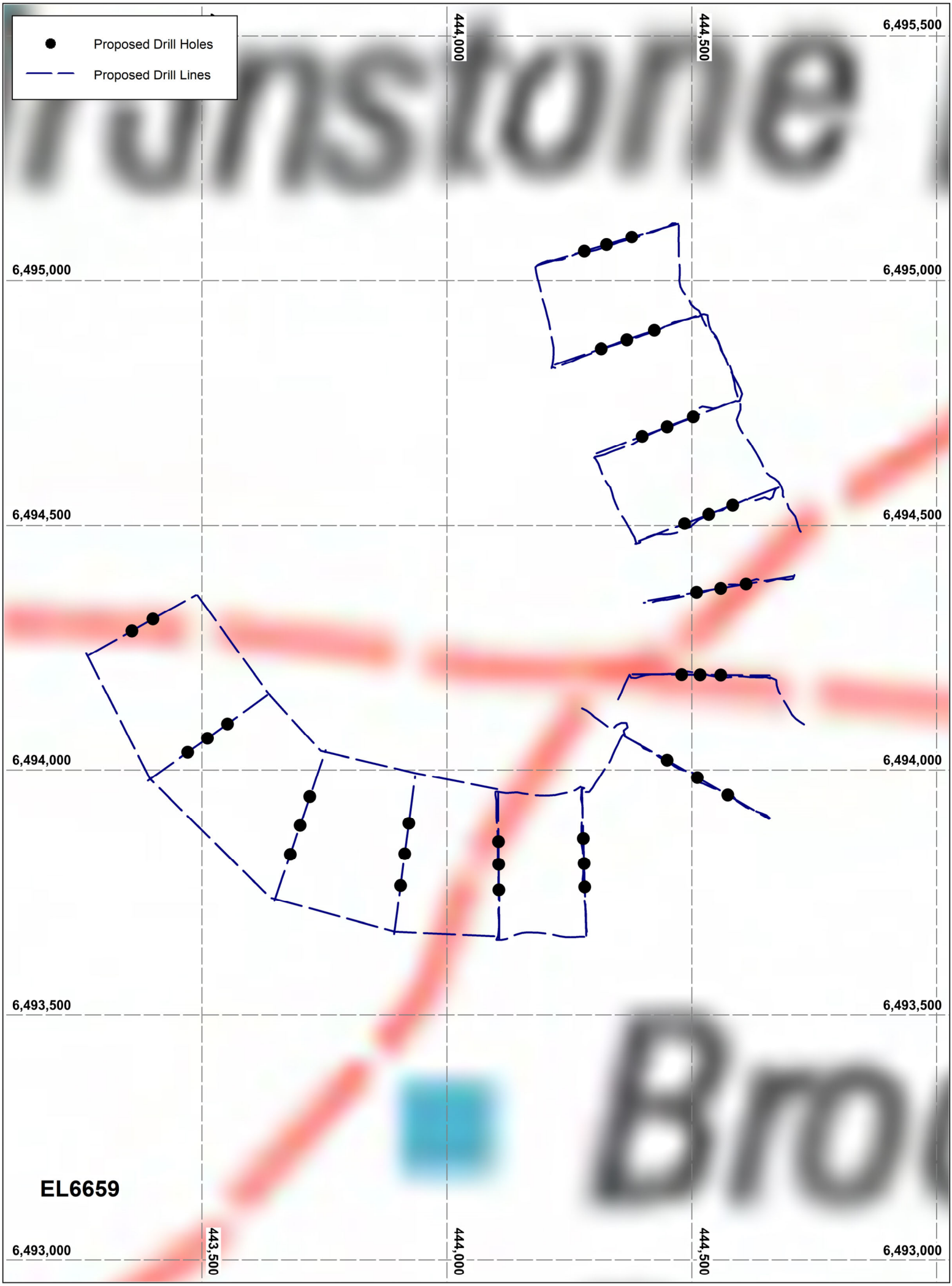
Data Interpretation

The primary data for indicating strata is self-sealing is change in TD over time. If unsaturated strata are not self-sealing, this test tests the potential for self-sealing when saturated, i.e. below the regional water table. Table 1 provides a guide to the interpretation of TD and SWL time series data.

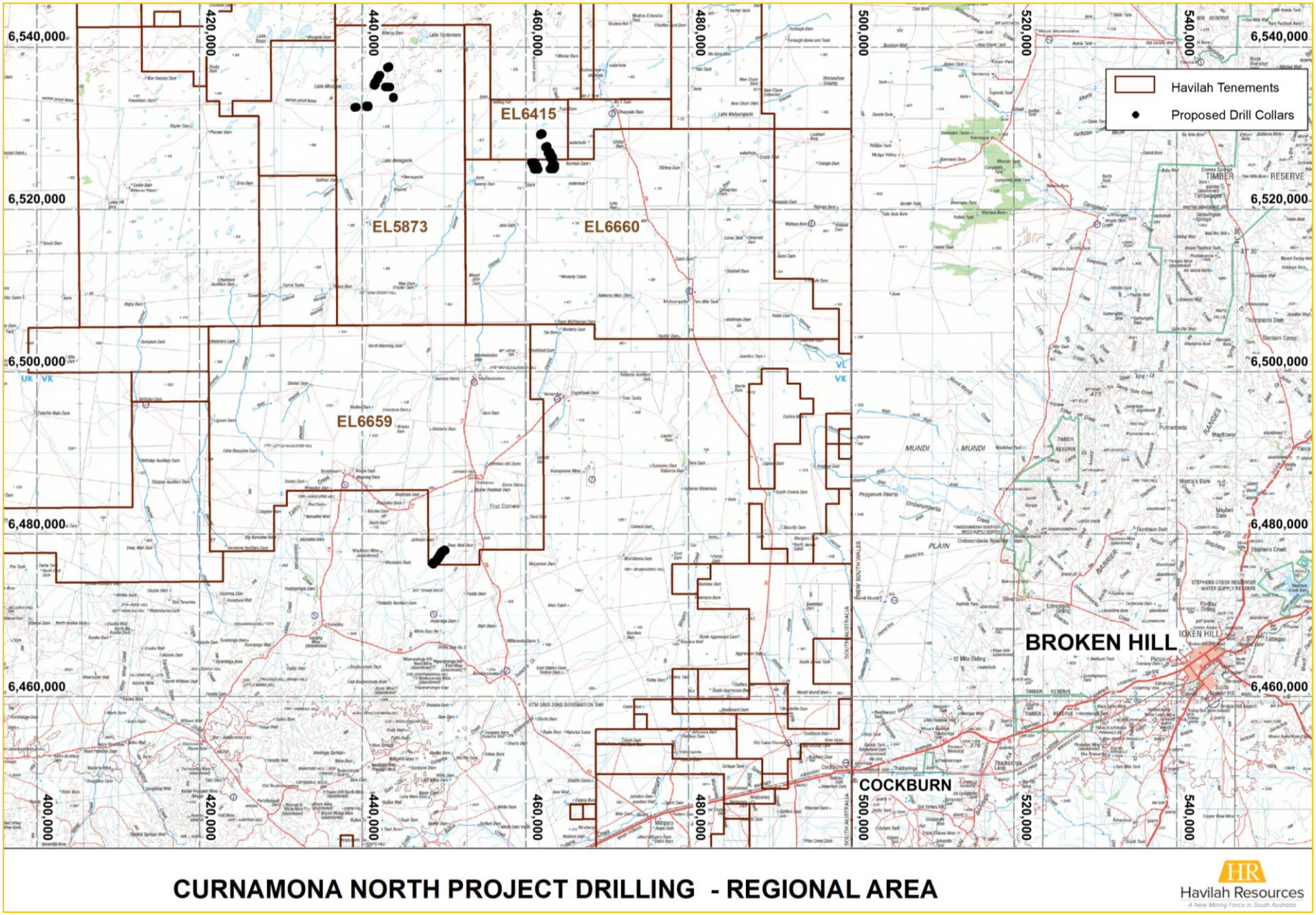
Table 3 Data Interpretation guide.

Data	Period of Measurement	Trend	Interpretation
Before water placement in drillhole:			
TD	3 days	TD Reducing (getting shallower)	**Self-sealing (unsaturated)**
		No change	Proceed with water placement
SWL		No groundwater	*TD results representative of unsaturated zone*
		SWL measured (getting shallower)	Localised perched groundwater intersected. *TD results indicative of saturated and unsaturated zones*
After water placement in drillhole:			
TD	3 days	Reducing	**Self-sealing (saturated)**
		No change	Not self-sealing
SWL		Rising (SWL getting shallower)	**Self-sealing (saturated)**
		No change or Falling (SWL getting deeper)	*Changes in TD used to assess self-sealing*

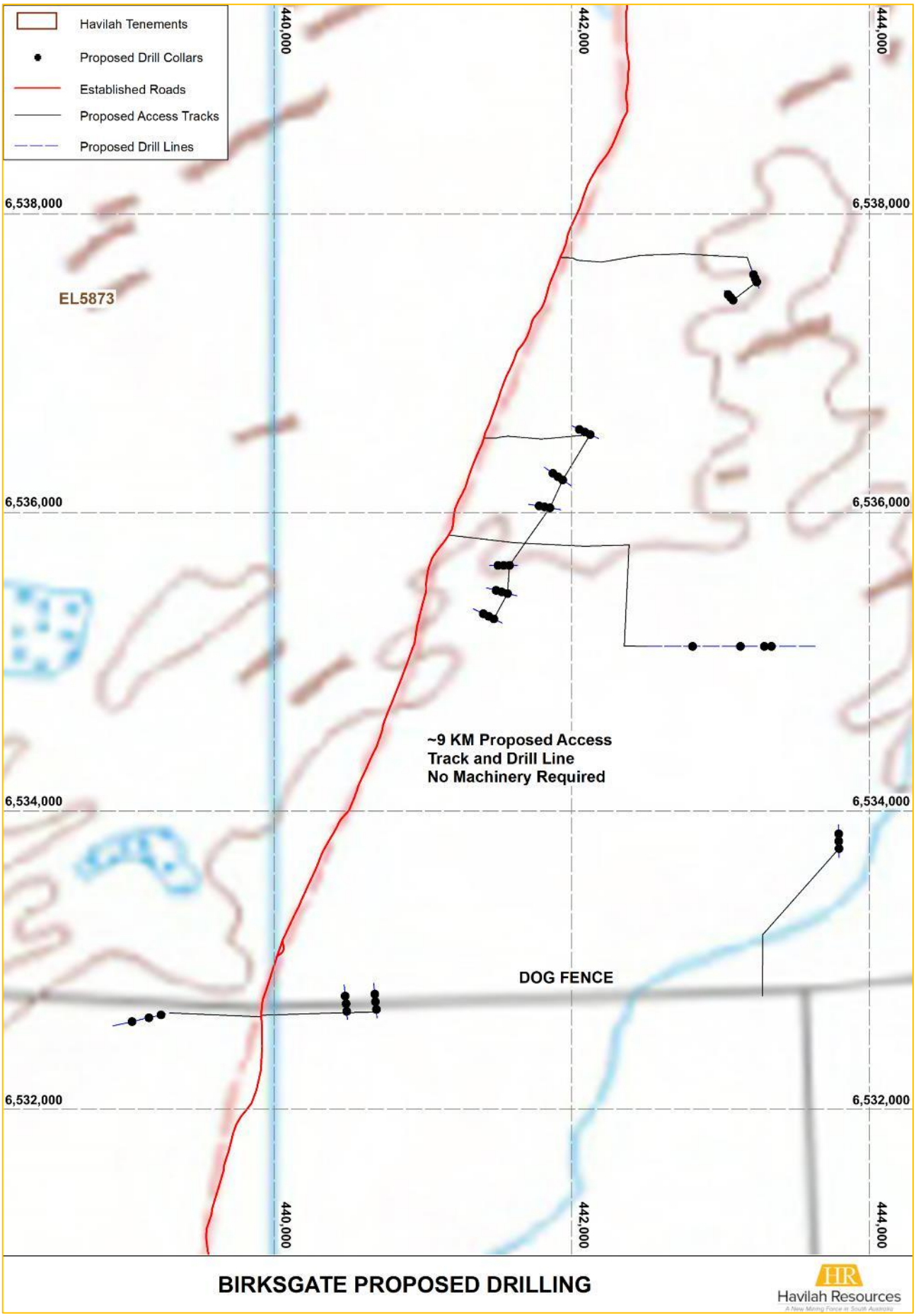
Hydrogeological Conditions	Proposed Drillhole Decommissioning	Comments	Additional Control Measures
Basement strata outcrop or subcrop under thin veneer (generally <10 m) of recent unconsolidated soil and sediments with one unconfined fractured rock aquifer (water table > 30 m). Drillholes constructed with PVC collar from surface to competent strata (sealing of unconsolidated strata). No evidence of shallow permanent of potential ephemeral water table.	**Backfill drillhole with cuttings to the extent practicable.** **Leave collar in place to prevent ingress of shallow perched ephemeral groundwater (if it occurs) , cut the collar below ground level and cap.** **Backfill above the cap to restore surface ground conditions consistent with surroundings.**	RC cuttings and samples disposed in pit away from the drillholes. Does not require import of additional material to backfill drillholes. Leaving the collar in place and capped prevents formation of a preferential pathway for ingress of ephemeral shallow groundwater entering the drill hole and connecting with the regional unconfined fractured rock aquifer. Capping the collar prevents formation of a void opening to the surface that could result in wildlife to surface contaminants entering the drillhole.	
Basement strata subcrop under Cenozoic low permeability sedimentary strata (Namba Formation, Eyre Clay) with one unconfined low permeability aquifer reporting to the regional water table within or below Cenozoic strata. Drillholes constructed with PVC Collar from surface down into the top of the Namba Formation to seal off surficial soil and Recent unconsolidated sediments.	**Namba Formation sediments will swell and seal the unsupported drillhole, i.e. drill rods and casing removed.** **Leave collar in place to prevent ingress of shallow perched ephemeral groundwater (if it occurs), cut the collar below ground level and cap.** **Backfill above the cap to restore surface ground conditions consistent with surroundings.**	The potential for shallow perched ephemeral groundwater accumulating and forming temporary water tables above the Namba Formation are considered unlikely in the exploration prospect areas. Leaving collars in place is proposed as an additional control measure.	Test mythologies for assessing the self-sealing ability of Namba Formation strata and characterising the groundwater chemistry in basement and Namba Formation / Eyre Clay screened wells or drillholes to compare to current interpretation these being a single continuous low permeability water-bearing zone are provided in **Appendix 2**.



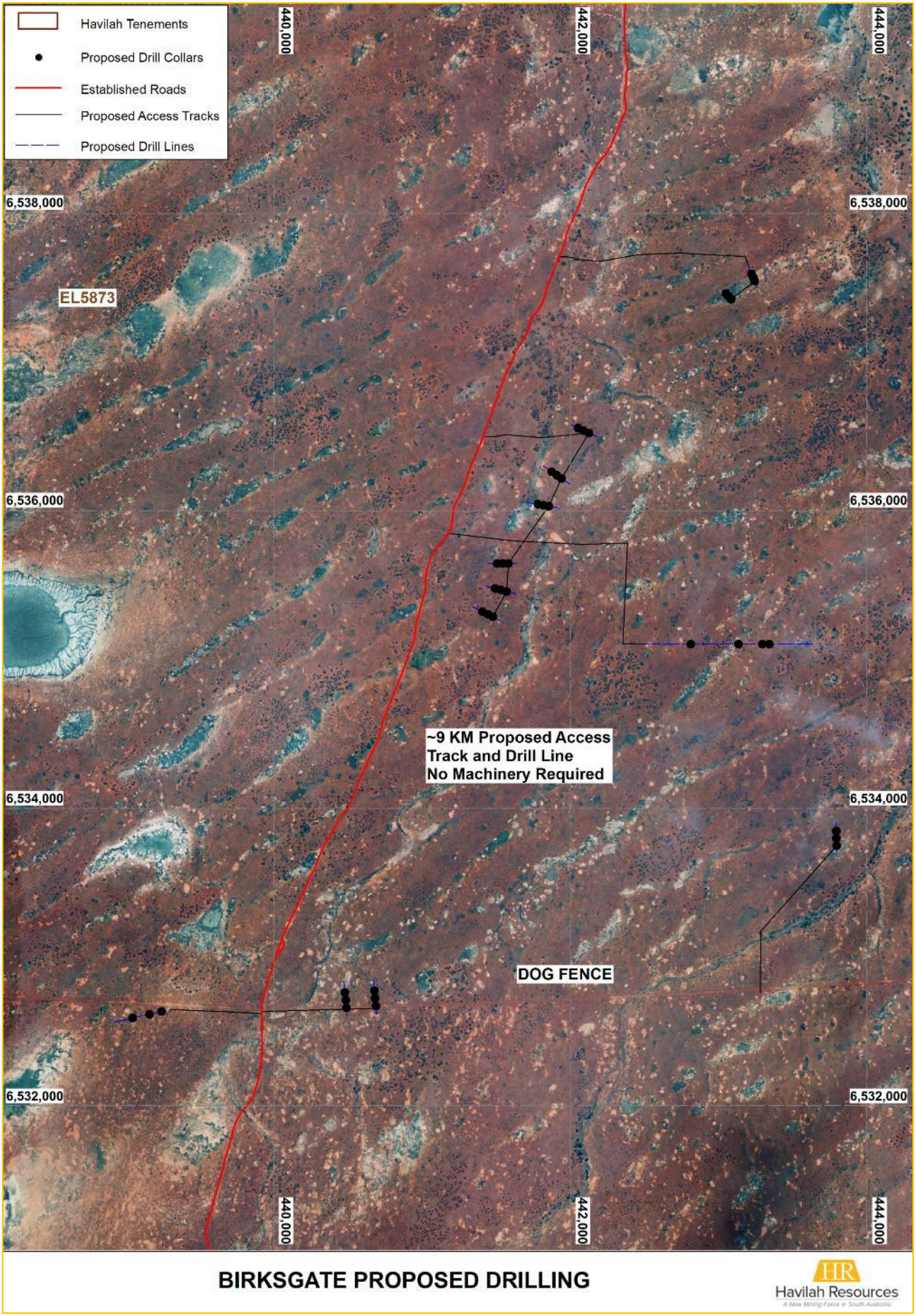
Curnamona North PEPR - Brooks Dam



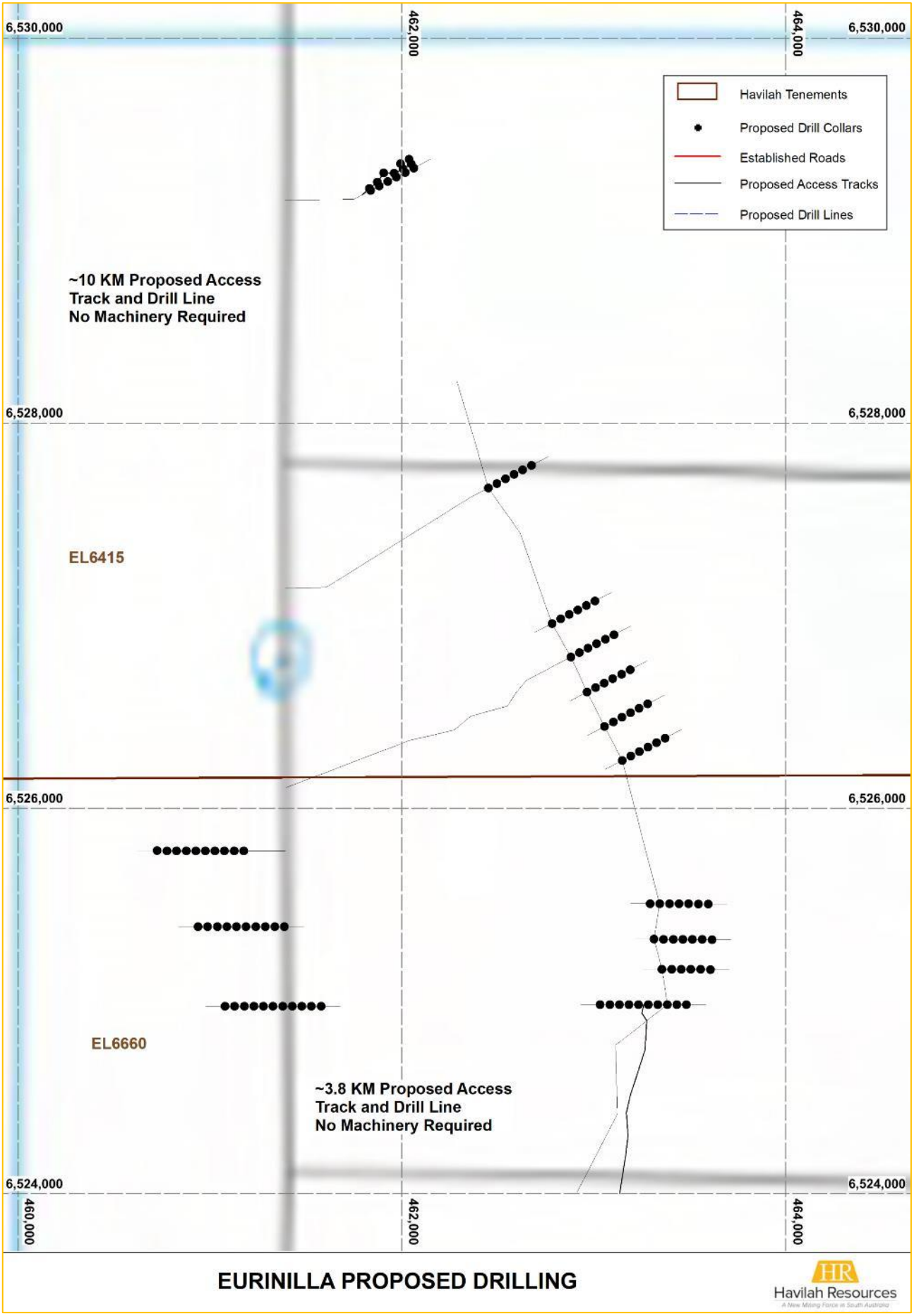
Map 1: Tenement Location – Regional.



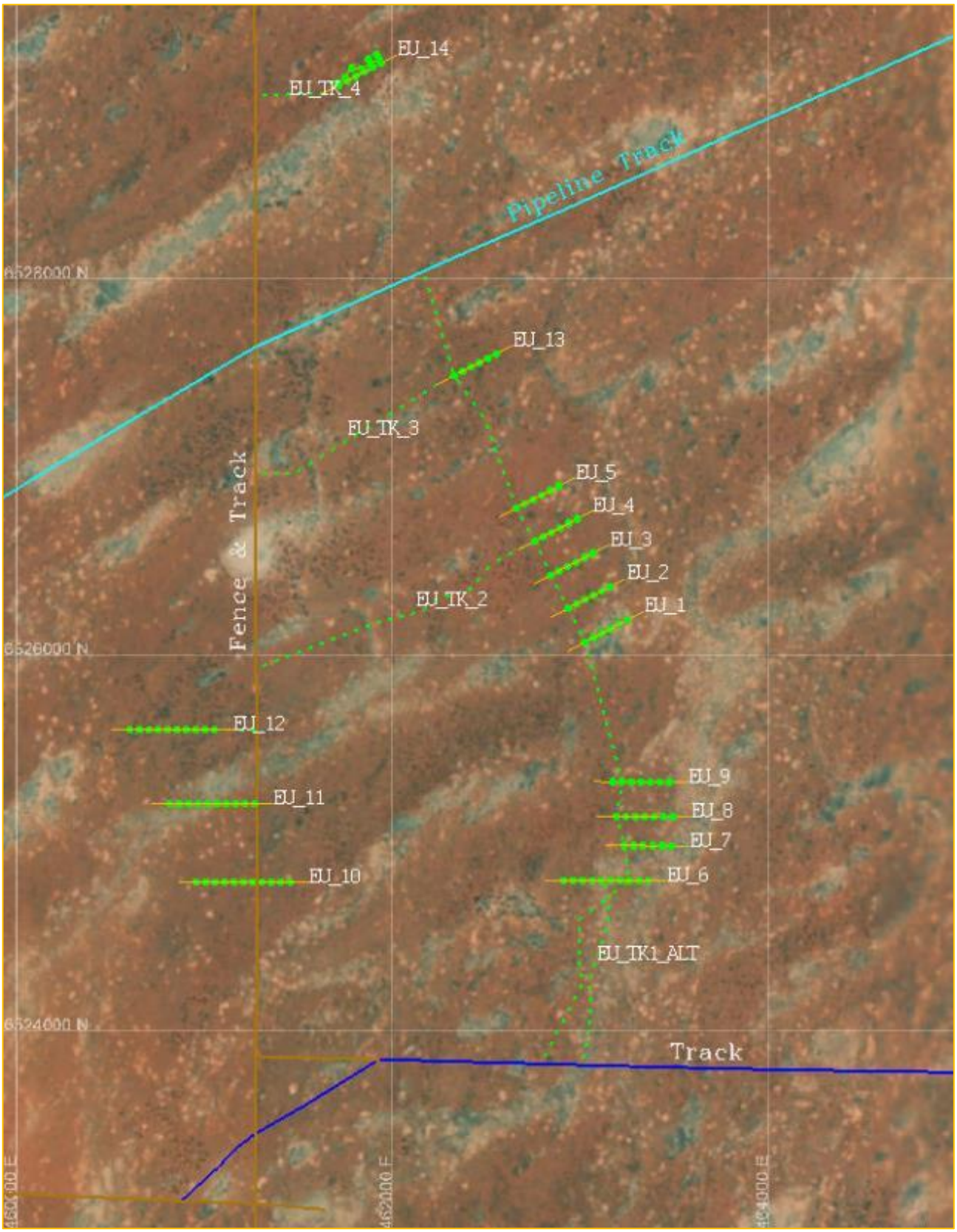
Map 2: Birksgate Proposed Drilling – Topography.



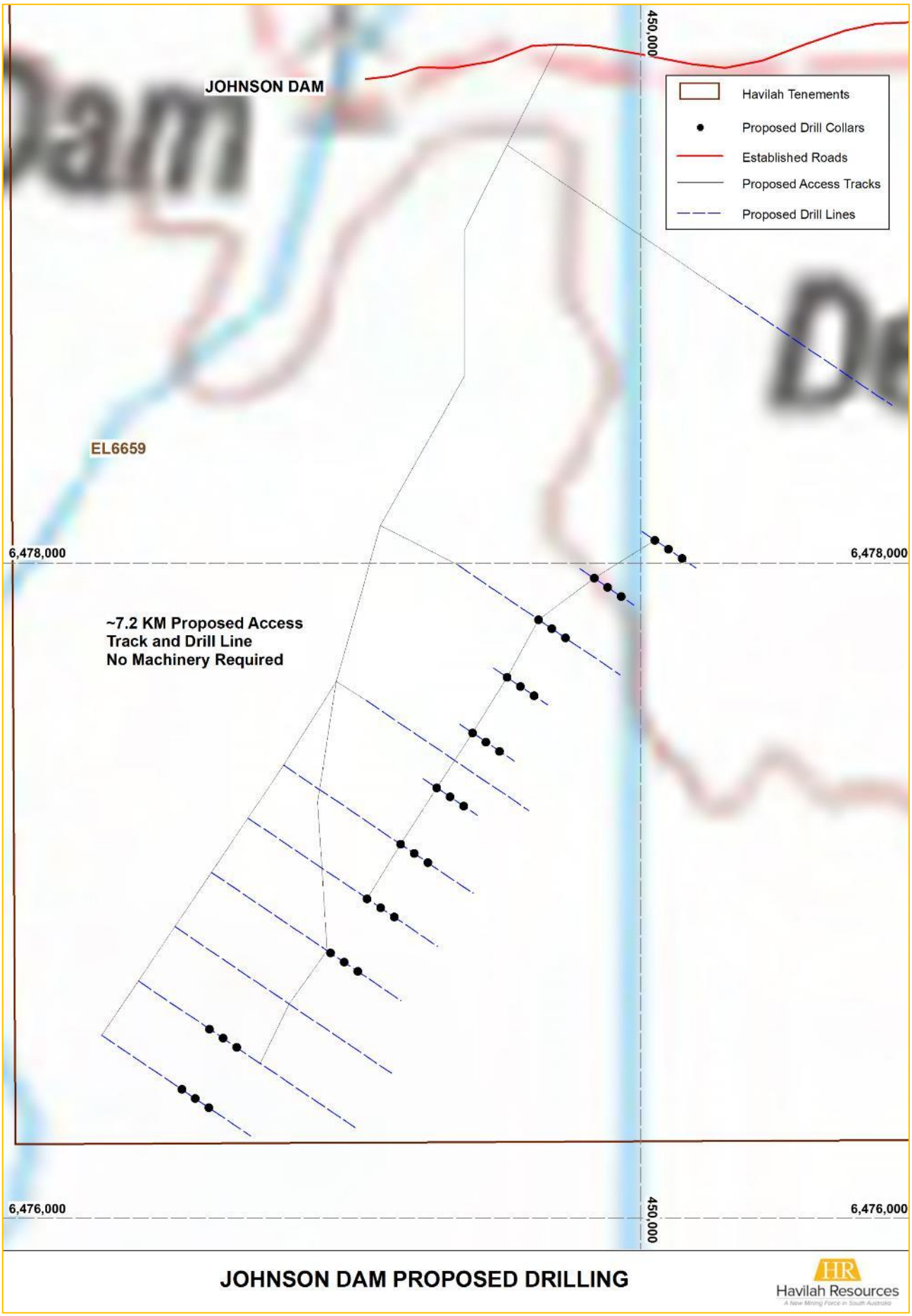
Map 3: Birksgate Proposed Drilling – Satellite Image.



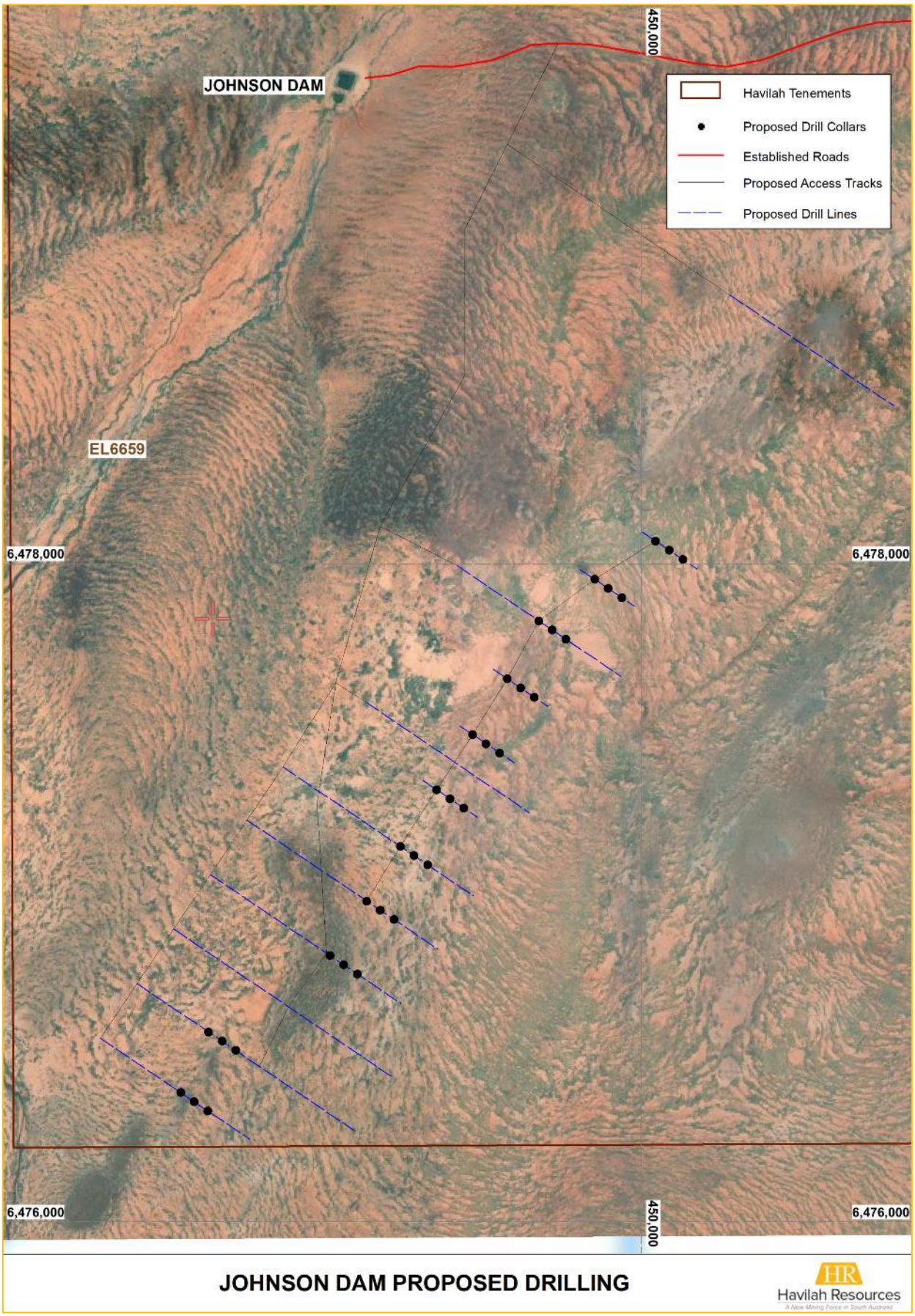
Map 4: Eurinilla Proposed Drilling – Topography.



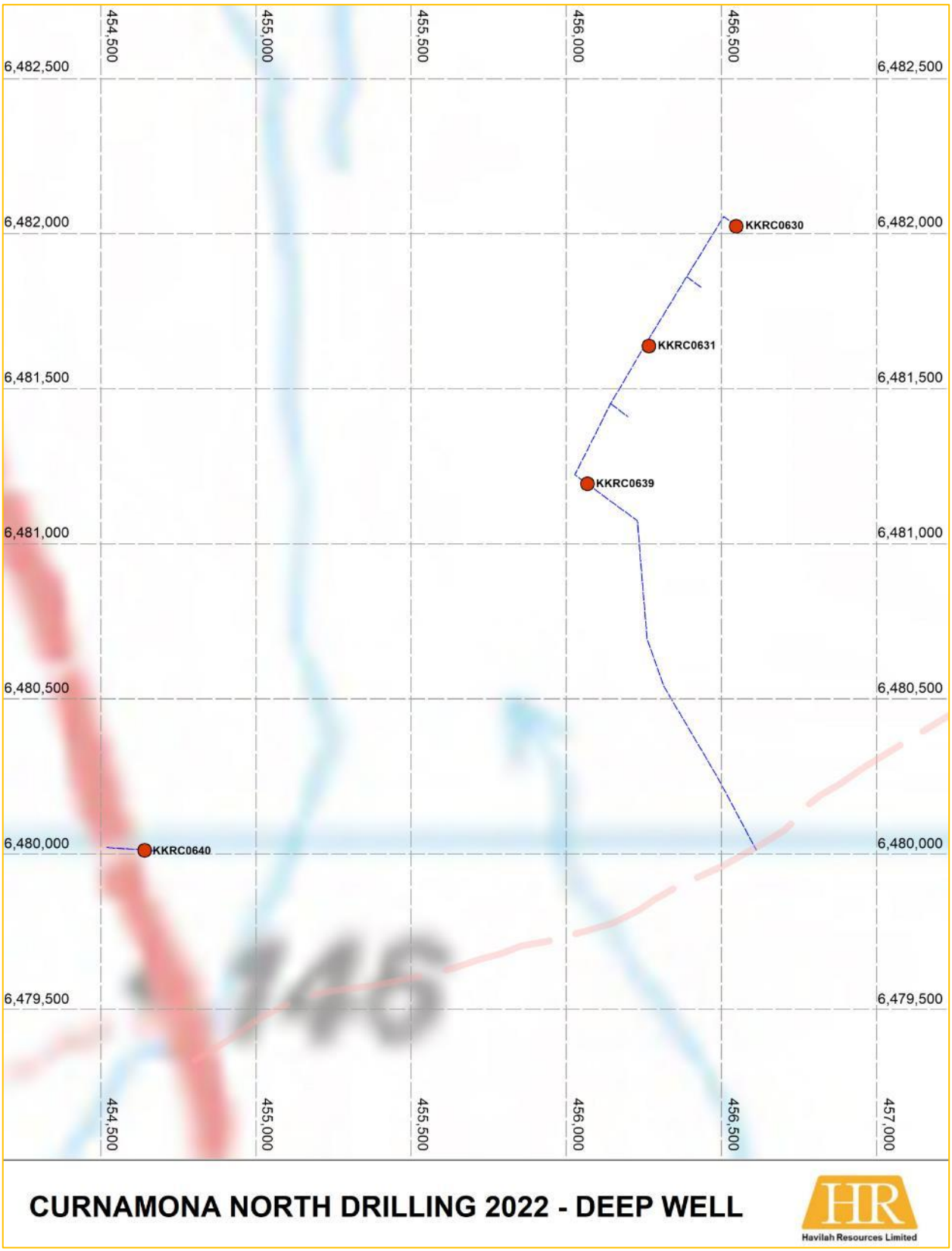
Map 5: Eurinilla Proposed Drilling – Satellite Image.



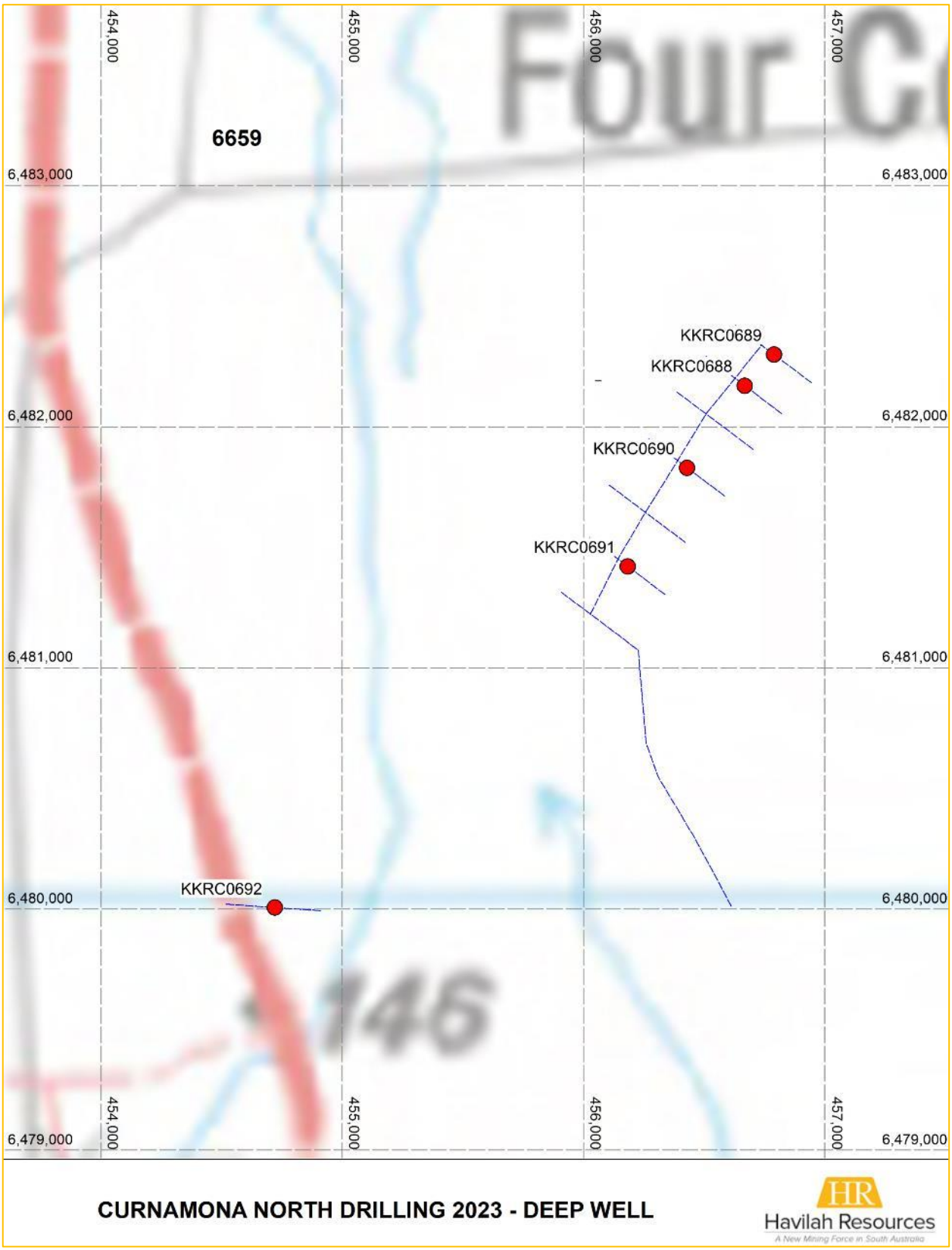
Map 6: Johnson Dam Proposed Drilling – Topography.



Map 7: Johnson Dam Proposed Drilling – Satellite Image.



Map 8: Deep Well Previous Drilling – possible diamond tail location to be decided.



Map 9: Deep Well Previous Drilling – possible diamond tail location to be decided.

SECTION I – PHOTOS

Include photographs in this section:

- that have been obtained during site visits
- that help describe relevant environmental and operational aspects in the PEPR.

Site identification	Date taken	Photo number & PEPR section reference	Easting (GDA94)	Northing (GDA94)	Zone	Details and Comments
Northern Area – Birksgate Prospect (EL5873)	28/08/2023	Photo 01 Section C	442040	6537690	54	BKRC001 drill site, shows general area of the Birksgate Prospect, and drill rig set-up onsite.

Site identification	Date taken	Photo number & PEPR section reference	Easting (GDA94)	Northing (GDA94)	Zone	Details and Comments
Northern Area – Birksgate Prospect (EL5873)	25/08/2023	Photo 02 Section C	441090	6537690	54	Line 1 Access Track, shows general area of the Birksgate Prospect.

Site identification	Date taken	Photo number & PEPR section reference	Easting (GDA94)	Northing (GDA94)	Zone	Details and Comments
Northern Area – Eurinilla Prospect (EL6415)	21/09/2023	Photo 03 Section C	461430	6524970	54	EURC007 drill site, shows general area of the Eurinilla Prospect.

Site identification	Date taken	Photo number & PEPR section reference	Easting (GDA94)	Northing (GDA94)	Zone	Details and Comments
Southern Area – Kalkaroo (EL6659)	Nov 2013	Photo 04 Section C	454442	6488573	54	General area of proposed drilling looking east at Kalkaroo East and Kalkaroo Saddle Prospects.

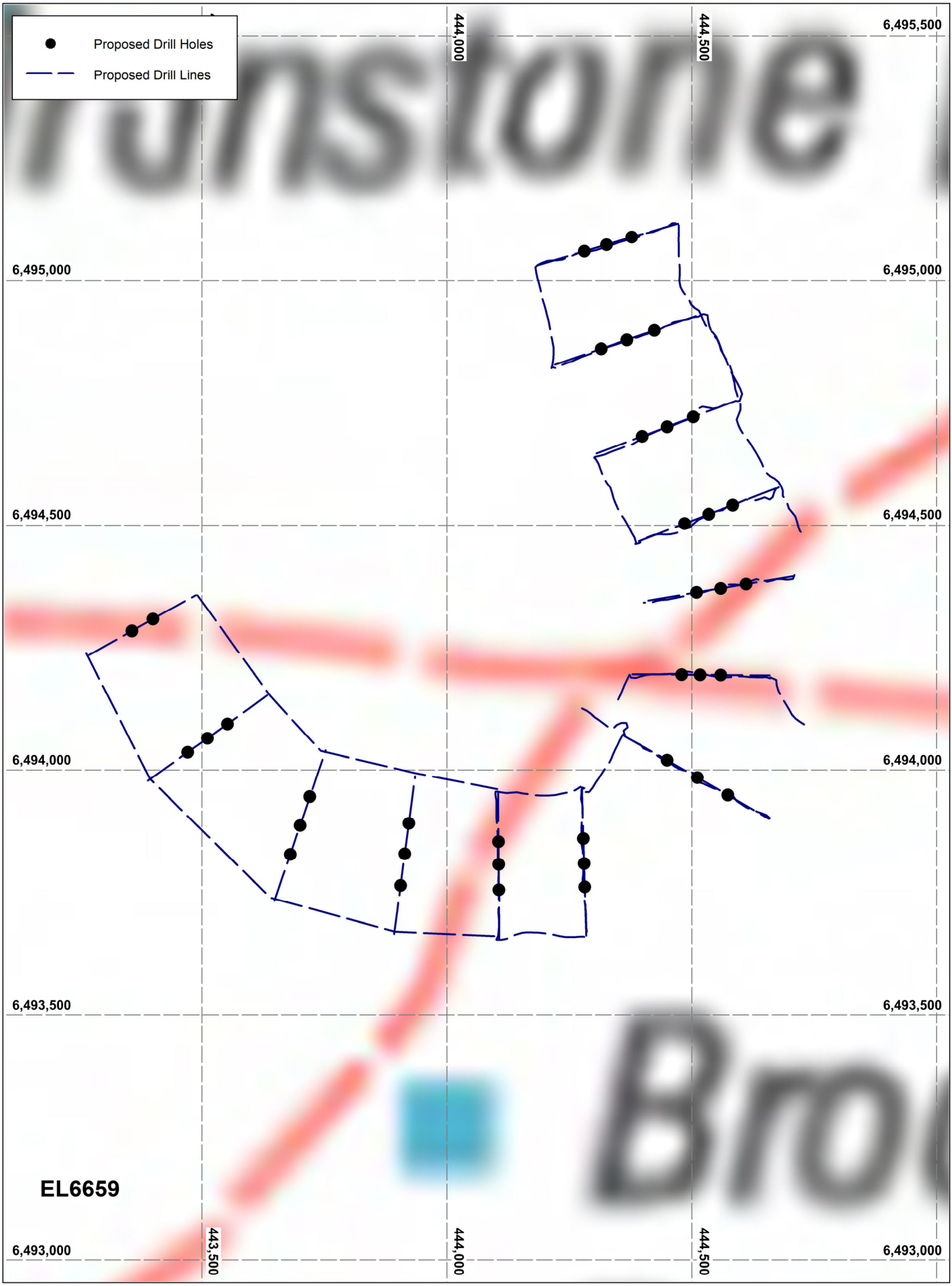
Site identification	Date taken	Photo number & PEPR section reference	Easting (GDA94)	Northing (GDA94)	Zone	Details and Comments
Southern Area – Kalkaroo (Deep Well Prospect) (EL6659)	18/03/2023/ 13/08/2023	Photo 05 Section D	456180	6481420	54	KKRC0691 drill site, shows general area of the Kalkaroo Area. The Deep Well Prospect is ~6 km northwest of Johnson Dam, which is characterised by similar country. Before drilling (above), after drilling* (below).

*Note: Bags used when this photo taken, as mentioned in Section D – Sample Management, green bags are being phased out.

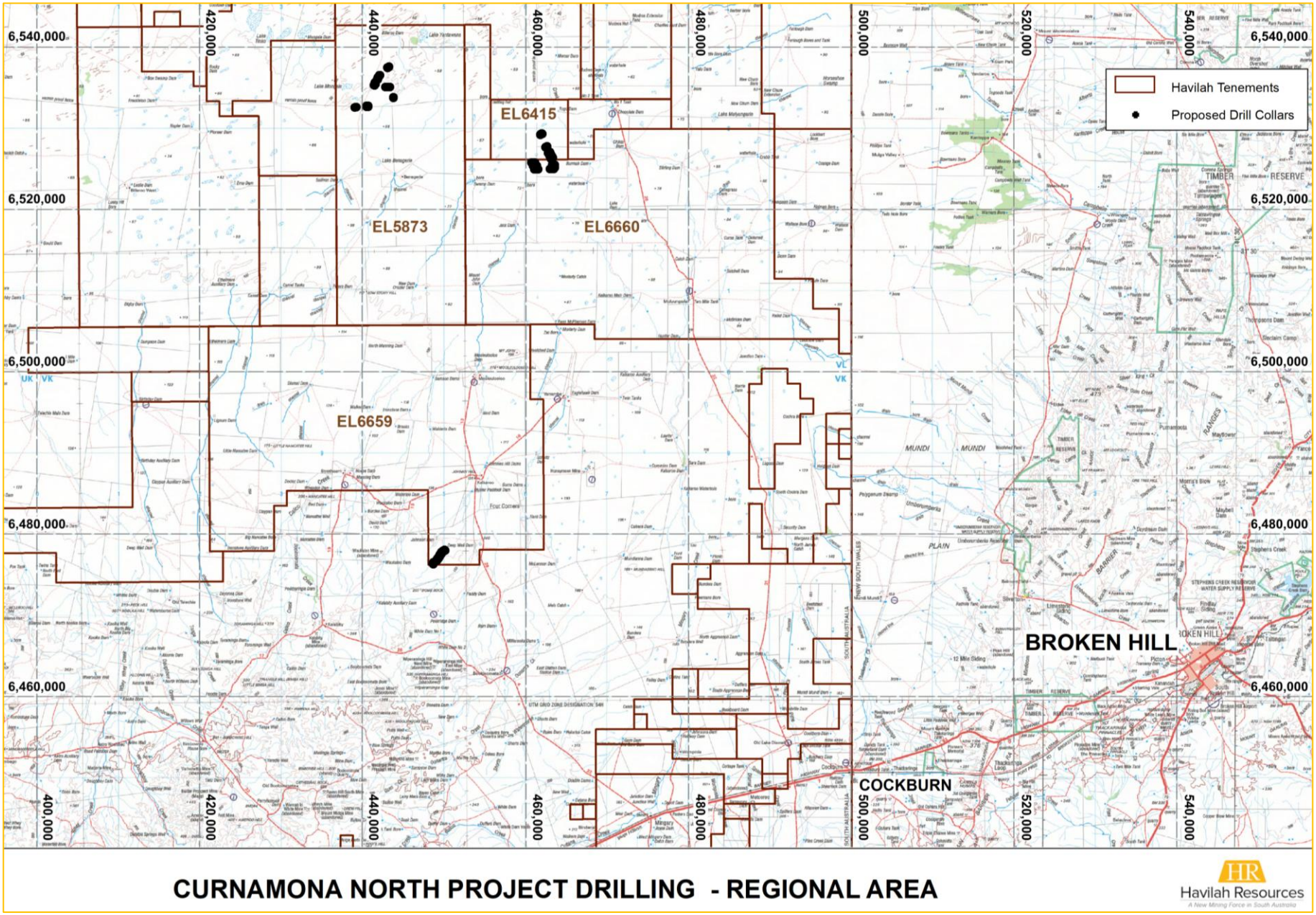
Site identification	Date taken	Photo number & PEPR section reference	Easting (GDA94)	Northing (GDA94)	Zone	Details and Comments
Southern Area – Johnson Dam Prospect (EL6659)	12/11/2022	Photo 06 Section D	~449265	~6477184	54	General area of the Johnson Dam Prospect before drilling (both pictures).

Site identification	Date taken	Photo number & PEPR section reference	Easting (GDA94)	Northing (GDA94)	Zone	Details and Comments
Southern Area – Kalkaroo (EL6659)	11/06/202 / 27/02/2022	Photo 07 Section D	454758	6488838	54	2020 drillhole KKAC0540 after drilling* (top), after rehabilitation (bottom).

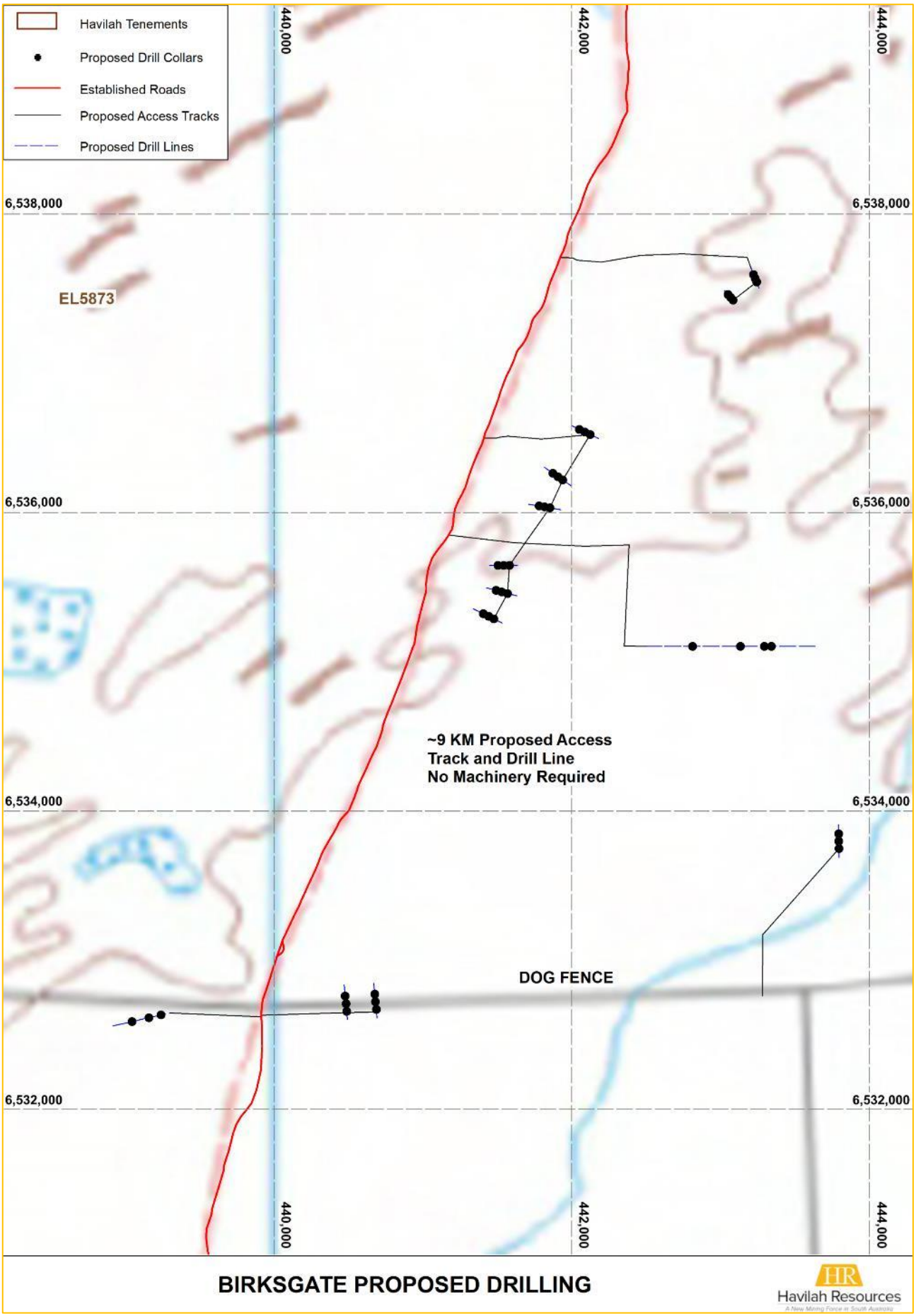
*Note: Bags used when this photo taken, as mentioned in Section D – Sample Management, green bags are being phased out.



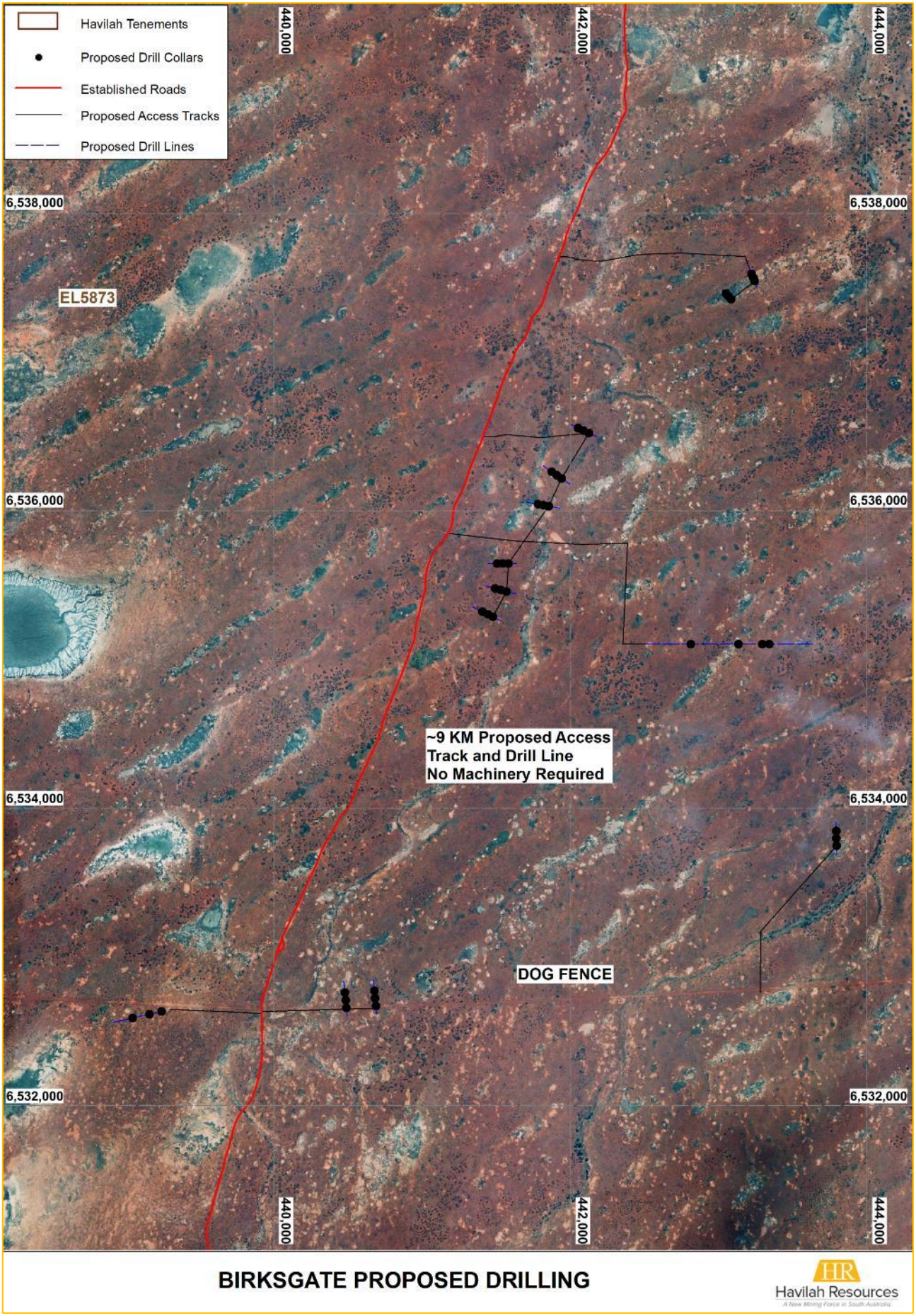
Curnamona North PEPR - Brooks Dam



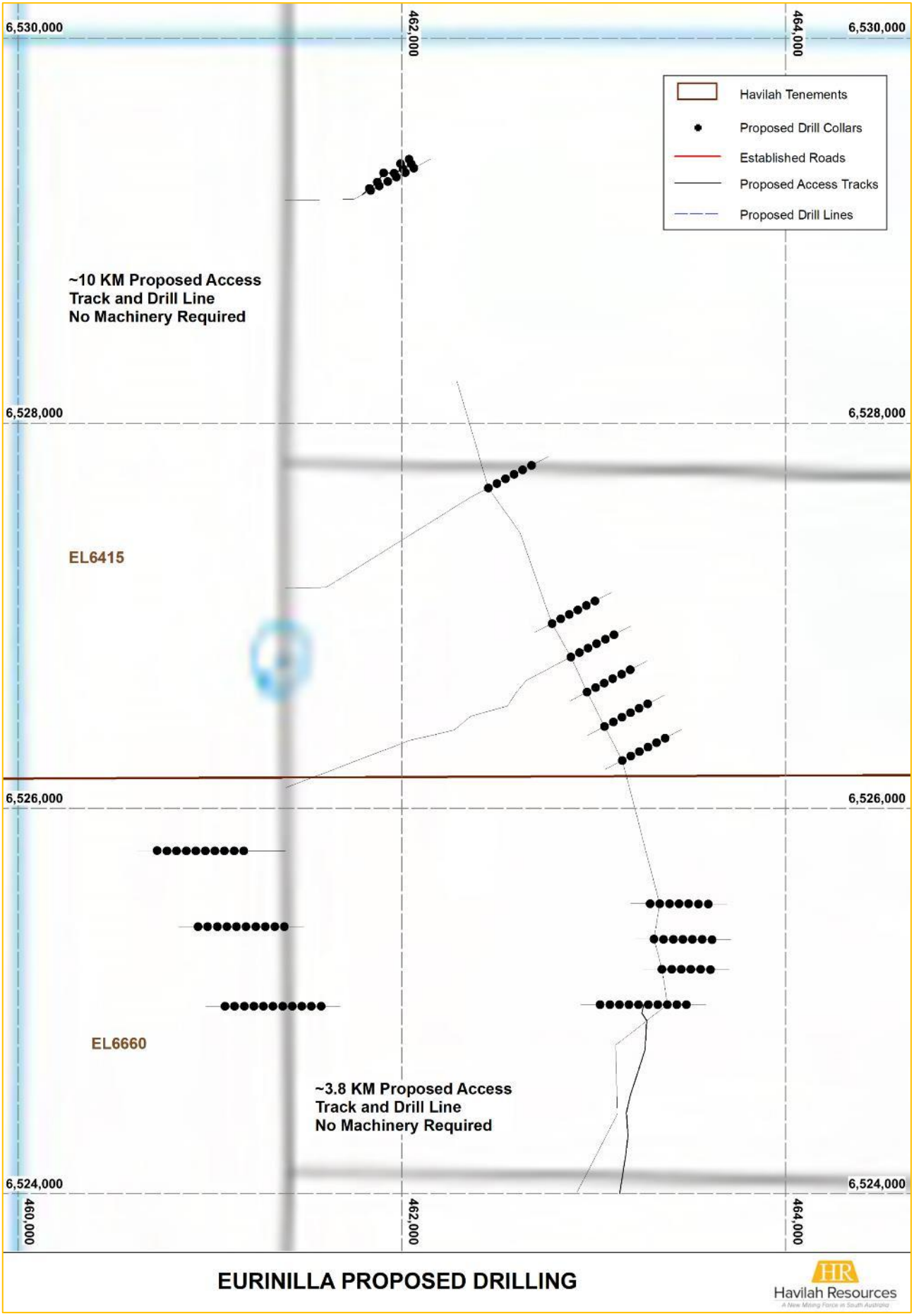
Map 1: Tenement Location – Regional.



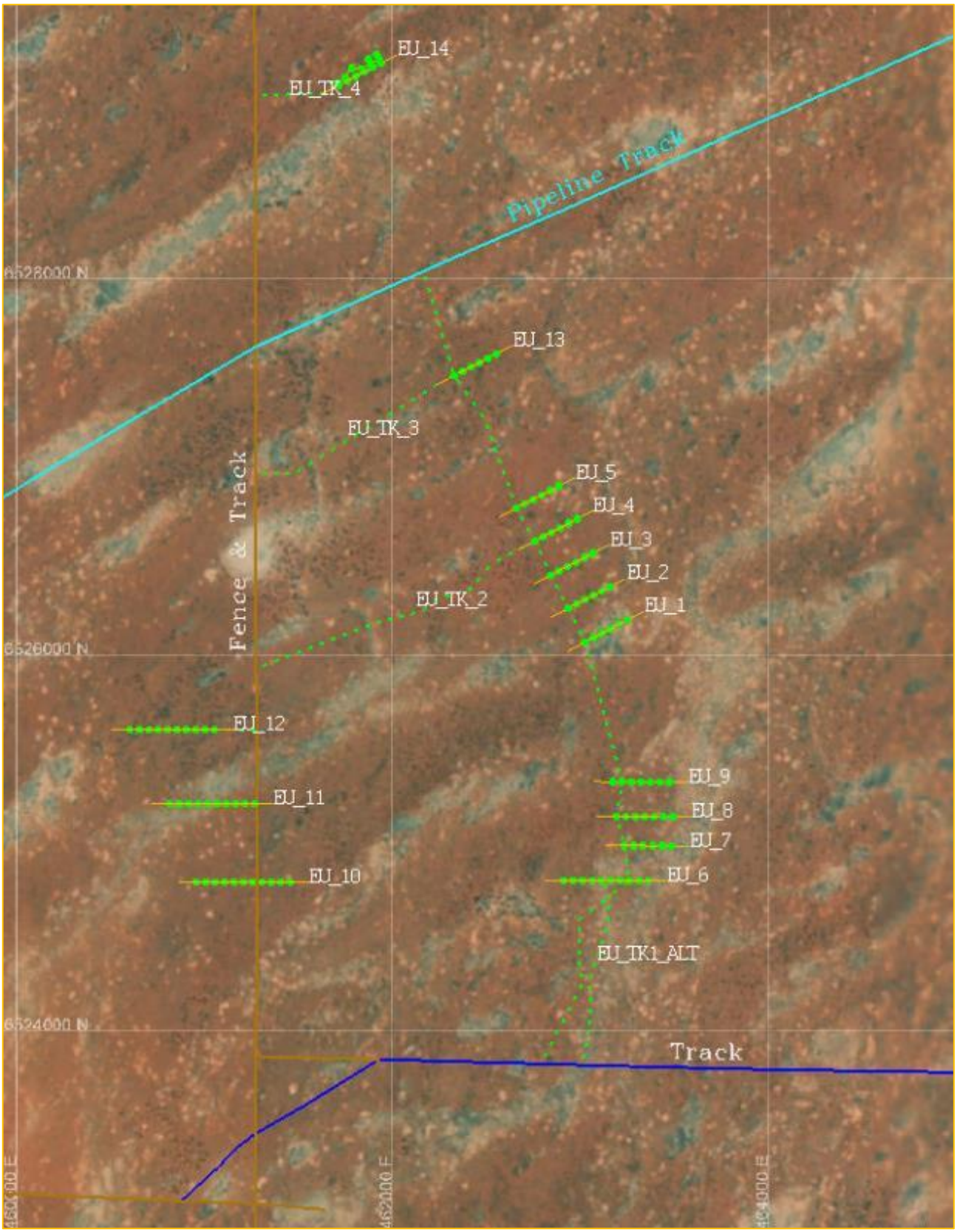
Map 2: Birksgate Proposed Drilling – Topography.



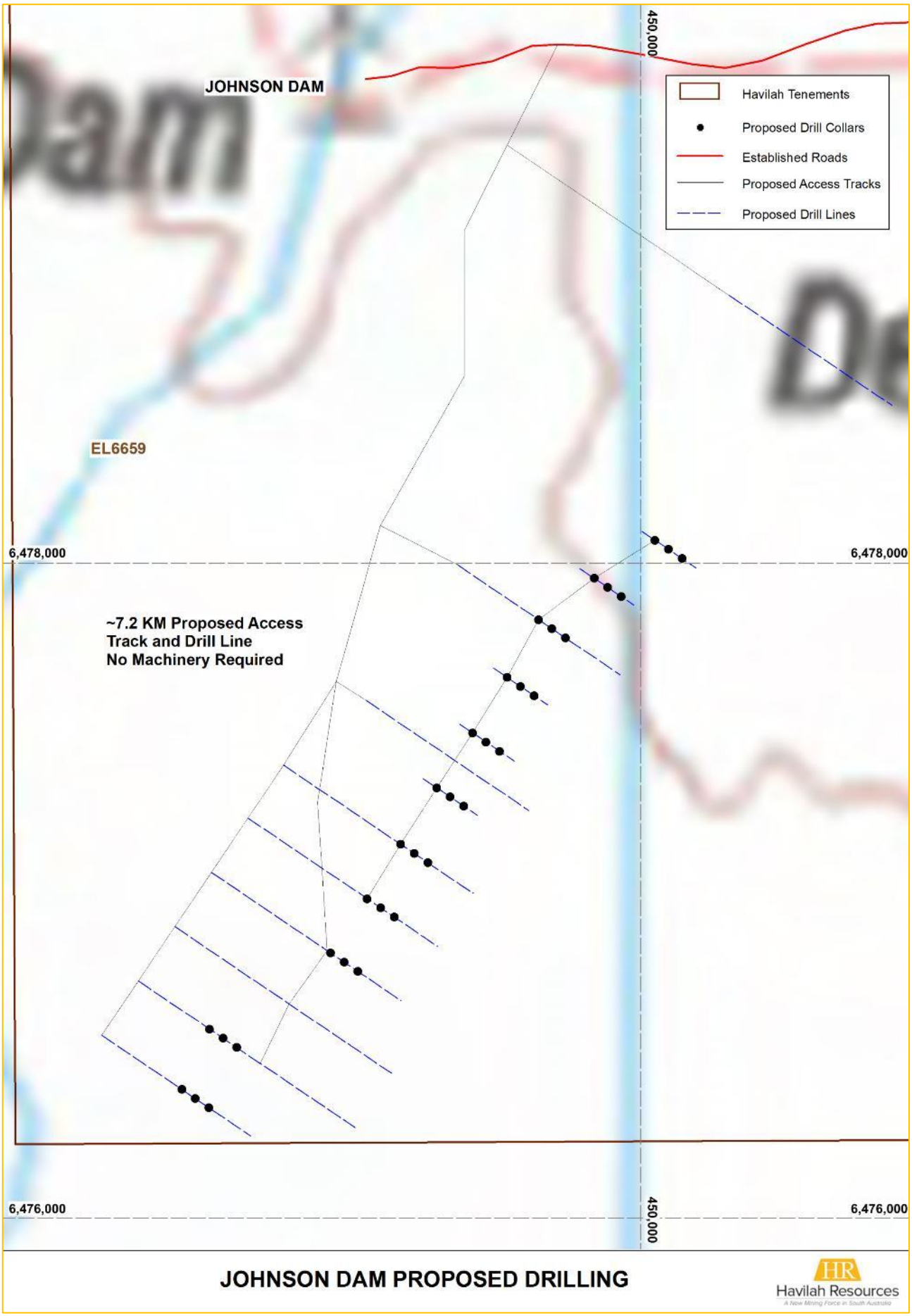
Map 3: Birksgate Proposed Drilling – Satellite Image.



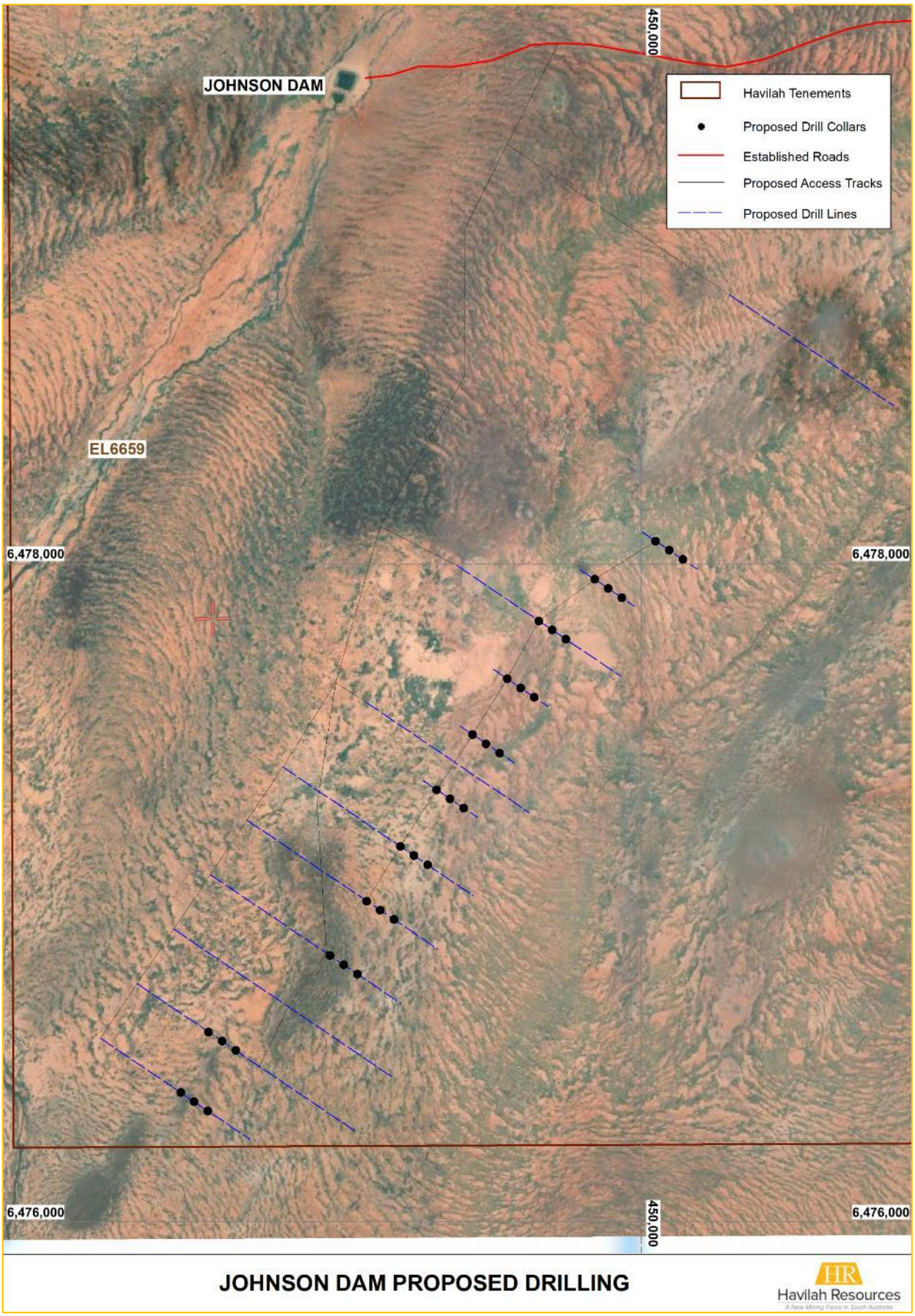
Map 4: Eurinilla Proposed Drilling – Topography.



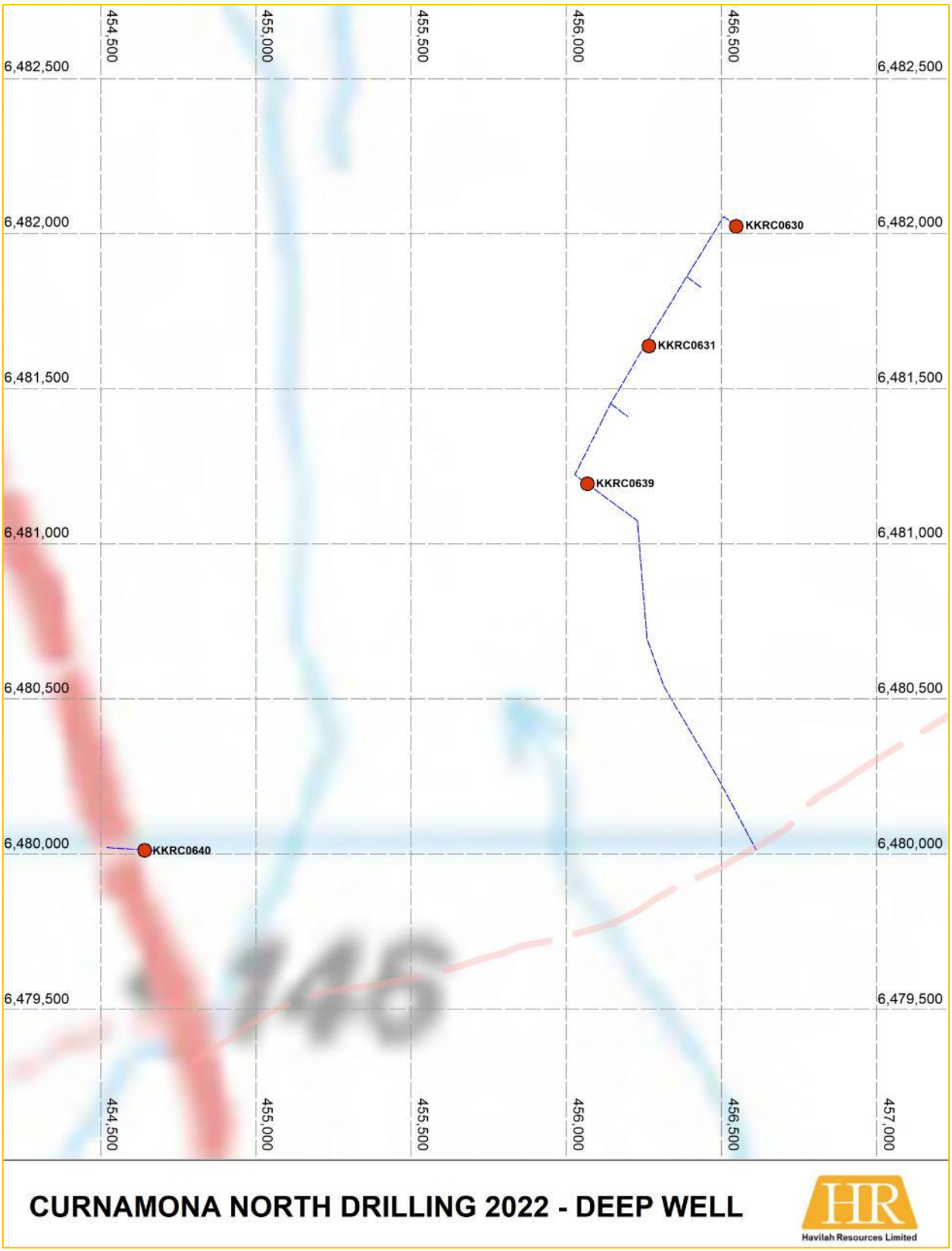
Map 5: Eurinilla Proposed Drilling – Satellite Image.



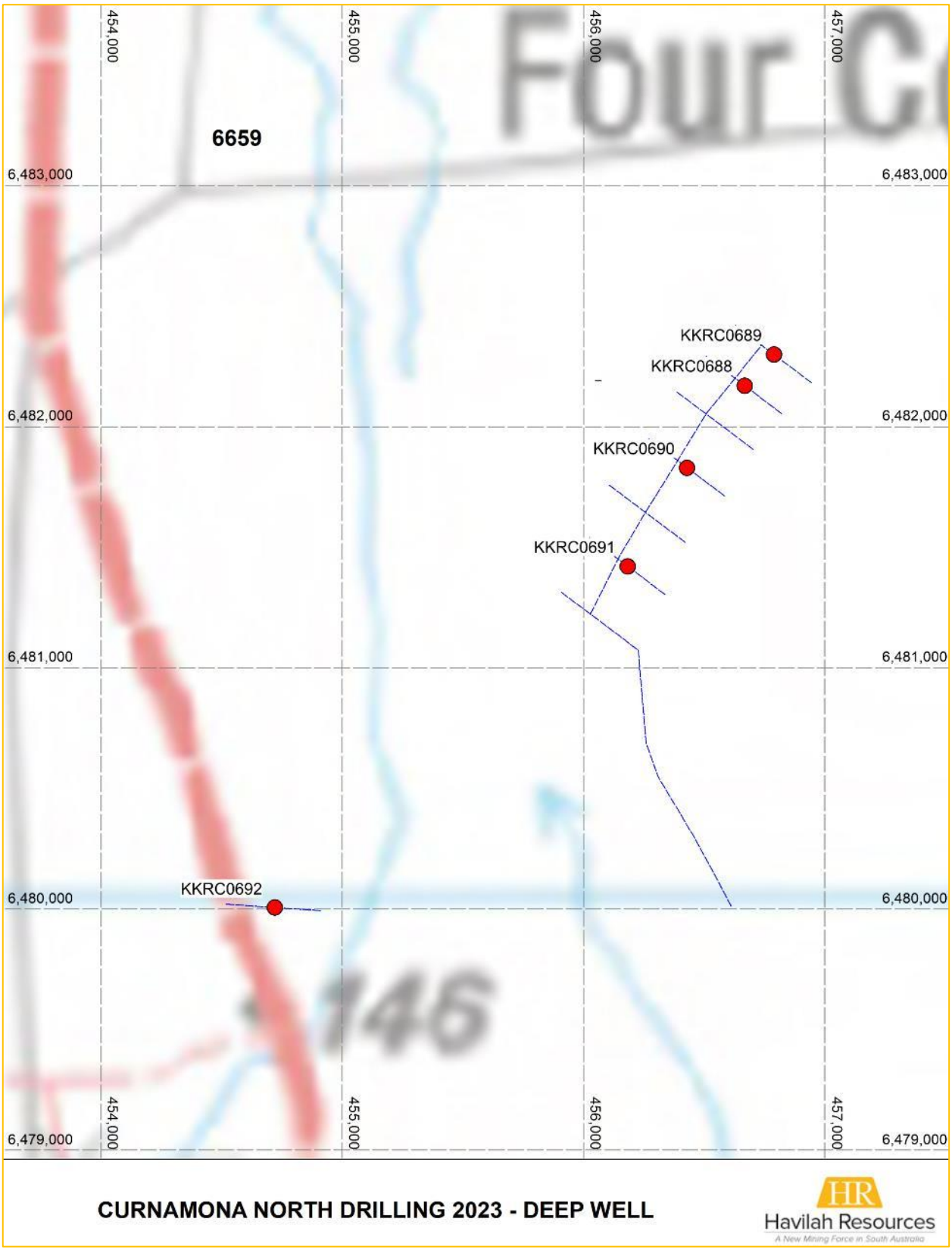
Map 6: Johnson Dam Proposed Drilling – Topography.



Map 7: Johnson Dam Proposed Drilling – Satellite Image.



Map 8: Deep Well Previous Drilling – possible diamond tail location to be decided.



Map 9: Deep Well Previous Drilling – possible diamond tail location to be decided.