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Sunrise Project

Groundwater Management Plan

August 2021
Revision 2

SUNRISE PROJECT

GROUNDWATER MANAGEMENT PLAN

REVISION 2

AUGUST 2021
Project No. CTL-17-03
Document No. 2020-CTEQ-0000-66AA-0017

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1 INTRODUCTION

The Sunrise Project (the Project) is a nickel, cobalt and scandium open cut mining project situated near the village of Fifield, approximately 350 kilometres (km) west northwest of Sydney, in New South Wales (NSW) (Figure 1).

The Project includes the establishment and operation of the following (Figure 1):

- mine (including the high pressure acid leach processing facility);
- limestone quarry;
- rail siding;
- gas pipeline;
- borefield, surface water extraction infrastructure and water pipeline;
- accommodation camp; and
- associated transport activities and transport infrastructure (e.g. the Fifield Bypass).

SRL Ops Pty Ltd owns the rights to develop the Project. SRL Ops Pty Ltd is a wholly owned subsidiary of Sunrise Energy Metals Limited (SEM)[1].

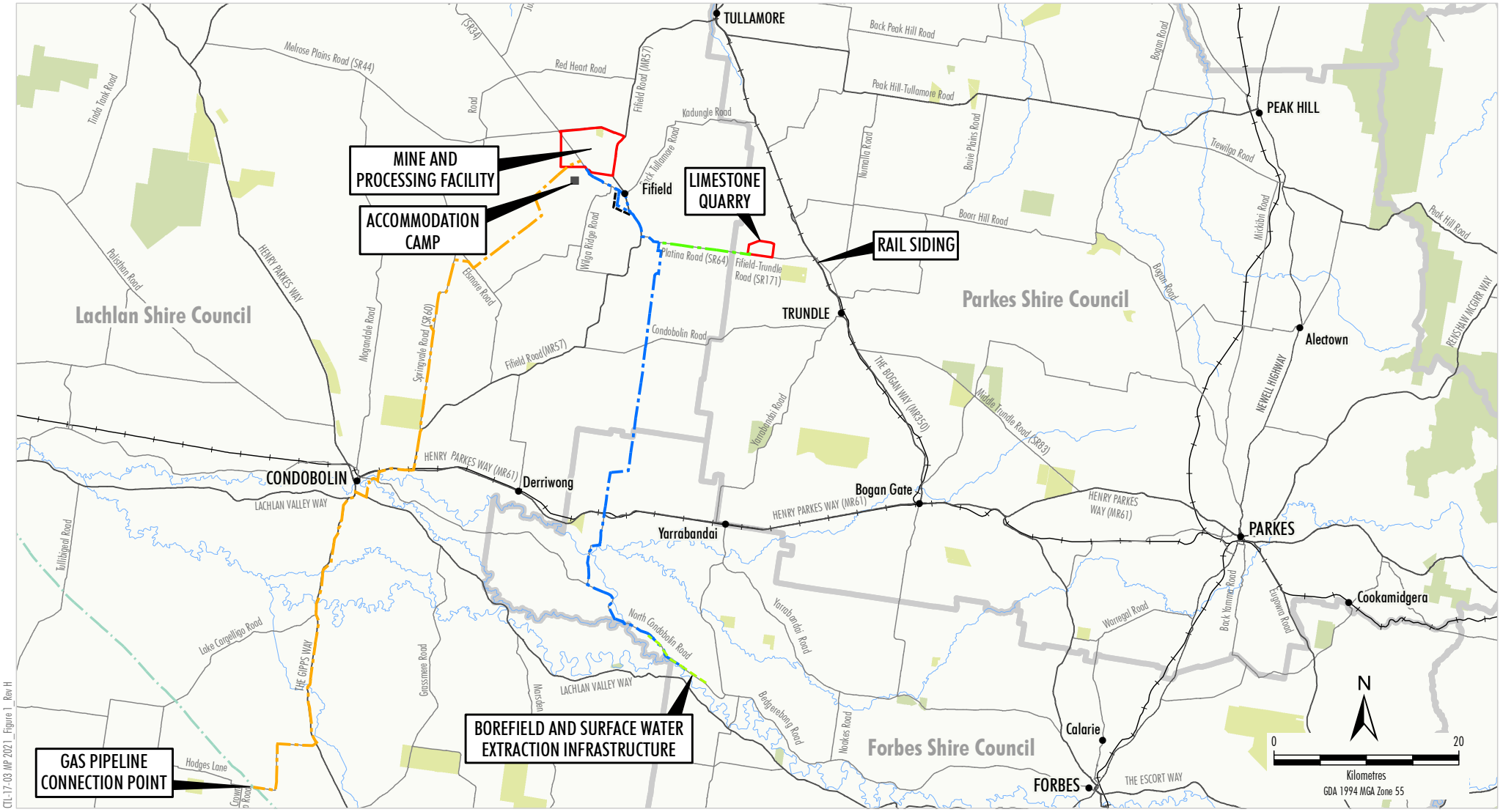
Development Consent DA 374-11-00 for the Project was issued under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) in 2001. Six modifications to Development Consent DA 374-11-00 have since been granted under the EP&A Act:

- 2005 – to allow for an increase of the autoclave feed rate, limestone quarry extraction rate and adjustments to ore processing operations;
- 2006 – to allow for the reconfiguration of the borefield;
- 2017 (May) – to allow for the production of scandium oxide;
- 2017 (December) – to amend hazard study requirements;
- 2018 (May) – to relocate the accommodation area; and
- 2018 (December) – to implement opportunities to improve the overall efficiency of the Project.

1.1 PURPOSE AND SCOPE

This Groundwater Management Plan (GWMP) has been prepared by SEM in accordance with the requirements of Condition 30(c), Schedule 3 of Development Consent DA 374-11-00 (Table 1).

[1] SEM was previously Clean TeQ Holdings Limited (Clean TeQ).



Source: Black Range Minerals (2000); Clean TeQ (2017, 2018); NSW Spatial Services (2020)

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Regional Location

Figure 1

Table 1
GWMP Requirements in Development Consent DA 374-11-00

Development Consent DA 374-11-00 Schedule 3	Section Where Addressed in this GWMP
30. Prior to carrying out any development after 6 May 2017, the Applicant must prepare a Water Management Plan for the development in consultation with DoI Lands & Water and the EPA, and to the satisfaction of the Secretary. This plan must include:	The Water Management Plan (WMP)
c) a Groundwater Management Plan, that includes:	This GWMP
• *baseline data on groundwater levels, yield and quality in the region and privately-owned groundwater bores that could be affected by the development in the vicinity of the borefields;*	Section 4
• *groundwater assessment criteria, including trigger levels for investigating any potentially adverse groundwater impacts associated with the development in the vicinity of the borefields;*	Section 6
• *a program to monitor and report on:* – *groundwater inflows into the open cut pits, if relevant;* – *the seepage/leachate from the tailings storage facility and evaporation ponds; and* – *the impacts of the development on:* o *groundwater supply of any potentially affected landholders, particularly around the borefields;* o *regional and local aquifers; and* o *post-mining groundwater recovery;*	Section 8 to 10
• *a plan to respond to any exceedances of the groundwater assessment criteria, and mitigate any adverse impacts of the development;*	Sections 7 to 10
31. The Applicant must implement the approved Water Management Plan for the development.	Section 3.1.1

On 5 July 2018, the Secretary of the Department of Planning and Environment (now the Department of Planning, Industry and Environment [DPIE]) (the Secretary) approved the progressive submission of environmental management plans for the Project in accordance with Condition 12, Schedule 2 of Development Consent DA 374-11-00. The scope of this GWMP is specifically related to the following Initial Construction Activities at the Project:

- development of the mine, including:
- site establishment and earthworks;
- construction of site access roads and haul roads;
- processing facility earthworks;
- establishment of temporary facilities required for construction activities (e.g. offices, lay down areas, communications infrastructure);
- construction of the mine infrastructure area including the offices, workshops, warehouse, laboratory and amenities buildings, fuel storage areas, potable water treatment plant and car parking facilities;
- construction of the tailings storage facility and evaporation pond;
- construction of water management infrastructure including the raw water dam, water storage dam and sediment dams;
- construction and operation of the concrete batch plant;
- development of gravel and clay borrow pits (including blasting and crushing);
- installation of appropriate fencing and barriers for public safety and security for mining and construction; and

- other associated minor infrastructure, plant, equipment and activities.
- development and operation of the accommodation camp;
- installation and operation of the borefield[2], surface water extraction infrastructure and water pipeline; and
- road upgrades.

Up to 900 Million litres per year (ML/year) will be extracted from the Project borefield during the Initial Construction Activities.

The approximate extent of the Initial Construction Activities at the mine site and accommodation camp are shown on Figure 2. The general arrangement of the mine site and accommodation camp during operations is shown on Figure 3. The approved water pipeline alignment, and the borefield and surface water extraction general arrangement is shown on Figures 1 and 4 respectively.

The Initial Construction Activities would not include any development of the limestone quarry, rail siding or gas pipeline.

1.2 STRUCTURE OF THE GROUNDWATER MANAGEMENT PLAN

The remainder of this GWMP is structured as follows:

Section 2: Describes the review and update of the GWMP.

Section 3: Outlines the statutory requirements applicable to the GWMP.

Section 4: Provides an overview of the hydrogeological setting and baseline data.

Section 5: Describes the potential groundwater impacts associated with the Project.

Section 6: Details the performance measures and performance indicators that will be used to assess the Project, including trigger levels.

Section 7: Provides a description of the Project borefield layout and other groundwater management measures.

Section 8: Details the groundwater monitoring program.

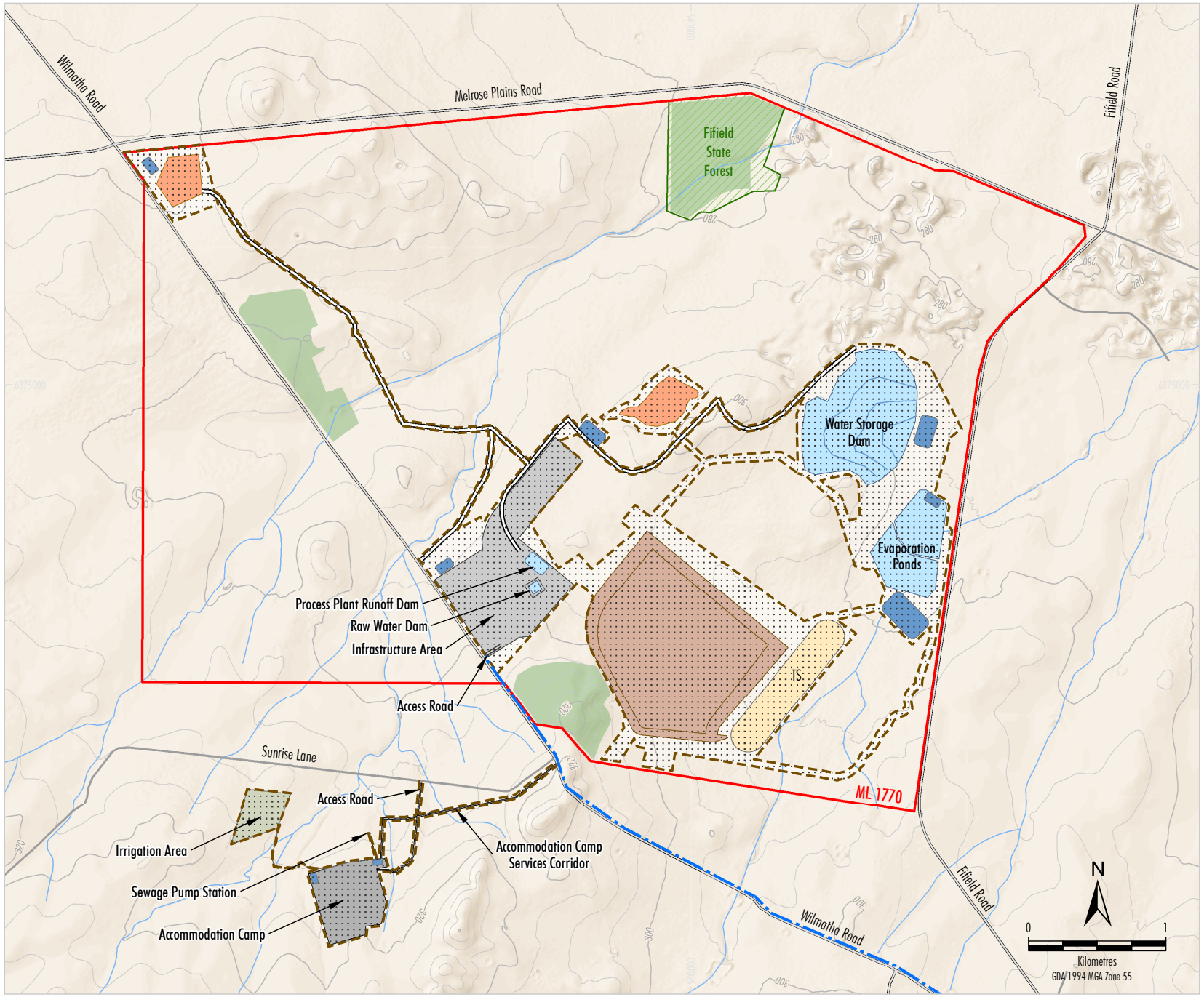
Section 9: Provides a Contingency Plan to manage any unpredicted impacts and their consequences.

Section 10: Describes the program to review and report on the effectiveness of management measures and improvement of environmental performance.

Section 11: Describes the protocol for management and reporting of incidents, complaints and non-compliances with statutory requirements.

Section 12: Lists the references cited in this GWMP

[2] Two of the six approved production bores have been constructed to date (Figure 4).



LEGEND

- State Forest
- Mining Lease Boundary (ML)
- Initial Construction Activities
- Surface Development Area
- Tailings Storage Facility
- Borrow Pit
- TS Topsoil Stockpile
- Infrastructure Area
- Water Storage
- Sediment Dam
- Existing Open Woodland to be Maintained
- Water Pipeline

Note: The sediment dam located in the footprint of the evaporation ponds will be used during construction of the evaporation ponds and will be decommissioned once the evaporation ponds are constructed.

Source: Black Range Minerals (2000); Clean TeQ (2017, 2019); NSW Spatial Services (2020)

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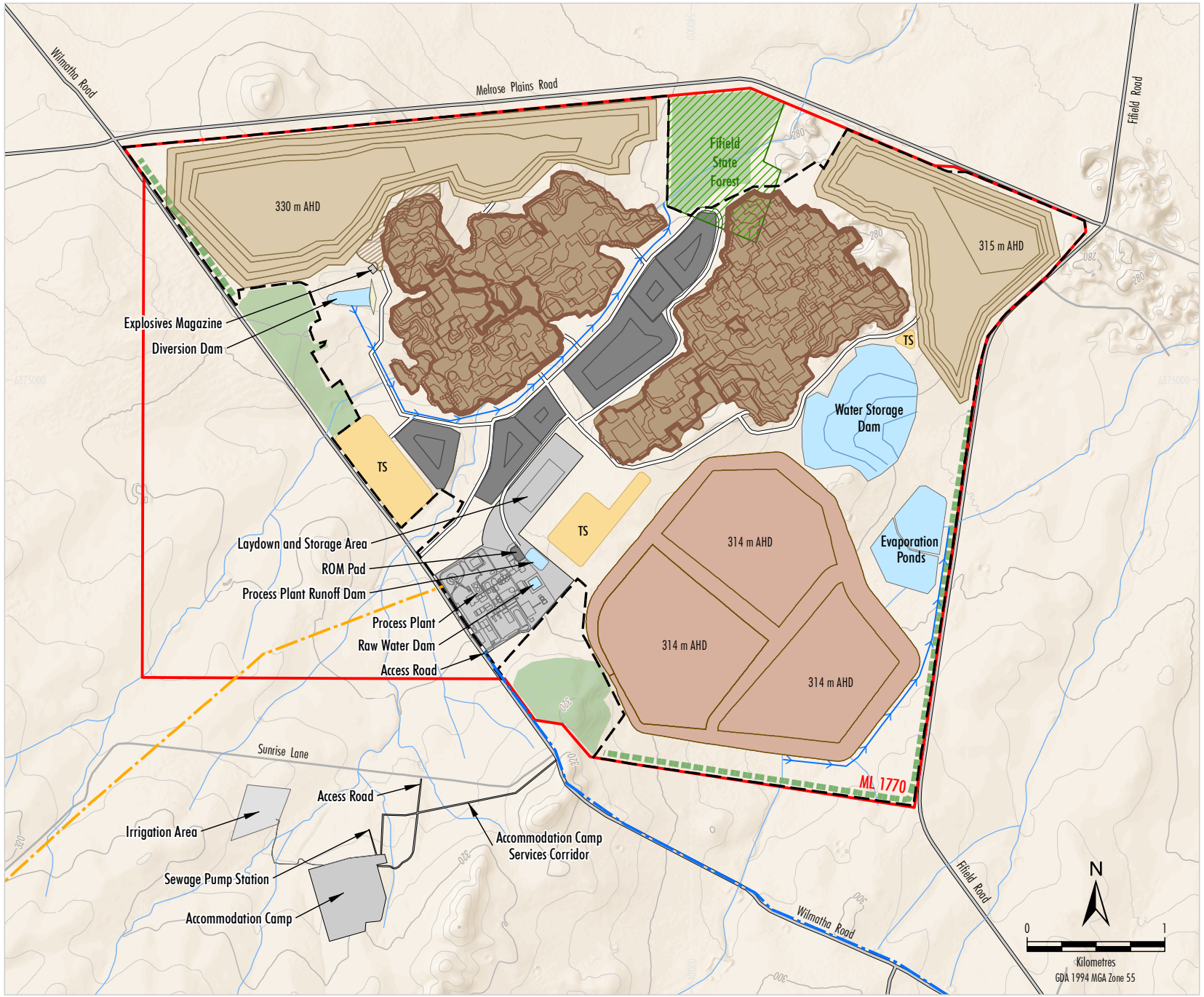
Mine and Processing Facility General Arrangement (Initial Construction Activities)

Figure 2



LEGEND

- State Forest
- Mining Lease Boundary (ML)
- Approved Surface Development Area
- Open Cut Pit (Scandium Oxide)
- Open Cut Pit
- Waste Rock Emplacement
- Tailings Storage Facility
- TS Topsoil Stockpile
- Ore Stockpile
- Mine Infrastructure Area
- Diversion Structure
- Vegetation Screening
- Existing Open Woodland to be Maintained
- Gas Pipeline
- Water Pipeline

Source: Black Range Minerals (2000); Clean TeQ (2017, 2019); NSW Spatial Services (2020)

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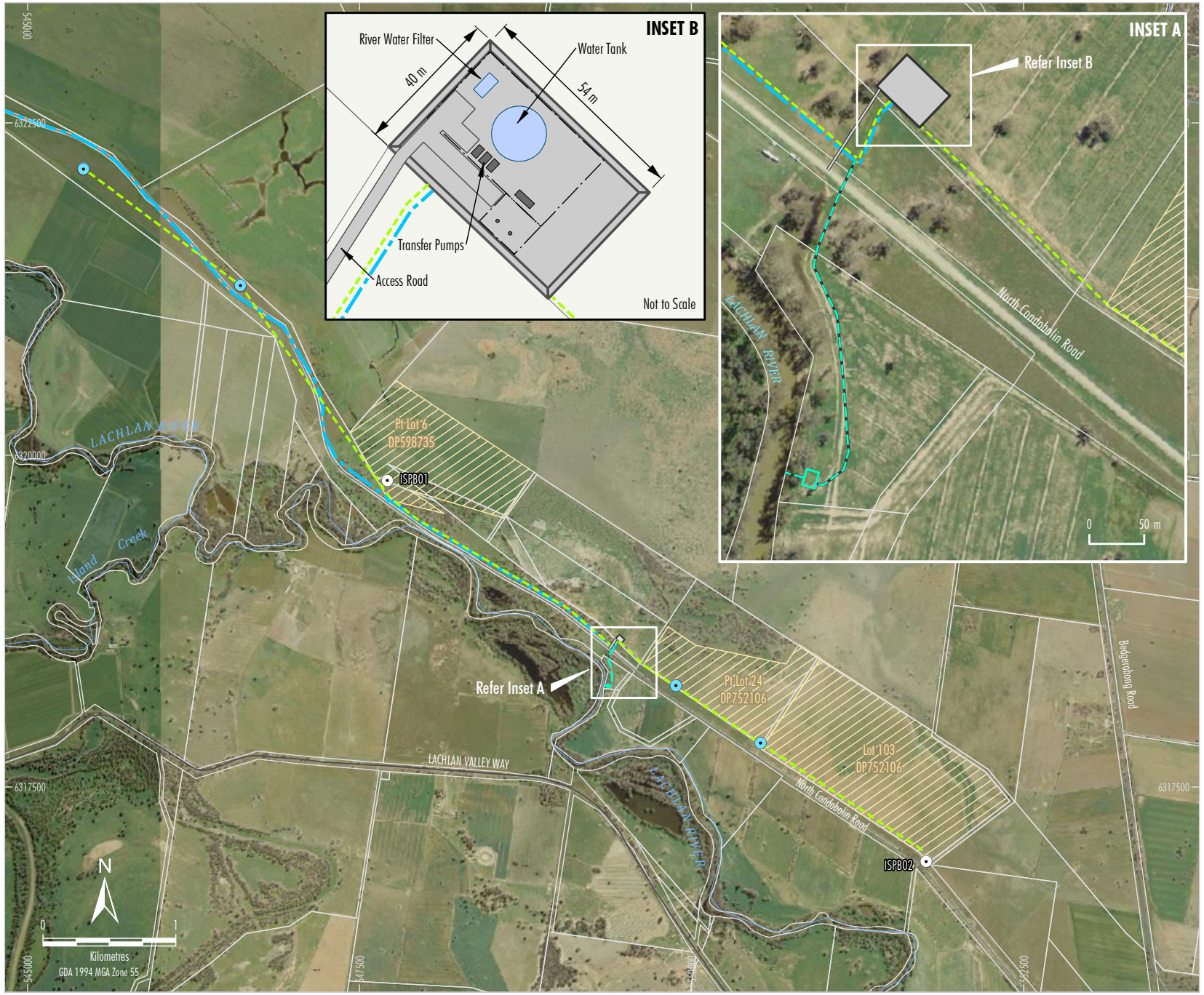
Mine and Processing Facility Conceptual General Arrangement

Figure 3



LEGEND

- Property Boundary
- Borefield Location
- Water Pipeline
- Borefield Infrastructure Corridor *
- Surface Water Infrastructure Corridor *
- Pump Station
- Transfer Station
- Access Road
- Production Bore (constructed)
- Production Bore (not constructed)

* Infrastructure Corridor includes linking pipline, access road and electricity transmission line.

Source: Clean TeQ (2017, 2019); Ivanplats Syerston (2005); NSW Spatial Services (2020)
NSW Imagery: © Department of Finance, Services & Innovation (2018)

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Borefield and Surface Water Extraction General Arrangement

Figure 4

2 GROUNDWATER MANAGEMENT PLAN REVIEW AND UPDATE

2.1 CONSULTATION

This GWMP (Revision 2) will be provided to the NSW Natural Resources Access Regulator (NRAR) and the NSW Environment Protection Authority (EPA) for consultation in accordance with Condition 30, Schedule 3 of Development Consent DA 374-11-00.

2.2 REVIEW AND UPDATE

Consistent with the Secretary's approval for the progressive submission of environmental management plans, this GWMP would be re submitted and approved prior to the commencement of activities not included in the scope of this GWMP. Specifically, this GWMP will be updated prior to completion of the Initial Construction Activities in the following stages:

- Construction Stage (after the Initial Construction Stage) – allow for the continued extraction of up to 900 ML/year from the two existing production bores.
- Operations Stage – allow for the extraction of more than 900 ML/year from the approved six production bores.

A summary of the staging of borefield development is provided in Section 4.2.1.

In accordance with Condition 6, Schedule 5 of Development Consent DA 374-11-00, this GWMP will be reviewed, and if necessary revised (to the satisfaction of the Secretary), within three months of the submission of:

- an Annual Review (Condition 5, Schedule 5);
- an incident report (Condition 8, Schedule 5);
- an independent environmental audit (Condition 10, Schedule 5); or
- any modification to the conditions of Development Consent DA 374-11-00 (unless the conditions require otherwise).

The reviews would be undertaken to ensure the GWMP is updated on a regular basis and to incorporate any recommended measures to improve the environmental performance of the Project.

Within four weeks of conducting a review of the GWMP, the Secretary will be advised of the outcomes of the review and any revised documents submitted to the Secretary for approval.

If agreed with the Secretary, a revision to the GWMP required under Development Consent DA 374-11-00 may be prepared without undertaking consultation with all parties nominated under the relevant condition of Development Consent DA 374-11-00.

The revision status of this GWMP is indicated on the title page of each copy.

The approved GWMP will be made publicly available on the SEM website, in accordance with Condition 12, Schedule 5 of Development Consent DA 374-11-00.

3 STATUTORY REQUIREMENTS

SEM's statutory obligations relevant to groundwater management are contained in:

- the conditions of Development Consent DA 374-11-00;
- relevant licences and permits, including conditions attached to mining leases; and
- other relevant legislation.

Obligations relevant to this GWMP are described below.

3.1 DEVELOPMENT CONSENT

3.1.1 GWMP Requirements

Condition 30(c), Schedule 3 of Development Consent DA 374-11-00 requires the preparation of a GWMP. Table 1 presents these requirements and indicates where they are addressed in this GWMP.

In accordance with the requirements of Condition 30, Schedule 3 of Development Consent DA 374-11-00 (Table 1), this GWMP is included as a component of the WMP (i.e. Appendix C of the WMP).

In accordance with Condition 31, Schedule 3 of Development Consent DA 374-11-00, SEM will implement the WMP (including the GWMP).

3.1.2 Management Plan (General) Requirements

In addition to the GWMP requirements prescribed in Condition 30(c), Schedule 3; Condition 4, Schedule 5 of Development Consent DA 374-11-00 outlines the management plan (general) requirements that are also applicable to the preparation of this GWMP.

Table 2 presents these requirements and indicates where each is addressed within this GWMP. As noted, the Secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans.

Table 2
Management Plan (General) Requirements

Development Consent DA 374-11-00 Schedule 5	GWMP Section
Management Plan Requirements	
4. The Applicant must ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, are consistent with other plans prepared for other stakeholders, and include:	
a) detailed baseline data;	Section 4
b) a description of:	
• *the relevant statutory requirements (including any relevant approval, licence or lease conditions);*	Section 3
• *any relevant limits or performance measures/criteria;*	Section 6
• *the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures;*	Section 6
c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	Section 7

Table 2 (Continued)
Management Plan (General) Requirements

Development Consent DA 374-11-00 Schedule 5	GWMP Section
d) a program to monitor and report on the: • *impacts and environmental performance of the development;* • *effectiveness of any management measures (see c above);*	Sections 8 to 10
e) a contingency plan to manage any unpredicted impacts and their consequences;	Section 9
f) a program to investigate and implement ways to improve the environmental performance of the development over time;	Section 10
g) a protocol for managing and reporting any:	
• *incidents;*	Section 11.1
• *complaints;*	Section 11.2
• *non-compliances with statutory requirements; and*	Section 11.3
• *exceedances of the impact assessment criteria and/or performance criteria; and*	Section 11.4
h) a protocol for periodic review of the plan.	Section 2
Note: The Secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans.	

3.1.3 Water Management Performance Measures

Table 9 in Development Consent DA 374-11-00 prescribes the water management performance measures for the Project, as follows:

- **Water Management – General**
  - Maintain separation between clean and mine water management systems.
  - Minimise the use of clean water on-site.
- **Construction and Operation of Infrastructure**
  - Design, install and maintain erosion and sediment controls generally in accordance with the series *Managing Urban Stormwater: Soils and Construction including Volume 1* (Landcom, 2004), *Volume 2A – Installation of Services* (Department of Environment and Climate Change [DECC], 2008a) and *Volume 2C – Unsealed Roads* (DECC, 2008b).
  - Design, install and maintain infrastructure within 40 metres (m) of watercourses generally in accordance with the *Guidelines for Controlled Activities on Waterfront Land* (Department of Primary Industries [DPI], 2012), or its latest version.
  - Design, install and maintain any creek crossings generally in accordance with the Policy and *Guidelines for Fish Habitat Conservation and Management* (DPI, 2013) and *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull, S. and Witheridge, G., 2003), or their latest versions.
- **Clean Water Diversion Infrastructure**
  - Maximise the diversion of clean water around disturbed areas on-site.
  - Design, construct and maintain the clean water diversions to capture and convey the 100 year, peak flow rainfall event.

- **Sediment Dams (Mine and Limestone Quarry)**
  - Design, install and/or maintain the dams generally in accordance with the series *Managing Urban Stormwater: Soils and Construction – Volume 1* (Landcom, 2004) and *Volume 2E Mines and Quarries* (DECC, 2008c).
- **Mine and Limestone Quarry Water Storages**
  - Design, install and/or maintain mine and limestone water storage infrastructure to ensure no discharge of mine or limestone quarry water off-site (except in accordance with an EPL).
  - On-site storages (including mine infrastructure dams, groundwater storage and treatment dams) are suitably designed, installed and/or maintained to minimise permeability.
  - Ensure that the floor and side walls of the Tailings Storage Facility, Evaporation Basin and Surge Dam are designed with a minimum of a 900 mm clay or modified soil liner with a permeability of no more than 1 x 10^{-9} metres per second (m/s), or a synthetic (plastic) liner of 1.5 mm minimum thickness with a permeability of no more than 1 x 10^{-14} m/s (or equivalent).
  - Design, install and maintain a seepage interception system in the Tailings Storage Facility embankments in accordance with Dams Safety Committee (DSC) guidelines.
  - Design, install and maintain the water storages to capture and convey the 100 year, 72 hour Average Recurrence Interval (ARI) rainfall event.
  - Design, install and/or maintain the facilities to meet the requirements of the DSC.
  - The design of the tailings storage facility should conform to:
    - *DSC3A – Consequence Categories for Dams* (DSC, 2015); and
    - *DSC3F – Tailings Dams* (DSC, 2012).
- **Chemical and Hydrocarbon Storage**
  - Chemical and hydrocarbon products to be stored in bunded areas in accordance with the relevant Australian Standards.
- **Irrigation Area**
  - Manage the irrigation area in accordance with the EPA's *Environmental Guidelines: Use of Effluent by Irrigation* (Department of Environment and Conservation [DEC], 2004).

SEM will undertake the Project in accordance with these performance measures.

3.1.4 General Requirements

Conditions 26 to 28, Schedule 3 of Development Consent DA 374-11-00 prescribe general water-related requirements for the Project. These conditions are considered in Sections 7.6, 3.3 and 7.5, respectively.

3.1.5 Notification Requirements

In accordance with Condition 10, Schedule 2 of Development Consent DA 374-11-00, SEM will notify the DPIE, Lachlan Shire Council (LSC), Forbes Shire Council and Parkes Shire Council in writing of the day which the:

- commissioning of the borefield starts;
- development of the water pipeline starts; and
- commissioning of the water pipeline starts.

3.2 LICENCES, PERMITS AND LEASES

In addition to the requirements of Development Consent DA 374-11-00, all activities at or in association with the Project will be undertaken in accordance with the following licences, permits and leases which have been issued or are pending issue:

- Mining Leases 1770 and 1769 sought and issued by the NSW Minister for Resources under the NSW *Mining Act 1992*.
- Mining Operations Plan(s) submitted and approved by the NSW Division of Resources and Geoscience.
- Environment Protection Licence (EPL) 21146 issued by the EPA under the NSW *Protection of the Environment Operations Act 1997* (POEO Act).
- Water supply works, water use approvals and water access licences (WALs) issued under the NSW *Water Management Act 2000* (Water Management Act) including:
  - Water Supply Works Approval (WSWA) 70CA614098 for the Project borefield and linking pipeline.
  - WSWA 70WA617095 for the surface water extraction infrastructure and water pipeline.
  - WAL 32068 in the Upper Lachlan Alluvial Groundwater Source (Upper Lachlan Alluvial Zone 5 Management Zone) for 3,154 share components under the *Water Sharing Plan for the Lachlan Alluvial Groundwater Sources 2020*.
  - WAL 39837 in the Upper Lachlan Alluvial Groundwater Source (Upper Lachlan Alluvial Zone 5 Management Zone) for 766 share components under the *Water Sharing Plan for the Lachlan Alluvial Groundwater Sources 2020*.
  - WAL 28681 in the Lachlan Fold Belt Murray-Darling Basin (MDB) Groundwater Source (Lachlan Fold Belt MDB [Other] Management Zone), for 243 share components under the *Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020*.
  - WAL 6679 in the Lachlan Regulated River Water Source, for 123 share components (General Security) under the *Water Sharing Plan for the Lachlan Regulated River Water Source 2016*.
  - WAL 1798 in the Lachlan Regulated River Water Source, for 300 share components (General Security) under the *Water Sharing Plan for the Lachlan Regulated River Water Source 2016*.
  - WAL 42370 in the Lachlan Regulated River Water Source, for zero share components (High Security) under the *Water Sharing Plan for the Lachlan Regulated River Water Source 2016*.
- Groundwater licences for monitoring bores under the Water Management Act.
- Aboriginal Heritage Impact Permits (AHIP #C0003049 and AHIP #C0003887) issued by the Office of Environment and Heritage (OEH) under the NSW *National Parks and Wildlife Act 1974*.
- Mining and workplace health and safety related approvals granted by the NSW Department of Industry and SafeWork NSW.
- Permits under the *Roads Act 1993*.
- Heavy Vehicle Authorisation Permit 119039v2 issued by the National Heavy Vehicle Regulator (NHVR) under the *Heavy Vehicle National Law Act 2012.*
- Crown Land Licences issued under the *Crown Land Management Act 2016*.
- Activity Approvals under Section 68 of the *Local Government Act 1993.*

3.3 OTHER LEGISLATION, POLICIES AND GUIDELINES

SEM will conduct the Project consistent with the requirements of Development Consent DA 374-11-00 and any other legislation that is applicable to an approved Part 4 Project under the EP&A Act.

In addition to the statutory obligations described in Sections 3.1 and 3.2, the following NSW Acts (and their Regulations) may be applicable to the conduct of the Project:

- *Aboriginal Land Rights Act 1983*;
- *Biodiversity Conservation Act 2016;*
- *Biosecurity Act 2015;*
- *Crown Land Management Act 2016;*
- *Contaminated Land Management Act 1997;*
- *Dams Safety Act 2015;*
- *Dangerous Goods (Road and Rail Transport) Act 2008;*
- *Energy and Utilities Administration Act 1987;*
- EP&A Act;
- *Fisheries Management Act 1994;*
- *Forestry Act 2012;*
- *Local Government Act 1993;*
- *Mining Act 1992;*
- *National Parks and Wildlife Act 1974;*
- *Pipelines Act 1967;*
- POEO Act;
- *Rail Safety (Adoption of National Law) Act 2012;*
- *Roads Act 1993;*
- *Soil Conservation Act 1938;*
- *Water Act 1912;*
- Water Management Act*;*
- *Work Health and Safety Act 2011; and*
- *Work Health and Safety (Mines and Petroleum Sites) Act 2013.*

Commonwealth Acts which may also be applicable to the conduct of the Project include:

- *Environment Protection and Biodiversity Conservation Act 1999; and*
- *Native Title Act 1993.*

Relevant licences or approvals required under these Acts will be obtained as required.

Further details relating to the above NSW Acts regulated by DPIE – Water, NRAR, the EPA and other relevant water policy and guideline documentation relevant to this GWMP, is provided in the following sub sections.

3.3.1 Water Management Act 2000

As water sharing plans have commenced under the Water Management Act for all groundwater systems within which the Project lies, the Water Management Act is relevant to groundwater licensing considerations for the Project. The following water sharing plans have commenced under the Water Management Act for all groundwater systems within which the Project lies:

Mine (including Processing Facility)

- *Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020.*

Borefield

- *Water Sharing Plan for the Lachlan Alluvial Groundwater Sources 2020.*

The Water Management Act incorporates the provisions of various prior Acts relating to the management of surface and groundwater in NSW and provides a single statute for regulation of water access, use and works (e.g. pumps or bores) that affect the licensing of surface water and alluvial and non alluvial (i.e. fractured rock and porous rock) groundwater in the vicinity of the Project.

3.3.2 Water Act 1912

As water sharing plans have commenced under the Water Management Act for all groundwater systems within which the Project lies (Section 3.3.1), the *Water Act 1912* is not relevant to groundwater licensing considerations for the Project.

3.3.3 Protection of the Environment Operations Act 1997

SEM holds EPL 21146 for the Project issued under the POEO Act.

In accordance with Condition 27, Schedule 3 of Development Consent DA 374-11-00, unless EPL 21146 authorises otherwise, the Project will be carried out to comply with section 120 of the POEO Act.

3.3.4 Aquifer Interference policy

The *NSW Aquifer Interference Policy* (AIP) (NSW Government, 2012) has been developed by the NSW Government as a component of the NSW Government's *Strategic Regional Land Use Policy*. The AIP applies statewide and details water licence and impact assessment requirements. The AIP has been developed to ensure equitable water sharing between various water users and proper licensing of water taken by aquifer interference activities such that the take is accounted for in the water budget and water sharing arrangements. The AIP also enhances existing regulation, contributing to a comprehensive framework to protect the rights of all water users and the environment in NSW.

The AIP includes minimal impact considerations relating to water table and groundwater pressure drawdown and changes in groundwater and surface water quality. Where relevant, these minimal impact considerations have informed the groundwater impact trigger levels (Section 6.1).

3.3.5 National Water Quality Management Strategy

The National Water Quality Management Strategy is a joint national approach to improving water quality in Australian and New Zealand waterways. The Australian and New Zealand Water Quality Guidelines (ANZG, 2018) have been developed to progressively supersede the ANZECC & ARMCANZ (2000) Guidelines, with revisions provided for aquatic ecosystem default guideline values. Where updated default guideline values are yet to be published under the ANZG (2018) Guidelines, adoption of the ANZECC & ARMCANZ (2000) Guideline default values is recommended.

The ANZG (2018) and ANZECC & ARMCANZ (2000) Guidelines have been considered where applicable in this GWMP (Section 4.1.5).

3.3.6 NSW Groundwater Quality Protection Policy

The NSW Groundwater Protection Policy (Department of Land and Water Conservation [DLWC], 1998) describes the beneficial use categories adopted by NRAR, as recommended by the *National Water Quality Management Strategy Guidelines for Groundwater Protection in Australia* for major (or significant) aquifers. The *NSW Groundwater Protection Policy* (DLWC, 1998) has been considered where applicable in this GWMP (Section 6.1.3).

3.3.7 Australian Standard 1940-2017

Australian Standard 1940-2017 *The Storage and Handling of Flammable and Combustible Liquids* sets out requirements and recommendations for the safe storage and handling of flammable liquids of dangerous goods (Class 3) and also provides requirements and recommendations for the storage and handling of combustible liquids. It also provides minimum acceptable safety requirements for storage facilities, operating procedures, emergency planning and fire protection.

AS 1940-2017 have been considered where applicable in this GWMP.

4 HYDROGEOLOGICAL SETTING AND BASELINE DATA

4.1 MINE SITE

4.1.1 Local Geology

Previous hydrogeological investigations for the Project have encountered the following geological formations within the mine site and immediate surrounds (Golder Associates [Golder], 2017):

- Laterite;
- Ultrabasic intrusive rocks (pyroxenite, gabbro, diorite); and
- Residual soils/alluvial (including palaeochannel deposits).

Residual soil/alluvial covers up to 2 m of low-lying area of the mine site (Golder, 2017). In addition, an unsaturated palaeochannel exists through the mine site in a north-easterly direction (encountered in several boreholes [GAM 07, GAM 09 and GAM 16 – Section 4.1.2]). The palaeochannel is up to 1,500 m wide and 35 m deep and comprises silts, clays, gravels, quartz and rock fragments (Golder, 2017).

The residual soil/alluvium is generally underlain by highly and slightly weathered ultrabasic intrusive rocks including pyroxenite, gabbro and diorite. The average thickness of the highly and slightly weathered rock stratum is reported as 11 m and 13 m, respectively (Golder, 2017).

The mine site is formed predominantly of an oblate Dunite core intrusion approximately 2 km north south by 3 km east-west which is surrounded by ultramafic and mafic rocks (gabbro, diorite and olivine pyroxenite) and Laterite. The deposit targeted for mining contains resource grade nickel and cobalt mineralisation within the Laterite profile overlying the Dunite core intrusion.

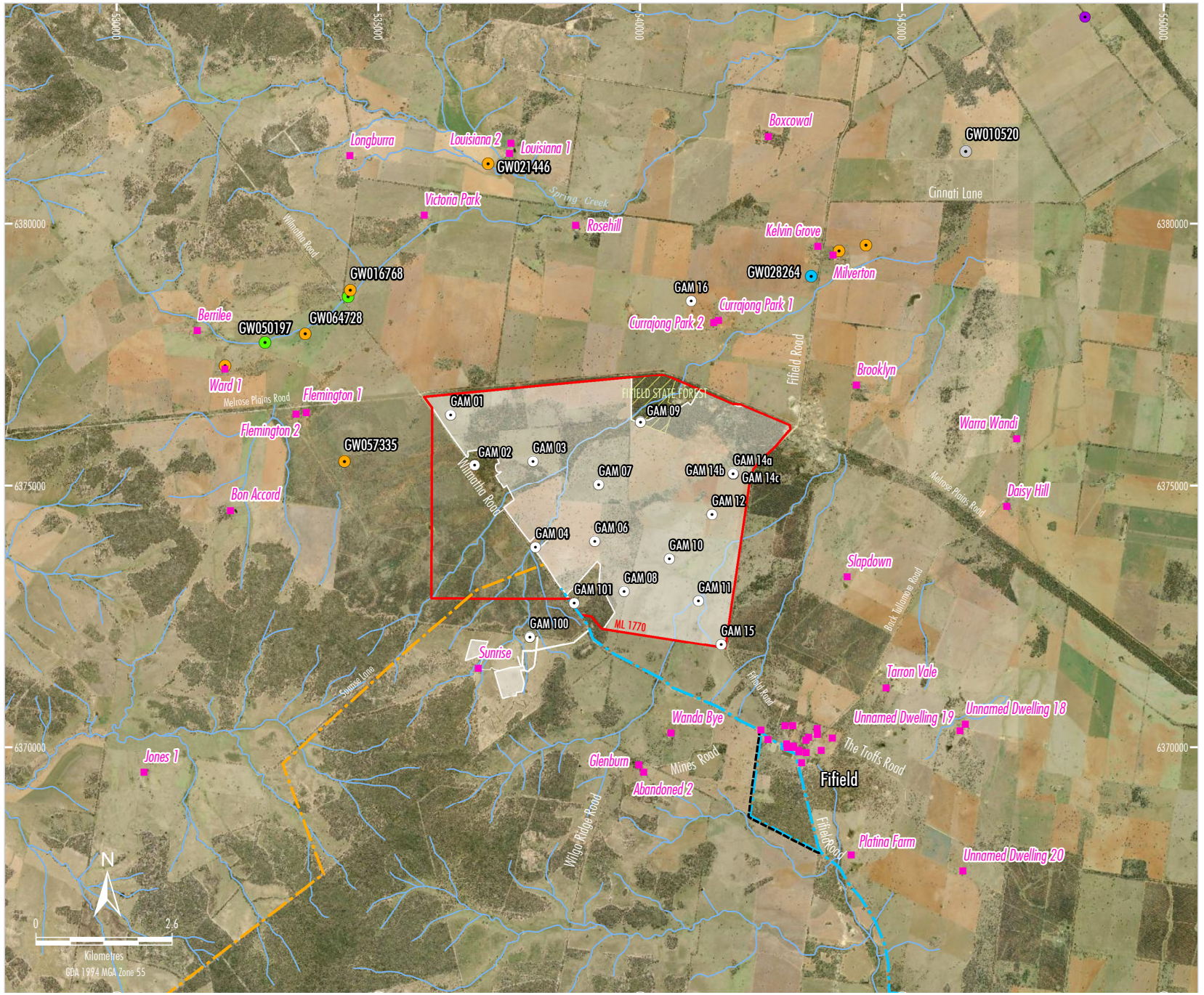
The Girilambone Group forms the basement rock beneath the three geological formations. The bedrock is mostly dominated by fine quartz sandstone, siltstones and shale, mostly metamorphoses to quartzite, phyllite and schist (Golder, 2017). The occurrence of groundwater within the bedrock (slightly weathered and fresh rock) is expected to be limited to secondary permeability such as joints, fault/shear zones or other geological discontinuities in the rock mass (Coffey, 2018a).

4.1.2 Groundwater Levels

A number of groundwater monitoring sites have been established at the mine site and surrounds (Figure 5 and Table 3). Generally, groundwater levels are 30 m to 60 m below ground level (mbgl) and follow the surface topography, being highest in the western area of the mine site. The open cut pits will have an average depth of 35 mbgl with localised deeper areas up to approximately 55 mbgl.

Manual groundwater level measurements are periodically recorded at the monitoring sites, while continuous loggers have also been installed in these monitoring sites. The groundwater level data recorded by the continuous loggers up to April 2021 for each of the mine site monitoring bores is shown on Chart 1.

The groundwater flow direction is from the west of the mine site and flows south-east towards the paleochannel and north-east, generally following the lowering topography. A groundwater divide is interpreted to exist beneath the topographical ridge in the (centre) eastern area of the site (Golder, 2017).



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Existing Project Groundwater Monitoring Network and Groundwater Users - Mine Site

Figure 5

Table 3
Groundwater Monitoring Bores – Mine Site

Bore ID	Screen lithology	Easting (m)	Northing (m)	TOC (mAHD)	Drilled Depth (mbgl)	Screened Interval (mbTOC)
GAM 01	Gabbro	536383.224	6376348.799	301.779	44.0	37.9 to 43.9
GAM 02	Pyroxenite	536848.063	6375383.307	301.049	52.7	46.3 to 52.3
GAM 03	Pyroxenite	537955.978	6375461.749	293.986	48.2	41.9 to 47.9
GAM 04	Pyroxenite	538003.266	6373815.024	293.359	48.2	42.0 to 48.0
GAM 06	Pyroxenite	539134.445	6373938.672	295.133	57.4	51.2 to 57.2
GAM 07	Pyroxenite	539209.996	6375016.866	289.834	57.7	51.1 to 57.1
GAM 08	Gabbro/diorite	539695.397	6372978.265	294.359	57.4	51.0 to 57.0
GAM 09	Pyroxenite	540008.782	6376210.015	280.29	52.9	46.3 to 52.3
GAM 10	Pyroxenite	540563.474	6373596.582	283.837	52.9	46.5 to 52.5
GAM 11	Pyroxenite / diorite	541113.440	6372787.771	282.955	61.9	55.5 to 61.5
GAM 12	Gabbro	541376.362	6374444.090	281.039	57.4	51.0 to 57.0
GAM 14a	Gabbro	541786.984	6375221.909	283.381	99.5	90.0 to 96.0
GAM 14b	Diorite	541781.521	6375222.219	283.5	71.8	64.0 to 70.0
GAM 14c	Diorite	541775.994	6375222.723	283.606	39.3	33.0 to 39.0
GAM 15	Pyroxenite	541550.712	6371957.454	294.815	70.7	64.5 to 70.5
GAM 16	Alluvium / laterite	540976.000	6378523.000	273.54	69.7	56.7 to 65.7
GAM 100	Siltstone	537900.805	6372104.116	307.385	61.3	56.0 to 62.3
GAM 101	Siltstone	538741.752	6372748.068	308.367	73.4	58.9 to 70.9

Source: Minstaff Survey Pty Ltd Drawing No. M2809 4002 001 (29/10/2019)
mAHD – metres Australian Height Datum
mbTOC – metres below top of casing

4.1.3 Groundwater Yield

Groundwater at the mine site and surrounds is typically low yielding as indicated by hydraulic testing. The hydraulic testing (falling head) was conducted and analysed on five of the existing groundwater monitoring locations at the mine site and the results summarised in Table 4. The hydraulic conductivities are generally very low and the potential yield of the fractured rock aquifer is expected to be low (in the order of 0.1 litres per second (L/s) or less [Golder, 2017]).

4.1.4 Groundwater Use

Groundwater use at the mine site and surrounds is limited.

A contemporary bore census has been undertaken in the vicinity of the mine site by Environmental and Natural Resource Solutions (ENRS) (2019a), on behalf of SEM. The bore census included inspections of the Pine Park, Milverton, Victoria Park, Berrilee, Louisiana, Slapdown and Currajong Park[3] properties and information collected included bore location, groundwater level and groundwater quality (field measurements). The locations of bores inspected during the bore census are included on Figure 5. A copy of the Bore Census (ENRS, 2019a) was provided to the DPIE with the previous version of this GWMP (i.e. Revision 1).

[3] The landholders of the Slapdown and Currajong Park properties confirmed no private bores are located on their properties during the bore census (ENRS, 2019a).

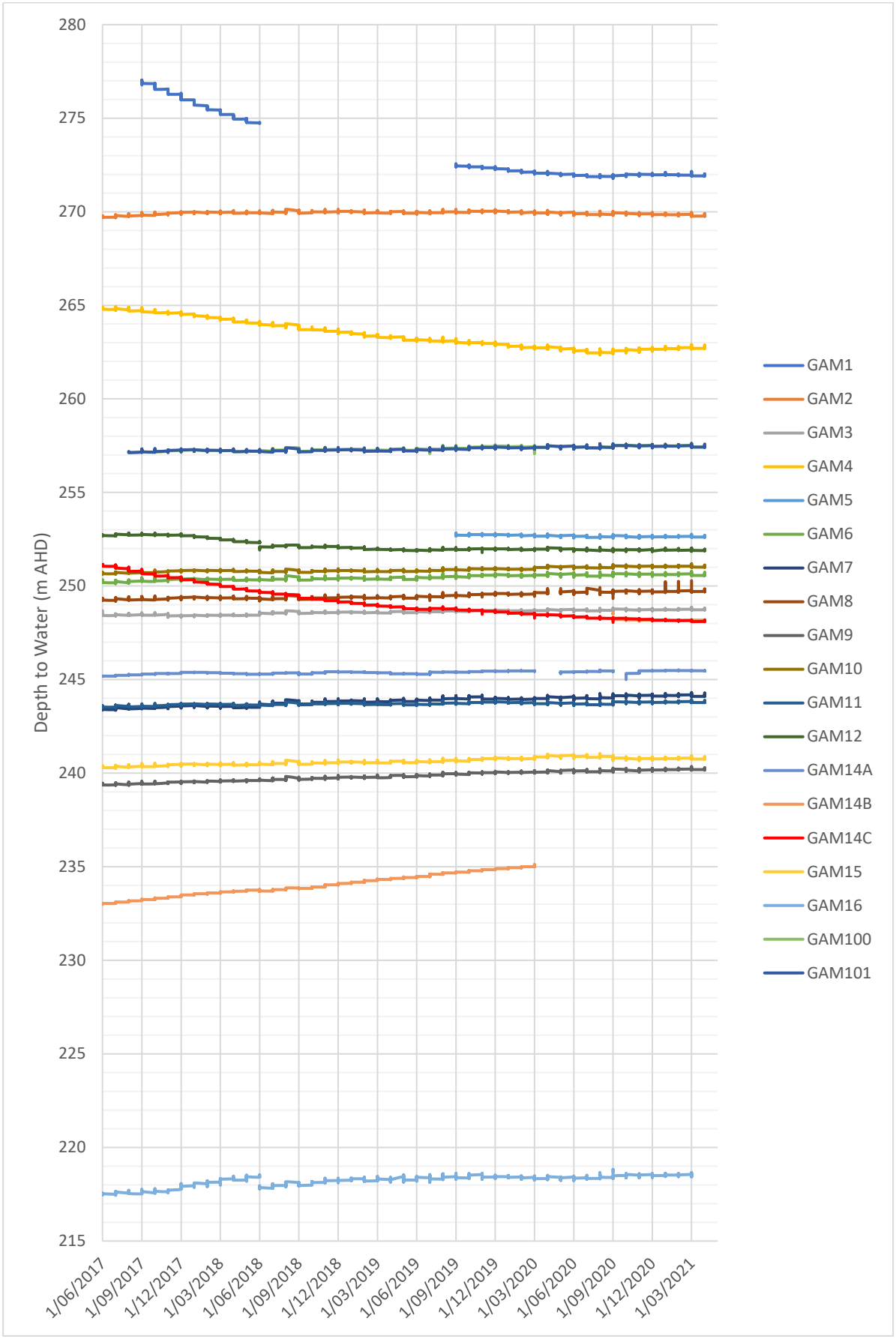

Chart 1 Groundwater Level Measurements – Mine site

Table 4
Summary of Hydraulic Testing – Mine Site

Bore ID	Formation Tested	Aquifer Thickness (m)	K (Average) [metres/second]
GAM 01	Gabbro, fresh to slightly weathered basement	-	$9.7x10^{-4}$
GAM 02	Pyroxenite, moderately weathered	-	$2.9x10^{-7}$
GAM 04	Pyroxenite, fresh to slightly weathered basement	-	$1.4x10^{-7}$
GAM 06	Pyroxenite, fresh rock, some veining	13.14	$1.9x10^{-6}$
GAM 08	Gabbro/diorite, fresh to slightly weathered basement	-	$6.2x10^{-9}$
GAM 07	Pyroxenite, slightly weathered	10.27	$6.6x10^{-7}$
GAM 10	Pyroxenite, fresh to slightly weathered basement	-	$5.2x10^{-7}$
GAM 11	Pyroxenite/diorite, slightly weathered	22.10	$2.4x10^{-7}$
GAM 12	Gabbro fresh rock	29.59	$9.3x10^{-9}$
GAM 13	Pyroxenite, fresh to slightly weathered basement	-	$1.4x10^{-7}$
GAM 15	Pyroxenite, slightly weathered	16.85	$1.4x10^{-6}$

Source: Golder (2017)

The closest privately-owned bore (GW057335) is located approximately 1.8 km to the west (and hydraulically upgradient) of Mining Lease 1770 (Figure 5).

4.1.5 Groundwater Quality

Based on the groundwater quality monitoring between June 2018 and April 2021, groundwater salinity across the mine site and surrounds varies from fresh (170 milligrams per litre [mg/L] total dissolved solids [TDS]) to saline (10,300 mg/L TDS). Fresh groundwater has been encountered in the north west area of the site (GAM 01), brackish in and near the palaeochannel (GAM 03), and saline in the south east area of the site (GAM 11) (Ground Doctor, 2020a – 2020c). These results are similar to groundwater quality monitoring reported in Coffey (2018a) and Golder (2000).

The groundwater is generally neutral to slightly alkaline and the metal concentrations are generally below the ANZG (2018) and ANZECC & ARMCANZ (2000) livestock trigger values. Where available, metals concentrations show similar values between 1999, 2018, and 2020 (Coffey, 2018a; Ground Doctor, 2020a – 2020c).

Detailed water quality results from June 2018 to April 2021 are provided in Attachment 1.

4.2 BOREFIELD

4.2.1 Borefield Layout

The approved borefield consists of six production bores (Figure 4). Two of the approved production bores (ISPB01 and ISPB02) were constructed and tested in 2006. The staging of the development of the borefield is summarised in Table 5.

The predicted average and maximum annual off-site water demand during the operations stage is approximately 2,800 ML/year and 4,080 ML/year, respectively (HEC, 2019). This would be sourced from the Project borefield and the Lachlan River.

Table 5
Summary of Borefield Development Stages

Borefield Development Stage	Number of Bores	Borefield Extraction (ML/year)	Description
Initial Construction	2	≤ 900	Extraction of up to 900 ML/year from the two existing production bores and construction of the remaining four approved production bores.
Construction	2	≤ 900	The continued extraction of up to 900 ML/year from the two existing production bores (after the Initial Construction Stage).
Operations	6	≤ 3,154	Extraction of up to 3,154 ML/year, from the six production bores.

4.2.2 Existing Groundwater Regime

The borefield site associated with the Lachlan River floodplain comprises generally the Cowra Formation which disconformably overlies the Lachlan Formation. The Cowra Formation comprises clay, silt and gravel. The Lachlan Formation consists of sand, fine to medium gravel, with a minor silt and clay unit, and is the main water supply media for the Project borefield (Coffey, 2016b; HydroSimulations, 2021).

Bedrock below the Lachlan River Floodplain consists of Silurian phyllite, schist, micaceous siltstone, sandstone, dolomite, andesite and conglomerate within the north-south trending Tullamore and Murda Synclines (Coffey, 2016b; HydroSimulations, 2021).

4.2.3 Groundwater Levels

SEM Monitoring Bores

Two production bores (ISPB01 and ISPB02) and seven monitoring bores (including two existing bores constructed suitable for pumping) were installed over the period 1999 to 2006 (Figure 6). Both production bores were paired with a monitoring well, ISMW01 and ISMW02, respectively (Figure 6). Details of the production bores and monitoring wells are provided in Table 6.

LEGEND

- Property Boundary
- Borefield Location
- Water Pipeline
- Borefield Infrastructure Corridor *
- Surface Water Infrastructure Corridor *
- Pump Station
- Transfer Station
- Access Road
- Monitoring Bore
- Production Bore (constructed)
- Production Bore (not constructed)

* Infrastructure Corridor includes linking pipline, access road and electricity transmission line.

Source: Ivanplats Syerston (2005); Clean TeQ (2017); NSW Spatial Services (2020)
NSW Imagery: © Department of Finance, Services & Innovation (2018)

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Existing Project Network
- Borefield

Figure 6

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Table 6
Lachlan Formation – Borefield Production and Pumping Bores and Monitoring Wells

Bore/Monitoring Well ID	Type	Easting	Northing	Drilled Depth (mbTOC)	TOC (mAHD)	Ground Level Survey [June 2018] (mAHD)	Pumping / Screen Depth (mbTOC)		Logger Depth [June 2018] (mbgl)
							Sump	Screen	
ISPB01[1]	Production	547711	6319812	141.7	208.6	~208	134-136	112-134	N/A
ISMW01[1]	Monitoring	547695	6319812	141.1	208.93	208.38	N/A	114-135	29.5
PBW1[3]	Monitoring	547240	6320179	141	TBC	~208	N/A	126-136	No Logger
PBW2[3]	Monitoring/Pumping	547230	6320190	137	TBC	~208	135-137	115-135	No Logger
MW-W1[1]	Monitoring	547196	6320263	137.0	209.10	208.11	N/A	126-136	29.0
ISPB02[2]	Production	551766	6316941	128.6	210.6	~211	126-128	104-126	N/A
ISMW02[1]	Monitoring	551775	6316929	129.8	211.40	210.64	N/A	117-129	29.2*
PBE1[3]	Monitoring/Pumping	553413	6316485	128	TBC	~211	126-128	108-126	No Logger
MW-E1[1]	Monitoring	553407	6316482	127.0	212.04	211.10	N/A	108-126	29.1

[1] Coffey (2018c)
[2] Coffey (2006) Bore installation and Pump Test Report
[3] Coffey (2000)

ISMW01 and ISMW02 have been manually monitored for standing water levels since 2006, while automatic standing water level loggers (recording on 6 to 12 hour intervals) were installed (June 2018) in four of the monitoring wells in the Lachlan formation, namely: ISMW01; ISMW02; MW E1; and MW W1 (Table 6 and Figure 6). From 2006 to 2018, manually monitored groundwater levels varied between approximately 182 m AHD and 202 m AHD. Logger data is downloaded from each monitoring bore on a regular basis. Chart 2 shows the recorded water levels from bores ISMW01; ISMW02; MW E1; and MW W1 from June 2018 to April 2021.

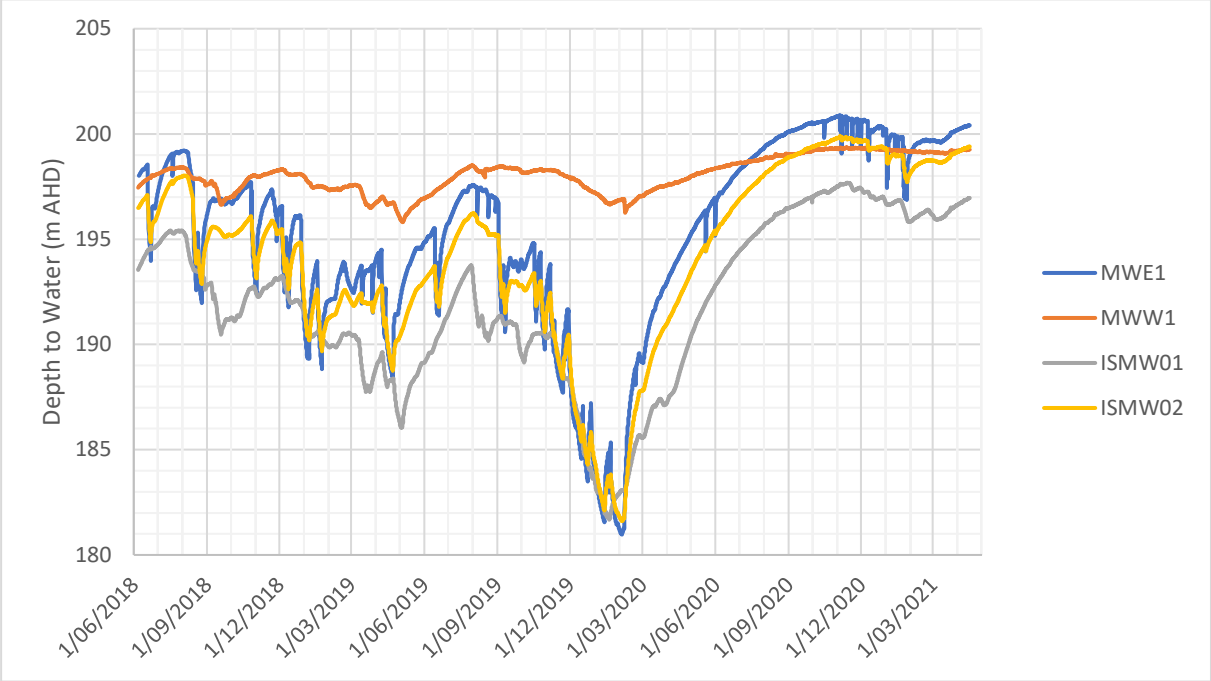


Chart 2 Hydrographs for Monitoring Bores MW-E1, MW-W1, ISMW01 and ISMW02

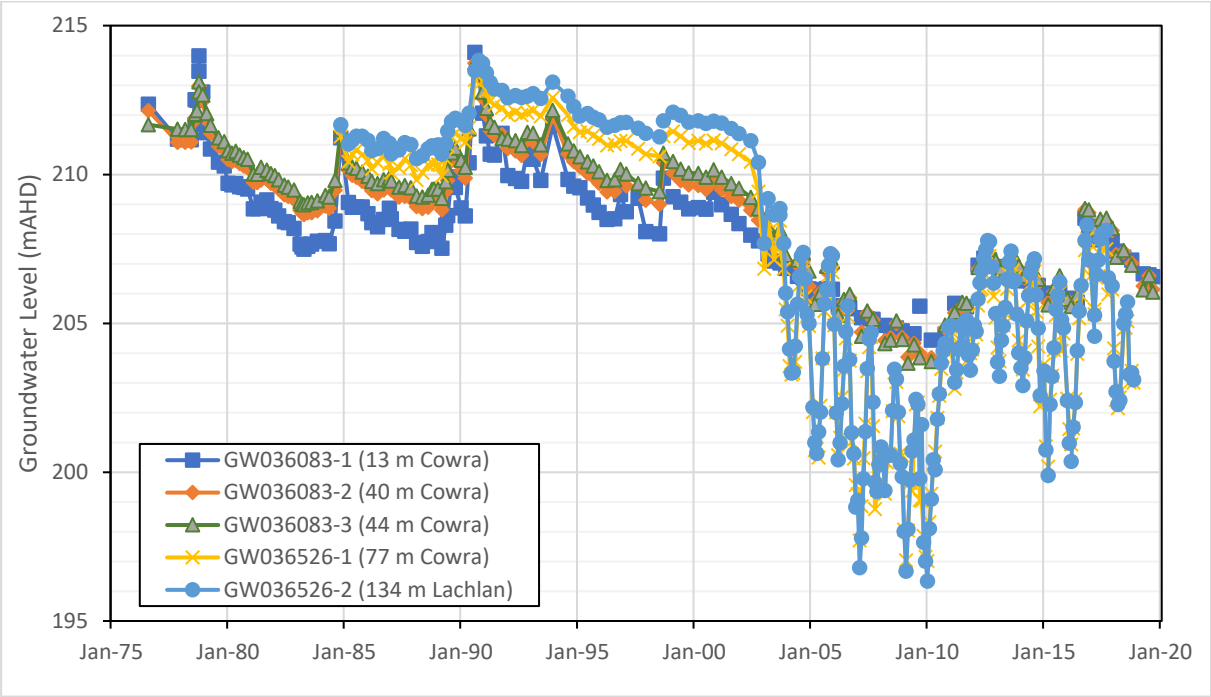
Other Monitoring Bores

In addition to SEM's monitoring network, Jemalong Irrigation Limited[4] and DPIE – Water maintain extensive networks of standpipe monitoring piezometers in the area surrounding the borefield for various purposes.

The hydrographs for two DPIE Water nested piezometers (GW036083 and GW036526 – Figure 13 in Section 8) both located approximately 8 km south-east and up river from the borefield are shown in Chart 3. The chart demonstrates the significant drawdown in the Lachlan Formation from 2002 (caused by the onset of drought conditions and corresponding increase in groundwater use to offset the reduced surface water allocations).

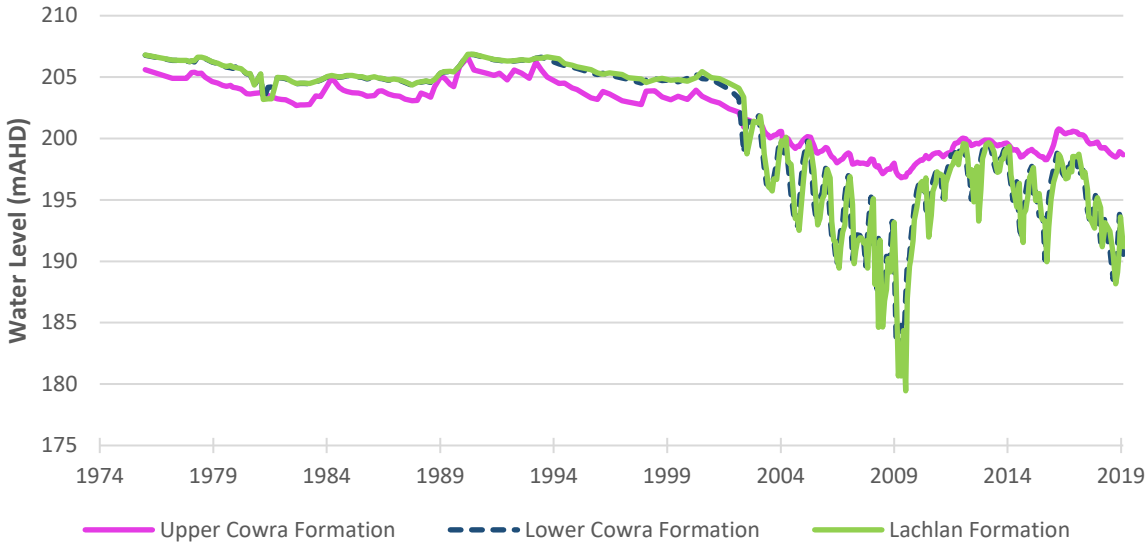
DPIE – Water piezometer nest GW036087 is the nearest nest to the borefield (Figure 13 in Section 8), and includes piezometers screened in the Upper Cowra, Lower Cowra and Lachlan Formations. Chart 4 shows water level observations at this nest from 1976 to September 2019, and also demonstrates the significant drawdown in the Lachlan Formation from 2002. These observations are typical of water level behaviour in the area, and in conjunction with other piezometers, provide a pre-mining baseline dataset of water levels throughout the profile in proximity to the borefield. Drawdowns between depths of 80 m and 130 m below ground (Lower Cowra and Lachlan Formations) are similar, however the drawdown at 40 m depth (Upper Cowra Formation) is greatly attenuated.

[4] Jemalong Irrigation Limited is a private irrigation scheme located on the southern side of the Lachlan River opposite the borefield.



Note: Monitoring data from bores GW036083 and GW036526 is not available beyond September 2019.

Chart 3 Hydrographs for Nested Piezometers and GW036083 and GW036526 Highlighting Millennium Drought



Note: Monitoring data from bore GW036087 is not available beyond October 2019.

Chart 4 Groundwater Level Observations at GW036087 (1976 to 2019)

4.2.4 Groundwater Yield

Pump tests (48 hour) have been carried out on the two existing production bores at the borefield. ISPB01 was pumped at a rate of 50 L/s and ISPB02 at 80 L/s for a 48 hour duration. Monitoring results for ISPB02 showed that a barrier boundary was apparent after 200 minutes of pumping. The interpreted transmissivity ranged between 1,260 square metres per day (m^2/day) and 5,500 m^2/day (Coffey, 2016a).

A 3-day single rate pump test was also undertaken at test bore PBW2 in the vicinity of production bore ISPB02 (Figure 6) in 1999 with monitoring at several observation piezometers. Analysis of the pump test results presented the following (Coffey, 2016a):

- Hydraulic conductivity (K) (optimised): 19.5 metres per day (m/day) (over a saturated media interval of 136 metres [m]);
- Vertical K (Kv) (optimised): 0.024 m/day
- Ratio of Kv to horizontal (Kh) of 0.001
- Specific storage (optimised): 2.2 x $10^{-5}m^{-1}$

No hydraulic test data is available for determining specific yield for the Cowra Formation at the borefield. Notwithstanding, Williams (1993) estimated a value of 5% for the refillable void space at the water table in the Upper Cowra Formation in the Jemalong Plains Irrigation District.

4.2.5 Groundwater Use

A contemporary bore census has been undertaken by ENRS (2019b) (the 2018 bore census), on behalf of SEM. The 2018 bore census extended across an area of approximately 735 square kilometres (km^2) including 84 properties. The 2018 bore census culminated in a database with records for one hundred and forty-six (146) bores comprising the following bore types (ENRS, 2019b):

- 1 Commercial and Industrial;
- 2 Domestic water supply bores;
- 19 Irrigation;
- 2 Monitoring;
- 119 Stock and domestic; and
- 3 Town Water Supply (not equipped).

The location of the bores identified during the 2018 bore census and the results of a recent search of the PINNEENA register for groundwater works in the vicinity of the borefield are presented in Attachment 2.

The results of the bore census have been used in the development of the contemporary groundwater model (HydroSimulations, 2021) (Section 4.2.7) and the development of triggers for the Project borefield (Section 6.1).

A copy of the 2018 bore census (ENRS, 2019b) was provided to the DPIE with the previous version of this GWMP (i.e. Revision 1).

4.2.6 Groundwater Quality

Water quality samples were collected from production bore ISPB01 in August 2006, August 2017, November 2019, March 2020, September 2020 and April 2021, ISPB02 in August 2006, and monitoring bores ISMW01 and ISMW02 in February 2020, September 2020 and April 2021. The results are provided in Table 7.

Detailed groundwater quality results up to April 2021 are provided in Attachment 1.

Chart 5 shows electrical conductivity (EC) measured at private bores during the bore census of 2000 and 2005 versus the bore depth (Coffey, 2016a). Also shown are laboratory EC results for samples from the Project borefield and GW036087 (from the Upper Cowra, Lower Cowra and Lachlan Formations), versus the midpoint of their screen intervals. There is a weak overall trend of decreasing EC with depth, to a depth of around 60 m. From measurements available, it appears that EC begins increasing with depth, below 60 m depth. However, the variation in EC in the upper 20 m is significant.

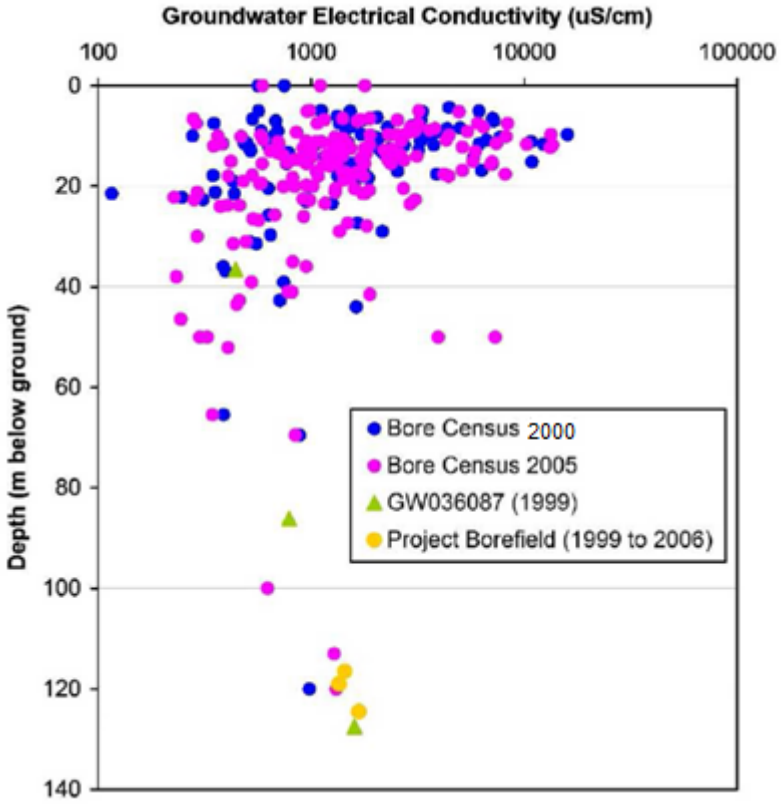


Chart 5 Borefield Groundwater Quality – Electrical Conductivity versus Depth

As described in Section 4.2.5, a contemporary bore census has been undertaken by ENRS (2019b), on behalf of SEM. The 2018 bore census included water quality sampling (EC and pH). Salinity ranged from 158 microsiemens per centimetre (µS/cm) to 8,440 µS/cm across the bore census area and averaged 1,613 µS/cm (ENRS, 2019b). This is consistent with previous salinity data recorded in the vicinity of the borefield (Chart 5). Acidity was typically neutral ranging from 5.72 to 8.64 pH units and averaging 6.78 pH units (ENRS, 2019b).

4.2.7 Groundwater Model

SEM commissioned HydroSimulations to develop a contemporary numerical groundwater model for the Project borefield (HydroSimulations, 2021) (herein referred to as 'the groundwater model'). A copy of the groundwater model report was provided to NRAR and DPIE – Water in October 2019. A copy of the updated groundwater model report was provided to NRAR and DPIE – Water in 2021.

The groundwater model extends approximately 65 km from west to east and approximately 85 km north to south, covering an area of approximately 5,500 km^2 (Figure 7). The model extent was designed to include the Upper Lachlan Alluvial Groundwater Management Zone 5 in full, and the northern part of the Upper Lachlan Alluvial Groundwater Management Zone 7 in order to include the Cowal Gold Mine borefields (HydroSimulations, 2021).

Table 7
Summary of Laboratory Analysis of Groundwater Samples Collected from 2006 to 2021

Parameter	Units	ISPB01						ISPB02	ISMW01			ISMW02		
		19 Aug 2006	15 Aug 2017	13 Nov 2019	17 Mar 2020	20 Sep 2020	16 Apr 2021	13 Aug 2006	10 Feb 2020	30 Sep 2020	16 Apr 2021	10 Feb 2020	30 Sep 2020	16 Apr 2021
pH (Field)	-	7.37	7.1	7.2	7.39	6.5	6.92	7.16	6.81	6.47	6.88	6.93	6.23	6.71
Electrical Conductivity	µS/cm	1,280	1,350	1,200	1,120	1,000	1,125	1,330	1,200	1,200	1,233	1,099	1,000	1,128
Alkalinity														
• Total Alkalinity as $CaCO_3$	mg/L	206	193	210	150	180	200	184	240	190	190	170	190	170
Dissolved Major Anions														
• Sulphate as SO_4^{2-}	mg/L	67	52	69	71	95	54	71	63	130	67	57	100	54
• Chloride	mg/L	240	235	-	260	320	220	277	290	400	250	370	380	260
Dissolved Major Cations														
• Calcium	mg/L	24	24	25	24	25	23	31	25	30	26	26	28	29
• Magnesium	mg/L	22	21	23	24	22	22	25	23	28	25	22	23	24
• Sodium	mg/L	188	188	190	200	190	190	215	180	230	200	170	190	190
• Potassium	mg/L	3.0	3.0	3.0	2.9	2.9	2.8	4.0	< 5	3.2	2.8	2.0	3	3.2
Other														
• Manganese	mg/L	0.042	0.051	0.048	0.048	0.045	0.051	0.034	0.048	0.046	0.044	0.036	0.037	0.038
• Iron	mg/L	<0.05	0.92	1.00	0.76	0.66	0.87	0.28	0.97	0.56	0.63	0.48	0.49	0.6
• Fluoride	mg/L	0.4	0.5	0.6	N/A	N/A	N/A	0.4	N/A	N/A	N/A	N/A	N/A	N/A
• Nitrite as N	mg/L	<0.010	<0.01	<0.02	<0.02	<0.02	<0.01	<0.010	<0.02	<0.02	<0.01	<0.02	<0.02	<0.01
• Nitrate as N	mg/L	<0.010	<0.01	<0.02	<0.02	<0.02	<0.01	0.012	<0.02	<0.02	<0.01	<0.02	<0.02	<0.01
• Nitrite + Nitrate as N	mg/L	<0.010	<0.01	<0.05	<0.05	<0.05	<0.01	0.012	<0.05	<0.05	<0.01	<0.2	<0.05	<0.01

The groundwater model adopted four layers, namely the Upper Cowra Formation (layer 1), Lower Cowra Formation (layer 2), the Lachlan Formation (layer 3), and a basement layer (layer 4). The approximate thickness of the model layers within the borefield area are:

- Upper Cowra Formation – 20 m to 50 m;
- Lower Cowra Formation – 20 m to 40 m; and
- Lachlan Formation – 60 m to 90 m.

Modelling Scenarios

HydroSimulations (2021) modelled two groundwater use scenarios to determine the potential groundwater impacts associated with the Project borefield:

1. Baseline scenario – landholder pumping and Cowal Gold Mine extraction only (i.e. no extraction from the Project borefield)[5].
2. Cumulative scenario – landholder pumping and Cowal Gold Mine extraction, plus extraction from the Project borefield (including separate construction and operation stages/extraction rates).

For the baseline scenario, existing groundwater use was represented in the groundwater model using available usage data available for the stock, domestic and irrigation bores identified in the recent bore census (ENRS, 2019b). In addition, groundwater usage data was provided by the Department of Industry – Water for bores in the Upper Lachlan Alluvial Management Zones 5 and 7.

For the cumulative scenario, extraction from the Project borefield was modelled in addition to the existing groundwater use included in the baseline scenario. The following Project borefield pumping stages were adopted in the model:

- Construction Stage (including Initial Construction Activities) (two years) – the extraction of up to 900 ML/year from the two existing production bores (equivalent to 1.23 ML/day per bore).
- Operations Stage (Year 1) – extraction of up to 1,752 ML/year from the six production bores (equivalent to 0.8 ML/day per bore).
- Operations Stage (Years 2 to 21) – extraction of up to 3,154 ML/year from the six production bores (equivalent to 1.44 ML/day per bore).

A summary of the potential impacts predicted by the groundwater model associated with the Project borefield is provided in Section 5.2.

4.2.8 Groundwater Recharge – Surface Water Flows

Groundwater recharge via surface water flows was considered in the groundwater model prepared by HydroSimulations (2021). Existing DPIE – Water flow gauges are located in the Lachlan River at Jemalong (Station 412036) and Mulguthrie (Station 412024), as well as Island Creek (Station 412023) and Bumbuggan Creek (412017) (Figure 8). Flow in Goobang Creek is not monitored.

[5] The Cowal Gold Mine borefields are located approximately 30 km to the south of the Project borefield, and are associated with a groundwater divide towards the southern boundary of the model area in the Lachlan Formation.

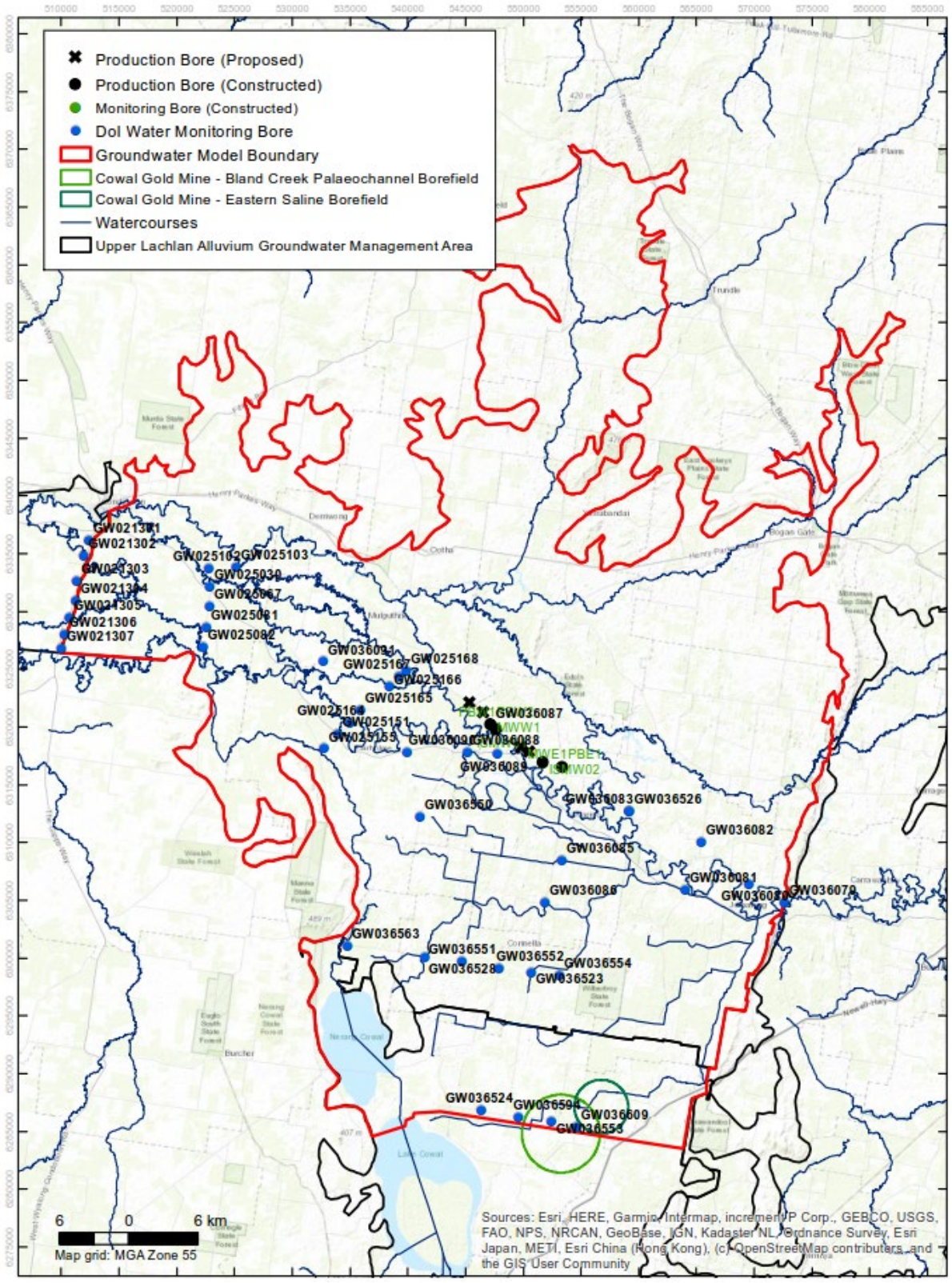


Figure 7 Groundwater Model Extent (HydroSimulations, 2021)

LEGEND

- Water Pipeline
- Borefield Infrastructure Corridor *
- Borefield Location
- Production Bore (not constructed)
- Production Bore (constructed)
- Monitoring Bore
- Surface Water Flow Gauge

* Infrastructure Corridor includes linking pipline, access road and electricity transmission line.

Source: Ivanplats Syerston (2005); NSW Land & Property Information (2017); NSW DPI - Water (2018) NSW Imagery: Esri, DigitialGlobe (2017)

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Location of Existing Select Monitoring Bores and Surface Water Flow Gauges - Borefield

Figure 8

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5 POTENTIAL GROUNDWATER IMPACTS

5.1 MINE SITE

The key potential groundwater impacts at the mine site will be associated with the excavation of the open cut pits and potential seepage from the tailings storage facility. A summary of the predicted potential groundwater impacts at the mine site, based on the previous groundwater assessments (Section 4.1.6) is provided below:

- **Groundwater Inflows** – the excavation of the open cut pits has the potential to intercept groundwater in the deepest area of the open cut pits resulting in predicted groundwater inflows of up to approximately 0.071 ML/year (or 0.0023 L/s) reducing to be generally less than 0.002 L/s in the long-term (Golder, 2017).
- **Groundwater Drawdown** – the excavation of the open cut pits has the potential to intercept groundwater in the deepest area of the open cut pits resulting in the predicted maximum groundwater drawdown extent of 1 m not extending beyond the Mining Lease 1770 boundary (Golder, 2017).
- **Seepage** – seepage from the tailings storage facility is not anticipated to migrate significantly beyond the tailings storage facility footprint during the Project life and thereafter the open cut pits would act as a sink that would collect the majority of seepage from the tailings storage facility (Coffey, 2018b), where it would evaporate.
- **Groundwater Users** – given no significant groundwater drawdown or seepage impacts are predicted, and the closest privately-owned bore (GW057335) is located approximately 1.8 km to the west of Mining Lease 1770 (Figure 5), no significant impacts are predicted to groundwater users (Golder, 2017 and Coffey, 2018b).

Given the small extent of groundwater drawdown over the Project life, post-mining groundwater levels are expected to recover slowly, although the open cut pit is expected to remain a groundwater sink.

5.2 BOREFIELD

Groundwater Drawdown

Project related drawdown has been determined by comparing model outputs for the baseline scenario with the cumulative scenario (Section 4.2.7).

The maximum predicted Project related drawdown in the Upper and Lower Cowra Formations is less than 1 m at the end of both the construction (Figures 9 and 10) and operations stages. The maximum predicted Project related drawdown in the Lachlan Formation (i.e. the target formation for the Project borefield) is less than 1 m at the end of the construction stage (Figure 11), and approximately 2.4 m at the end of the operations stage (HydroSimulations, 2021).

The maximum predicted drawdown at the end of the operations stage at all privately-owned bores is consistent with the maximum predicted drawdown for the three formations described above (i.e. less than 1 m for bores in the Upper and Lower Cowra Formations, and approximately 2.4 m for bores in the Lachlan Formation) (HydroSimulations, 2021).

In all formations, the maximum cumulative drawdown is located at the southern model boundary due to groundwater pumping from the Cowal Gold Mine borefields (HydroSimulations, 2021).

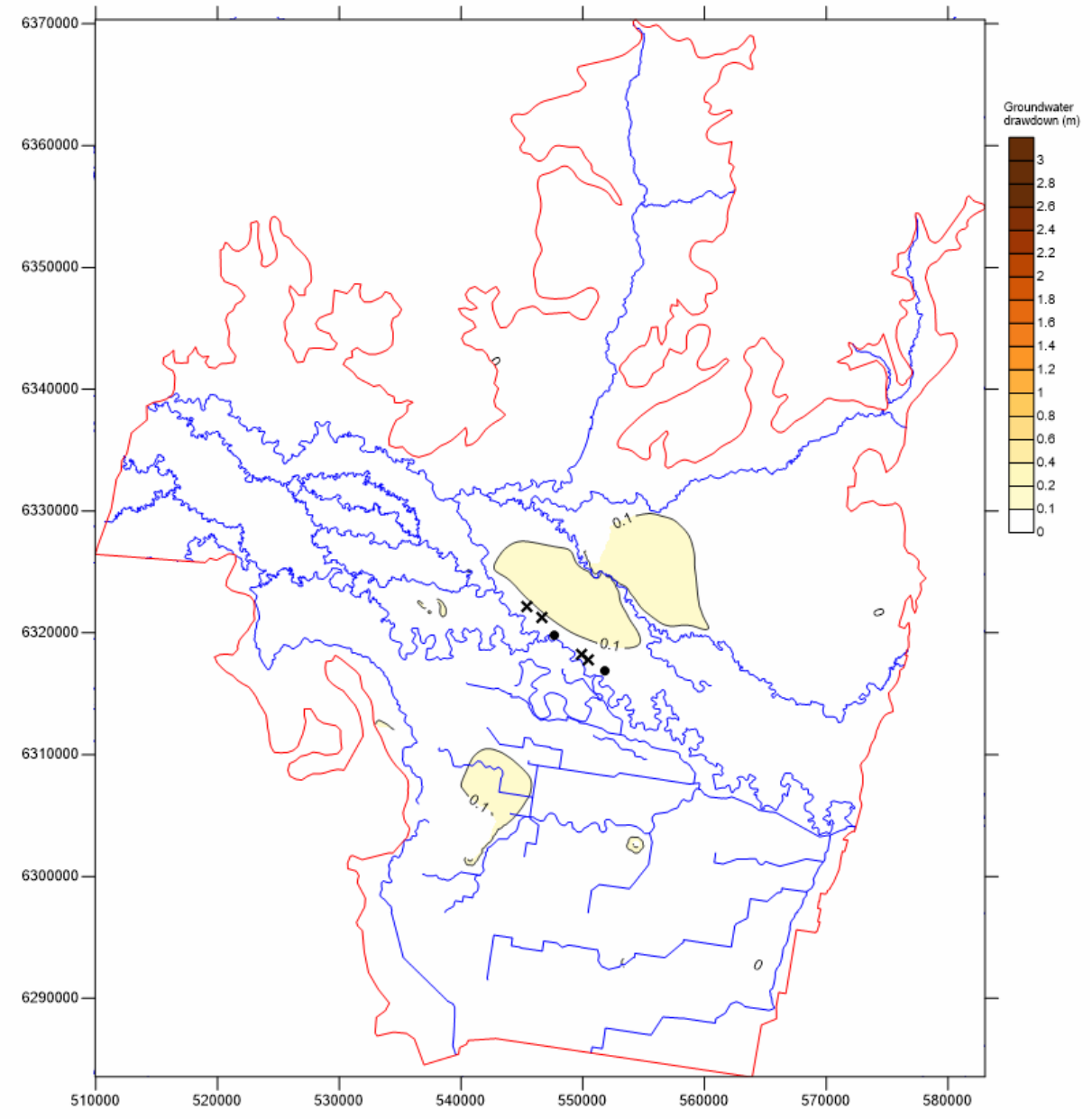


Figure 9 **Modelled Project-related Drawdown in the Upper Cowra Formation at the end of the Construction Stage (HydroSimulations, 2021)**

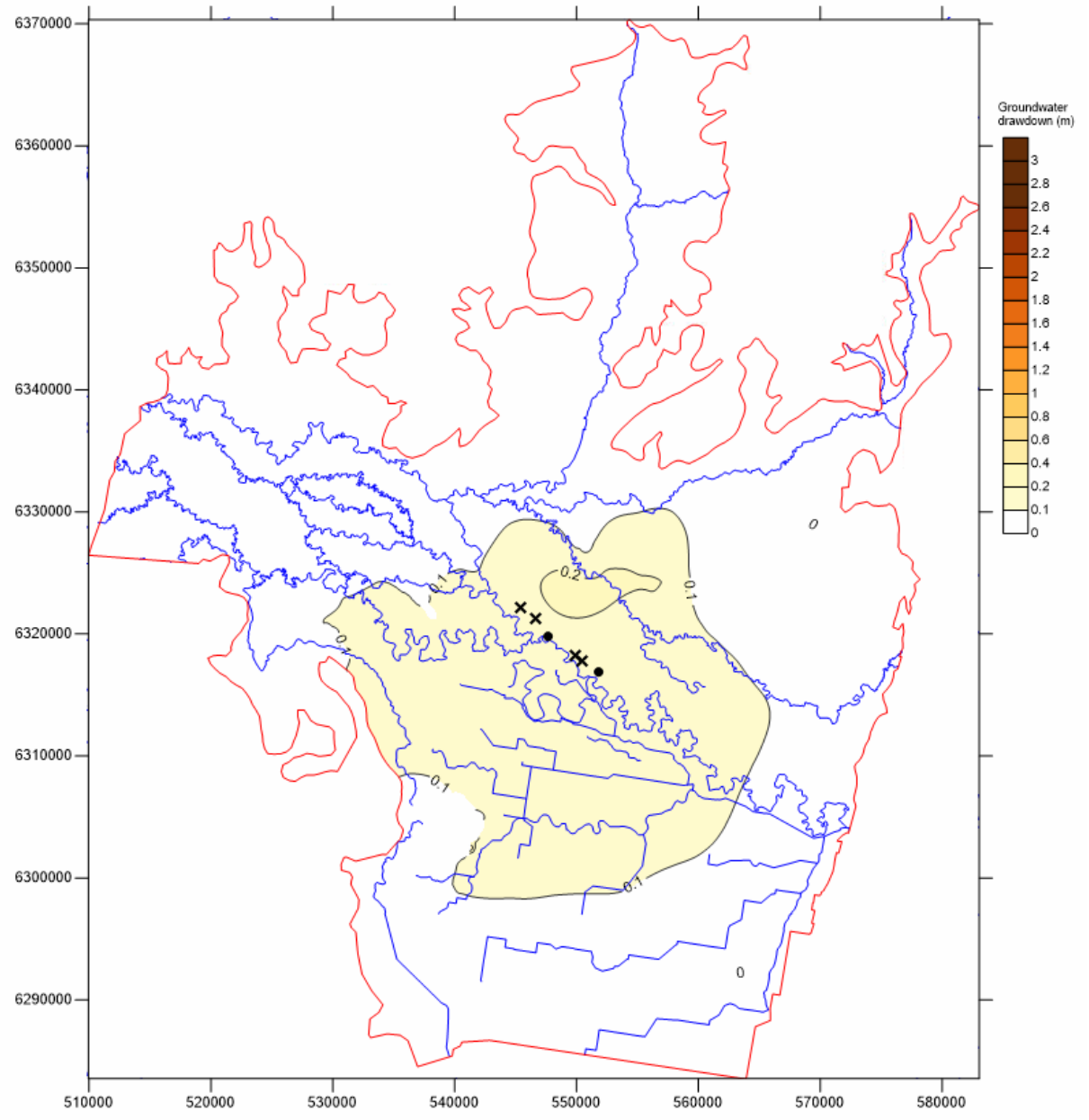


Figure 10 Modelled Project-related Drawdown in the Lower Cowra Formation at the end of the Construction Stage (HydroSimulations, 2021)

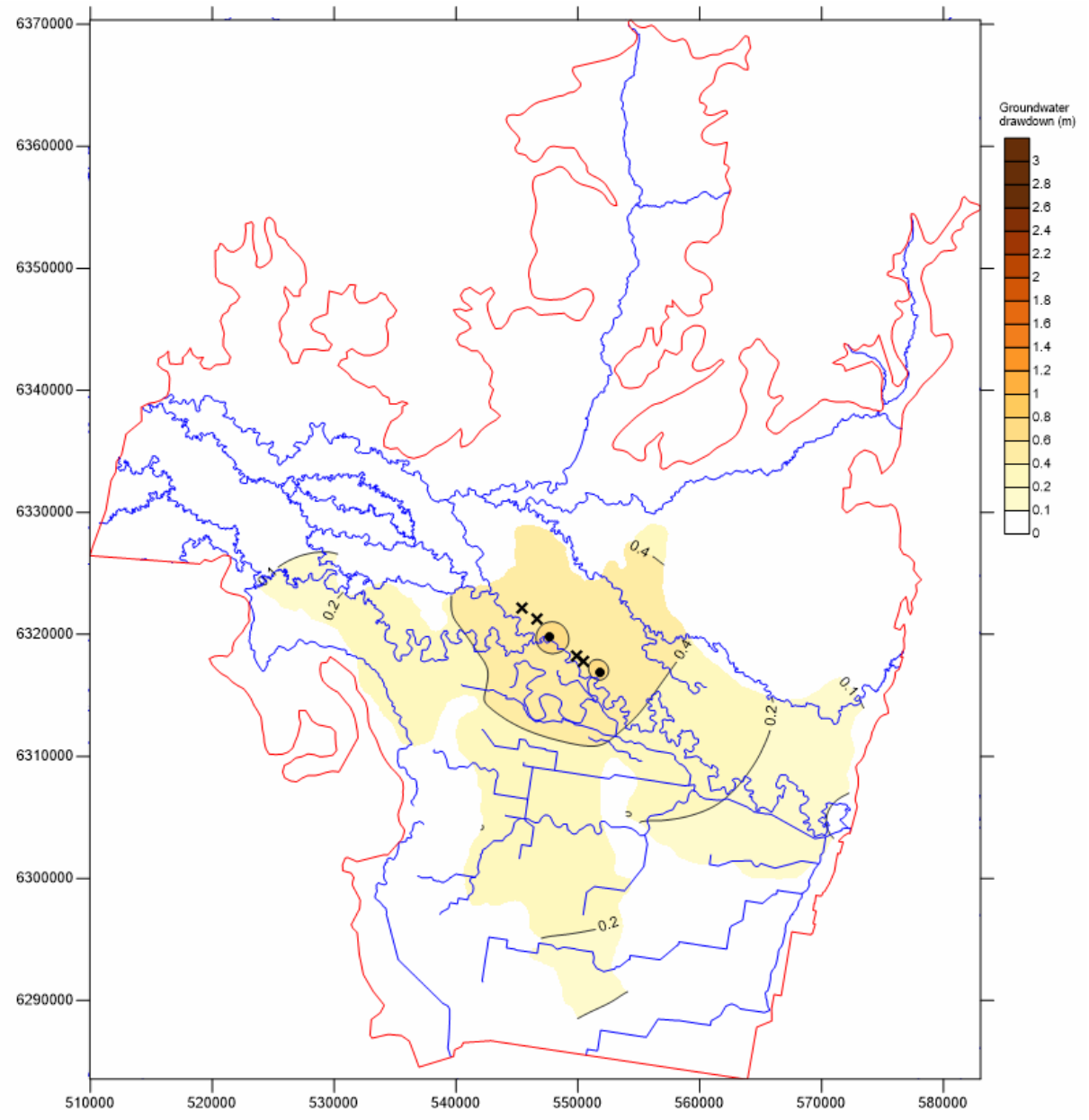


Figure 11 Modelled Project-related Drawdown in the Lachlan Formation at the end of the Construction Stage (HydroSimulations, 2021)

Groundwater Quality

The extraction of groundwater from the Project borefield is not expected to have any significant impact on groundwater quality, as the volumes to be extracted would be less than historical withdrawals of groundwater by private bores and no previous deterioration of quality is evident (HydroSimulations, 2021).

6 PERFORMANCE MEASURES AND PERFORMANCE INDICATORS

During Project construction activities, SEM will assess the Project against the specific water management performance indicators outlined in Table 8.

Table 8
Water Management Performance Indicators – Construction

Performance Measure	Performance Indicators
Water Management - General	
• Minimise the use of clean water on-site.	Water use is consistent with the water use priority described in the Water Balance and in accordance with relevant *Water Management Act 2000* approvals.
Mine Water Storages	
• On-site storages (including mine infrastructure dams, groundwater storage and treatment dams) are suitably designed, installed and/or maintained to minimise permeability.	Water management infrastructure is constructed and maintained generally in accordance with the design described in the Surface Water Management Plan (SWMP).
• Ensure that the floor and side walls of the tailings storage facility, Evaporation Basin and Surge Dam are designed with a minimum of a 900 mm clay or modified soil liner with a permeability of no more than 1 x 10^{-9} m/s, or a synthetic (plastic) liner of 1.5 mm minimum thickness with a permeability of no more than 1 x 10^{-14} m/s (or equivalent). • Design, install and maintain a seepage interception system in the Tailings Storage Facility embankments in accordance with the DSC guidelines. • Design, install and/or maintain the facilities to meet the requirements of the DSC. • The design of the tailings storage facility should conform to: – DSC3A – Consequence Categories for Dams (DSC, 2015); and – DSC3F – Tailings Dams (DSC, 2012).	The tailings storage facility and evaporation pond are constructed generally in accordance with the design described in the Water Balance and SWMP. The tailings storage facility is designed in consultation with Dams Safety NSW (previously the DSC), and the water management infrastructure constructed and maintained generally in accordance with the design described in the Water Balance and SWMP.
Chemical and Hydrocarbon Storage	
• Chemical and hydrocarbon products to be stored in bunded areas in accordance with the relevant Australian Standards.	Chemical and hydrocarbon storages will be constructed and maintained in accordance with the relevant Australian Standards (refer SWMP).
Irrigation Area	
• Manage the irrigation area in accordance with the EPA's *Environmental Guidelines: Use of Effluent by Irrigation*.	The irrigation area is designed and maintained generally in accordance with the design described in the Water Balance and SWMP.

Note: The Water Balance and SWMP are included as Appendices A and B of the WMP.

6.1 TRIGGER LEVELS FOR INVESTIGATION

6.1.1 Mine Site

Given the negligible potential for groundwater-related impacts during the Initial Construction Activities at the mine site (i.e. no mining or processing activities or groundwater extraction), the proposed trigger level for investigation will be receipt of a groundwater-related complaint.

Should a groundwater related complaint be received during the Initial Construction Activities, SEM will conduct an investigation and respond in accordance with the procedures described in Section 11.2.

This GWMP will be updated prior to the commencement of the Operations Stage to include mine site trigger levels for investigation, which will be developed using current and future baseline data (Sections 4.1 and 8.1).

6.1.2 Borefield

Trigger levels for select monitoring bores representative of all three formations (Figure 13 in Section 8) have been developed in consultation with DPIE – Water (Table 9).

Table 9
Monitoring Bore Trigger Levels – Borefield

Trigger Level Monitoring Bore	Trigger Level (m AHD)	Screened Formation
GW025167	195.14	Upper Cowra
GW036528	187.2	
GW036554	192.1	
GW036083	194.3	Lower Cowra
GW036085	194.1	
GW036550	183.4	
GW025165	164.2	Lachlan
GW036087	165.2	
GW036089	176.1	
GW036090	165.3	

An investigation will be triggered in the event that the groundwater level at any of the trigger level monitoring bores falls below the corresponding trigger level (Table 9) for two consecutive monthly measurements. This is to minimise the potential for false triggering due to local landholder pumping instead of the Project borefield. The investigation will be undertaken in accordance with the following steps:

1. Notify the DPIE that the investigation has been triggered, and a copy of the assessment report (Step 4) will be provided to DPIE within one month of assessment completion.
2. Determine whether the trigger level exceedance is attributable to extraction from the Project borefield, or seasonal (climatic) trends and/or other potential causes (e.g. landholder pumping).
3. If Step 2 determines the exceedance is likely attributable to the Project borefield, contact any potentially affected landholders to determine whether their groundwater supply has been affected.
4. Prepare an assessment report summarising the outcomes of Steps 2 and 3, and provide the report to DPIE, DPIE – Water and NRAR within one month of assessment completion.
5. Consider the need for preventative actions (Section 7.3), compensatory action (Section 7.5) or contingency measures (Section 9), to be implemented in consultation with the affected landowner/s.

6.1.3 Groundwater Quality Trigger Levels

Table 1 of the *NSW Aquifer Interference Policy* (NSW Government, 2012) sets out the minimal impact considerations for aquifer interference activities for groundwater sources including:

> *Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity.*

The following beneficial uses were recommended by the *National Water Quality Management Strategy Guidelines for Groundwater Protection in Australia* for major (or significant) aquifers and have been adopted by NRAR in *The NSW Groundwater Quality Protection Policy* (DLWC, 1998):

- ecosystem protection;
- recreation and aesthetics;
- raw water for drinking water supply; and
- agricultural water and industrial water.

The National Land and Water Resources Audit (Murray Darling Basin Commission, 2005) specified groundwater quality ranges for beneficial use categories based on salinity (Table 10). These salinity based categories generally align with the beneficial uses within *The NSW Groundwater Quality Protection Policy*.

Table 10
Groundwater Quality Categories: Electrical Conductivity

Beneficial Use	Quality Range	Description
Potable	Up to 800 µS/cm (500 mg/L TDS)*	Suitable for all drinking water and uses.
Marginal Potable	800-2,350 µS/cm (500-1,500 mg/L TDS)*	At the upper level, this water is at the limit of potable water, but is suitable for watering of livestock, irrigation and other general uses.
Irrigation	2,350-7,800 µS/cm (1,500-5,000 mg/L TDS)*	At the upper level, this water requires shandying for use as irrigation water or to be suitable for selective irrigation and watering of livestock.
Saline	7,800-22,000 µS/cm (5,000-14,000 mg/L TDS)*	Generally unsuitable for most uses. It may be suitable for a diminishing range of salt-tolerant livestock up to about 6,500 mg/L [~10,150 uS/cm] and some industrial uses.
Highly Saline	> 22,000 µS/cm (>14,000 mg/L TDS)*	Suitable for coarse industrial processes up to about 20,000 mg/L [~31,000 uS/cm].

µScm = microsiemens per centimetre; mg/L = milligrams per litre; TDS = total dissolved solids.

*Approximate EC ranges derived from TDS ranges, with conversion Factor of 1.5625 applied. Source: *National Land and Water Resources Audit* (Murray Darling Basin Commission, 2005).

Based on the baseline data collected to date at the borefield production and monitoring bores (Section 4.2.6), each of the existing borefield monitoring bores (i.e. ISMW01, ISMW02, MW-W1 and MW E1) have been assigned a beneficial use category of 'Marginal Potable'.

If the monitored EC value at any of the existing borefield monitoring bores is outside the range of the 'Marginal Potable' beneficial use category for two successive monitoring rounds (Section 8.2), an investigation will be initiated.

Should the investigation confirm that the Project has resulted in the change of the beneficial use category of the groundwater sampled at the monitoring bores for two successive monitoring rounds, the results will then be reported to DPIE and NRAR and the Contingency Plan enacted (Section 9).

7 GROUNDWATER MANAGEMENT MEASURES

7.1 MINE SITE

The groundwater management measures to be implemented at the mine site are outlined in this section.

7.1.1 Water Use

Consistent with the general water management performance measures for the Project (Table 8), SEM will minimise the use of clean water on-site to minimise the water requirements from the Project borefield and/or Lachlan River.

Additional detail on water use at the Project is provided in the Water Balance (Appendix A of the WMP) in accordance with Condition 30(a), Schedule 3 of Development Consent DA 374-11-00.

7.1.2 Mine Water Storages

The following mine water storages will be constructed during the Initial Construction Activities (Figure 2):

- tailings storage facility;
- evaporation pond;
- water storage dam;
- mine water dams and runoff dam; and
- raw water dam.

If a mine water storage is declared under the *Dams Safety Act 2015*, SEM will design, install and/or maintain it to meet the requirements of Dams Safety NSW (previously the DSC).

Additional detail on mine water storages at the Project is provided in the SWMP (Appendix B of the WMP) in accordance with Condition 30(b), Schedule 3 of Development Consent DA 374-11-00.

Tailings Storage Facility

Consistent with the relevant performance measures (Table 8):

- the tailings storage facility will be designed, installed and maintained to ensure no discharge of mine water off-site (except in accordance with an EPL);
- the floor and side walls of the tailings storage facility will be designed with a minimum of a 900 mm clay or modified soil liner with a permeability of no more than 1 x 10^{-9} m/s, or a synthetic (plastic) liner of 1.5 mm minimum thickness with a permeability of no more than 1 x 10^{-14} m/s (or equivalent);
- a seepage interception system will be designed, installed and maintained in the tailings storage facility embankments in accordance with Dams Safety NSW guidelines;
- the tailings storage facility will be designed, installed and maintained to meet the requirements of the Dams Safety NSW; and

- the tailings storage facility design will conform with:
  - *DSC3A – Consequence Categories for Dams* (DSC, 2015); and
  - *DSC3F – Tailings Dams* (DSC, 2012).

Evaporation Pond

Consistent with the relevant performance measures (Table 8):

- the evaporation pond will be designed, installed and maintained to ensure no discharge of mine water off-site (except in accordance with an EPL); and
- the floor and side walls of the evaporation pond will be designed with a minimum of a 900 mm clay or modified soil liner with a permeability of no more than 1 x 10^{-9} m/s, or a synthetic (plastic) liner of 1.5 mm minimum thickness with a permeability of no more than 1 x 10^{-14} m/s (or equivalent).

Water Storage Dam

Consistent with the relevant performance measures (Table 8):

- the water storage dam will be designed, installed and maintained to ensure no discharge of mine water off-site (except in accordance with an EPL);
- the water storage dam will be suitably designed, installed and/or maintained to minimise seepage; and
- the water storage dam will be designed, installed and maintained to meet the requirements of the Dams Safety NSW (if required under the provisions of the *Dams Safety Act 2015*).

Mine Water Dams and Runoff Dam

Consistent with the relevant performance measures (Table 8):

- the mine water dams and runoff dam will be suitably designed, installed and/or maintained to minimise seepage; and
- the runoff dam will be designed, installed and maintained to capture and convey the 100 year, 72-hour ARI rainfall event.

Raw Water Dam

Consistent with the relevant performance measures (Section 6):

- the raw water dam will be suitably designed, installed and/or maintained to minimise seepage; and
- the raw water dam will be designed, installed and maintained to capture and convey the 100 year, 72 hour ARI rainfall event.

7.1.3 Chemical and Hydrocarbon Storages

Consistent with the relevant performance measures (Table 8), chemical and hydrocarbon products will be stored in bunded areas in accordance with the relevant Australian Standards, including AS 1940-2017 *The Storage and Handling of Flammable and Combustible Liquids*.

7.1.4 Irrigation Area

Wastewater generated at the accommodation camp will be collected and treated at an on-site wastewater treatment plant. The wastewater treatment plant will consist of anaerobic and aerobic treatment and final disinfection of treated effluent.

The treated wastewater produced from the wastewater treatment plant will be pumped to the irrigation area via the irrigation water pipeline (Figure 2).

The irrigation application area will be approximately 3.5 hectares (ha) and will be divided into irrigation zones. Up to 100,000 litres per day of treated wastewater will be pumped to the irrigation area. Sprinklers will be used to evenly distribute the treated wastewater at a maximum rate of approximately 3 millimetres per square metre per day. This application rate is conservative and will minimise risk of surface pooling and runoff (True Water Australia, 2018).

True Water Australia (2018) conducted a nutrient balance for the irrigation area and concluded that the irrigation area is of sufficient size for the expected nutrient load (i.e. nutrient loading will not be a limiting factor to irrigation).

Consistent with the relevant performance measure (Table 8), the accommodation camp irrigation area would be managed in accordance with the *Environmental Guidelines: Use of Effluent by Irrigation* (DEC, 2004) and the irrigation rate would be controlled so as not to:

- cause irrigation water runoff from the irrigation area; or
- exceed the capacity of the soil in the irrigation area to effectively absorb the applied nutrient and hydraulic loads.

7.2 BOREFIELD

The groundwater management measures to be implemented at the borefield are outlined in this section.

7.2.1 Borefield Operational Management

Groundwater levels will be monitored at trigger level monitoring bores (Table 9), and if the groundwater level at any of the bores falls below the corresponding trigger level (Table 9) for one monthly measurement, SEM will conduct an internal review to determine whether the drawdown is likely attributable to extraction from the Project borefield, or seasonal (climatic) trends and/or other potential causes (e.g. landholder pumping).

If this review determines that the drawdown is likely due to the borefield, one or more of the following measures may be implemented as required to potentially avoid triggering an investigation (i.e. a second consecutive monthly measurement below the trigger level [Section 6.1]):

- optimise the extraction rate, duration and location of pumping at the borefield;
- optimise the surface water extraction rate and duration to accommodate potential reductions in the borefield extraction rate; and/or
- assess potential optimisation of Project water supply requirements.

7.2.2 Groundwater Model Review

The groundwater model (HydroSimulations, 2021) will be updated at least once every three years after the commencement of extraction, with the model set-up and input parameters progressively refined to improve the prediction of current and future drawdown impacts due to pumping of the borefield and regional usage. Contemporary usage data for private bores will also be obtained where possible, as these remain an important component of validation and future calibration, and for estimating pumping rates for future predictions.

Further, the Water Balance (Appendix A of the WMP) will be updated as required after the commencement of extraction to include a site water balance for each calendar year in accordance with Condition 30(a), Schedule 3 of Development Consent DA 374-11-00, and incorporated into the groundwater model where required.

7.3 PREVENTATIVE ACTIONS

In accordance with Condition 3, Schedule 5 of Development Consent DA 374-11-00, SEM will assess and manage risks to comply with the criteria and/or performance measures outlined in Schedule 3 of Development Consent DA 374-11-00. Preventative/adaptive management actions would include:

- construction of the mine water storages consistent with the performance measures (Table 8);
- chemical and hydrocarbon products will be stored in bunded areas in accordance with the relevant Australian Standards, including AS 1940-2017 *The Storage and Handling of Flammable and Combustible Liquids*;
- the accommodation camp irrigation area would be managed in accordance with the *Environmental Guidelines: Use of Effluent by Irrigation* (DEC, 2004);
- minimise the use of clean water on-site;
- the groundwater model for the borefield (Section 4.2.7) will be reviewed and updated at least once every three years after the commencement of extraction, with the model set-up and input parameters progressively refined to improve the prediction of current and future drawdown impacts due to pumping of the borefield and regional usage to allow for progressive validation of the numerical modelling predictions and an adaptive management approach;
- undertaking an investigation following an exceedance at a trigger level monitoring bore (Section 6.1);
- optimisation of the pumping regime with regard to extraction rate, duration and location of pumping at the borefield;
- optimisation of Project water supply requirements for the mine site (including surface water extraction from the Lachlan River); and/or
- identification of additional Project water supply sources.

7.4 GROUNDWATER USERS – MANAGEMENT OF COMPLAINTS

Should a groundwater related complaint be received during the Initial Construction Activities, SEM will conduct an investigation and respond in accordance with the procedures described in Section 11.2.

7.5 COMPENSATORY ACTION

In accordance with Condition 28, Schedule 3 of Development Consent DA 374-11-00, SEM will provide a compensatory water supply to anyone whose basic landholder water rights (as defined in the Water Management Act) are adversely and directly impacted as a result of the Project. This supply will be provided in consultation with NRAR, and to the satisfaction of the Secretary.

The compensatory water supply measures will provide an alternative long-term supply of water that is equivalent to the loss attributable to the Project. Equivalent water supply will be provided (at least on an interim basis) as soon as possible after the loss is identified, unless otherwise agreed with the landowner. Table 11 describes the landholder consultation process SEM will follow in determining a suitable compensatory water supply for a landholder.

Table 11
Landholder Consultation Process – Compensatory Action

Stage	Outcomes
Communication	• Notify the landholder that an alternative long-term supply of water must be provided by SEM equivalent to the loss attributable to the Project, in accordance with Condition 28, Schedule 3 of Development Consent DA 374-11-00. • Organise a suitable time and location with the landholder to commence/undertake negotiations.
Negotiation	• Determine the landholders water supply loss attributable to the Project. This could include review of historical and up-to-date groundwater extraction rates from the affected bore/s. • Discuss potential suitable compensatory water supply measures with the landholder, in consideration of the existing/affected water supply (i.e. equipment type, extraction capacity, water purpose). These measures could include: – lowering the pump intake; or – deepening the affected groundwater supply bore; or – construction of a new groundwater supply bore; or – provision of an alternative water supply. • Agree upon the compensatory water supply measures to be provided by SEM. The agreement would outline aspects such as: – The date on which the compensatory water supply measures will commence. – The technical specifications of the bore (where deepening or construction of a new water supply bore is to be provided). – The volume of water to be supplied. – The date on which the compensatory water supply measures will cease. • Provide a copy of the negotiated agreement to NRAR and DPIE, to allow for comments from these departments and determine if the Secretary is satisfied with the agreement (in accordance with Condition 28, Schedule 3 of Development Consent DA 374-11-00). • Based on the feedback of NRAR and DPIE, finalise and sign the agreement in consultation with the landholder.
Mediation	If SEM and the landholder cannot agree on the compensatory water supply measures to be implemented following the negotiation process above, a third-party mediator would be engaged to facilitate further negotiations. It is expected that the mediation process would follow the negotiation process described above (or the aspects relevant to the extent of the disagreement).
Arbitration	In accordance with Condition 28, Schedule 3 of Development Consent DA 374-11-00, if SEM and the landowner cannot agree on the compensatory water supply measures to be implemented following the negotiation and mediation processes above, then the matter would be referred to the Secretary for resolution.

If SEM is unable to provide an alternative long-term supply of water, then SEM will provide alternative compensation (e.g. financial compensation) to the satisfaction of the Secretary.

7.6 GROUNDWATER LICENSING

In accordance with Condition 26, Schedule 3 of the Development Consent DA 374-11-00, SEM will ensure that it has sufficient water for all stages of the development, and if necessary, adjust the scale of the Project to match its available water supply.

Water Access Licences

Mine Dewatering

In-pit dewatering is expected to be negligible over the life of the Project (Golder, 2017).

Notwithstanding, SEM currently holds WAL 28681 in the Lachlan Fold Belt MDB Groundwater Source (Lachlan Fold Belt MDB [Other] Management Zone), for 243 share components under the *Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020* for the mine pit should the deepest areas intercept any groundwater.

Borefield Operation

SEM currently holds WAL 32068 in the Upper Lachlan Alluvial Groundwater Source (Upper Lachlan Alluvial Zone 5 Management Zone) for 3,154 share components under the *Water Sharing Plan for the Lachlan Alluvial Groundwater Sources 2020* for the borefield. The borefield will be operated in accordance with the conditions of WAL 32068.

SEM currently also holds WAL 39837 for an additional 766 share components in the Upper Lachlan Alluvial Groundwater Source (Upper Lachlan Alluvial Zone 5 Management Zone).

8 MONITORING PROGRAMS

8.1 MINE SITE

Given that in-pit dewatering is expected to be negligible over the life of the Project (Golder, 2017), monitoring of groundwater levels and quality at the mine site is primarily aimed at adding to the baseline datasets and establishing sites for future operational monitoring associated with the potential impact of the tailings storage facility, evaporation pond and water storage dam on the groundwater table and groundwater quality.

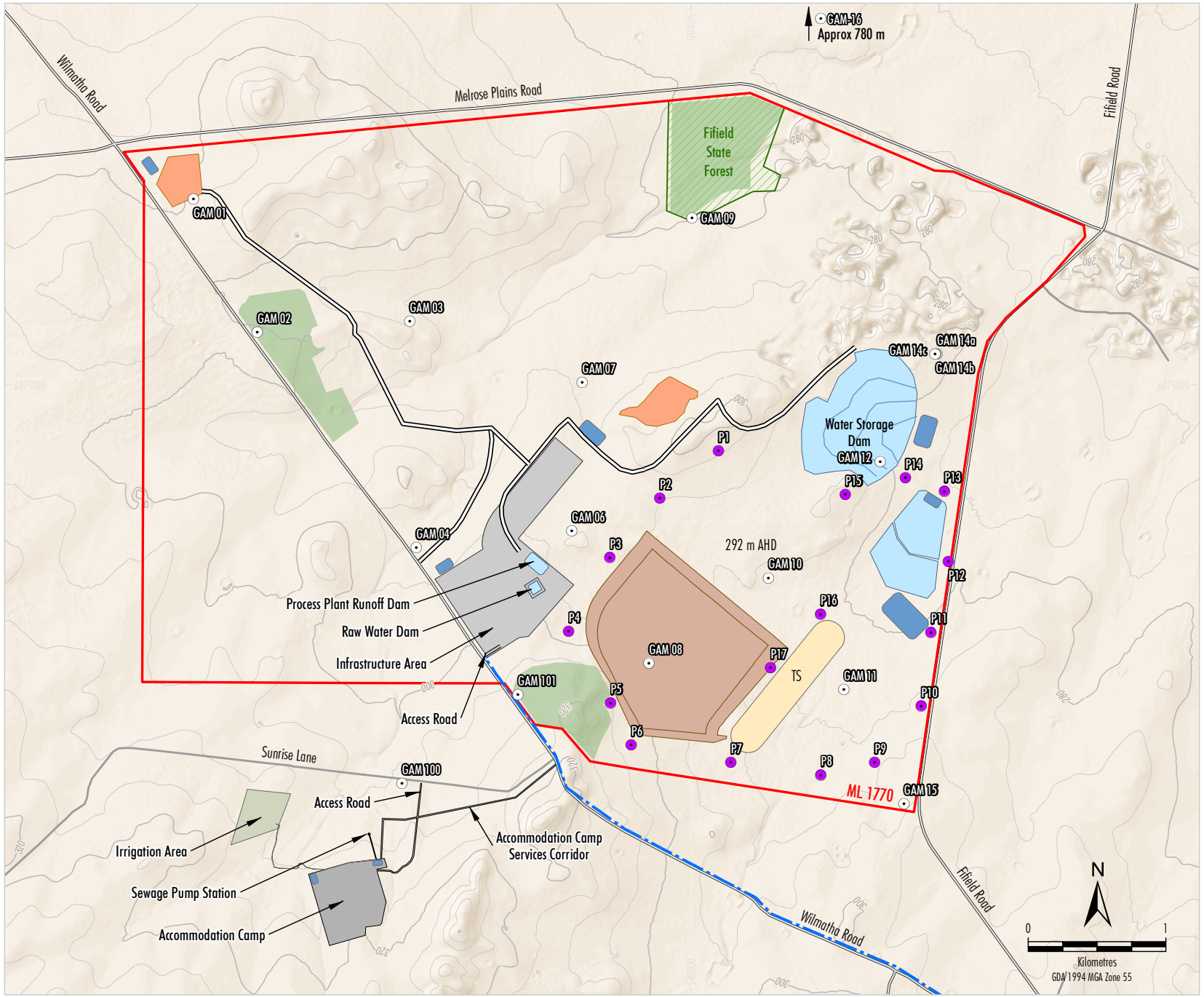
Baseline Monitoring

Baseline data collected from the existing groundwater monitoring network (GAM Series) at the mine site (Figure 5) will continue to be recorded prior to the commencement of construction to add to the existing baseline datasets.

Logging of groundwater levels will be continued and data downloaded periodically. The GAM Series monitoring bores will also be monitored six monthly for a suite of groundwater quality parameters including EC, pH, TDS, major cations, major anions and selected metals.

Construction Monitoring

During construction, baseline monitoring will continue to be collected from the existing groundwater monitoring network (GAM Series) (Figure 12). Logging of groundwater levels will be continued and data downloaded periodically.



LEGEND

- State Forest
- Mining Lease Boundary (ML)
- Tailings Storage Facility
- Borrow Pit
- TS Topsoil Stockpile
- Infrastructure Area
- Water Storage
- Sediment Dam
- Existing Open Woodland to be Maintained
- Water Pipeline
- Groundwater Monitoring Location
- Proposed Piezometer Location

Source: Black Range Minerals (2000); Clean TeQ (2017, 2018); NSW Spatial Services (2020)

sunrise energy metals

SUNRISE PROJECT

Groundwater Monitoring Program - Mine Site

Figure 12

CTL-17-03 MP 2021_GWMP_203A

The monitoring bores will also be utilised to monitor (six monthly) a suite of groundwater quality parameters including EC, pH, TDS, major cations, major anions and selected metals (Table 12).

A network of site-specific monitoring piezometers (Figure 12) will also be progressively established during the course of construction for future operational monitoring associated with the potential impact of the tailings storage facility, evaporation pond and water storage dam on the groundwater table and groundwater quality.

A summary of the construction stage mine site groundwater monitoring program is provided in Table 12.

Table 12
Mine Site Groundwater Monitoring Program

Monitoring Bore[1, 2]	Parameter	Frequency
GAM Series (GAM 01, GAM 02, GAM 03, GAM 04, GAM 06, GAM 07, GAM 08[2], GAM 9a, GAM 10, GAM 11, GAM 12[2], GAM 14a, GAM 14b, GAM 14c, GAM 15, GAM 100 and GAM 101)	Water Level	Daily
	Water Quality (EC, pH, TDS, total alkalinity as $CaCO_3$, total anions, total cations, hardness, ammonia as N, nitrate as N, nitrite as N, sulphate as SO_4, carbonate alkalinity as $CaCO_3$, Na, K, Ca, Mg, Cl and total and dissolved Al, As, Cd, Cu Co, Cr, Fe Mn, Ni, Pb, Zn)	Six Monthly
Piezometer Series (P1 to P15)[3] (once constructed)	Water Level	Daily
	Water Quality (EC, pH, TDS, total alkalinity as $CaCO_3$, total anions, total cations, hardness, ammonia as N, nitrate as N, nitrite as N, sulphate as SO_4, carbonate alkalinity as $CaCO_3$, Na, K, Ca, Mg, Cl and total and dissolved Al, As, Cd, Cu Co, Cr, Fe Mn, Ni, Pb, Zn)	Six Monthly

1 Refer to Figure 12.

2 Monitoring bores GAM 08 and GAM 12 will be decommissioned during initial construction activities as they are located within the footprint of the tailings storage facility and water storage dam, respectively.

3 Piezometers P8 to P10 would be established during operations prior to the commissioning of tailings storage facility Cell 3.

Operations Monitoring

The mine site groundwater monitoring program for operations and post-mining will be developed in a subsequent revision of this GWMP, including review and refinement of the existing groundwater monitoring network.

Notwithstanding the above, it is expected that during the first few years of operation, the existing network of groundwater bores at the mine site will continue to be monitored (logged) and samples collected periodically for quality analysis (e.g. EC, pH, TDS, major cations, major anions and selected metals). Thereafter, sampling may be reduced as required subject to review through the Annual Review process.

8.2 BOREFIELD

The objectives of the groundwater monitoring program for the borefield are:

- to assess the usage, status and maintenance requirements of the production bores;
- to assess the quality of groundwater supplied to the mine site;
- to identify potential groundwater impacts related to the Project;
- to optimise the operational management of the borefield to minimise potential impacts to groundwater users surrounding the borefield;

- to identify when and what remedial action may be required to maintain access to groundwater for existing groundwater users, if impacts of pumping from the borefield become significant; and
- to obtain aquifer and surface water flow data for ongoing review and refinement of the groundwater model.

Baseline Monitoring

Baseline data collected from the existing groundwater monitoring network (MW-W1, ISMW01, ISMW02 and MW-E1) at the borefield (Figure 6) will continue to be recorded prior to the commencement of extraction at the borefield to add to the existing baseline datasets (Table 13).

Table 13
Borefield Groundwater Monitoring Program – Prior to Extraction

Monitoring Bore[1]	Parameter	Frequency
MW-W1, ISMW01, ISMW02 and MW-E1	Water Level	Continuous
	Water Quality (pH, EC, redox potential, temperature and dissolved oxygen)	Six Monthly

[1] Refer to Figure 13.

Construction and Operations Monitoring

Prior to extraction of water from the borefield, based on the recommendations of HydroSimulations (2021), the groundwater monitoring program will be progressively expanded to include (Figure 13):

- continuous measurement of the groundwater level (with data-logging equipment) in the paired monitoring well adjacent to each of the production bores; specifically, Piezometers A, B, D and E (in addition to existing piezometers ISMW01 and ISMW02);
- continuous measurement of the groundwater level in Piezometer C, which will include piezometers screened in the Upper Cowra and Lower Cowra formations in addition to the screen in the Lachlan formation;
- continuous measurement of groundwater usage at the flow meters equipped at the production bores;
- monthly measurement of groundwater levels in regional monitoring bores (14 existing monitoring sites [including 12 NSW government monitoring sites], plus four additional regional groundwater monitoring sites [RB1 to RB4]);
- *in-situ* field measurements of groundwater quality at the six[6] production bores on a monthly basis for pH, EC, redox potential, temperature and dissolved oxygen; and
- measurement of groundwater usage by neighbouring licensed irrigation bores and users (where access is available and metered).

The groundwater level monitoring program once extraction of water from the borefield has commenced is summarised in Table 14.

[6] As described in Section 1.1, the Initial Construction Activities would include construction of the four remaining production bores, however extraction from these bores will not commence until the operations stage. *In-situ* measurements of groundwater quality would therefore only be undertaken at the two existing production bores during the construction stage.

Table 14
Borefield Groundwater Monitoring Program – Extraction

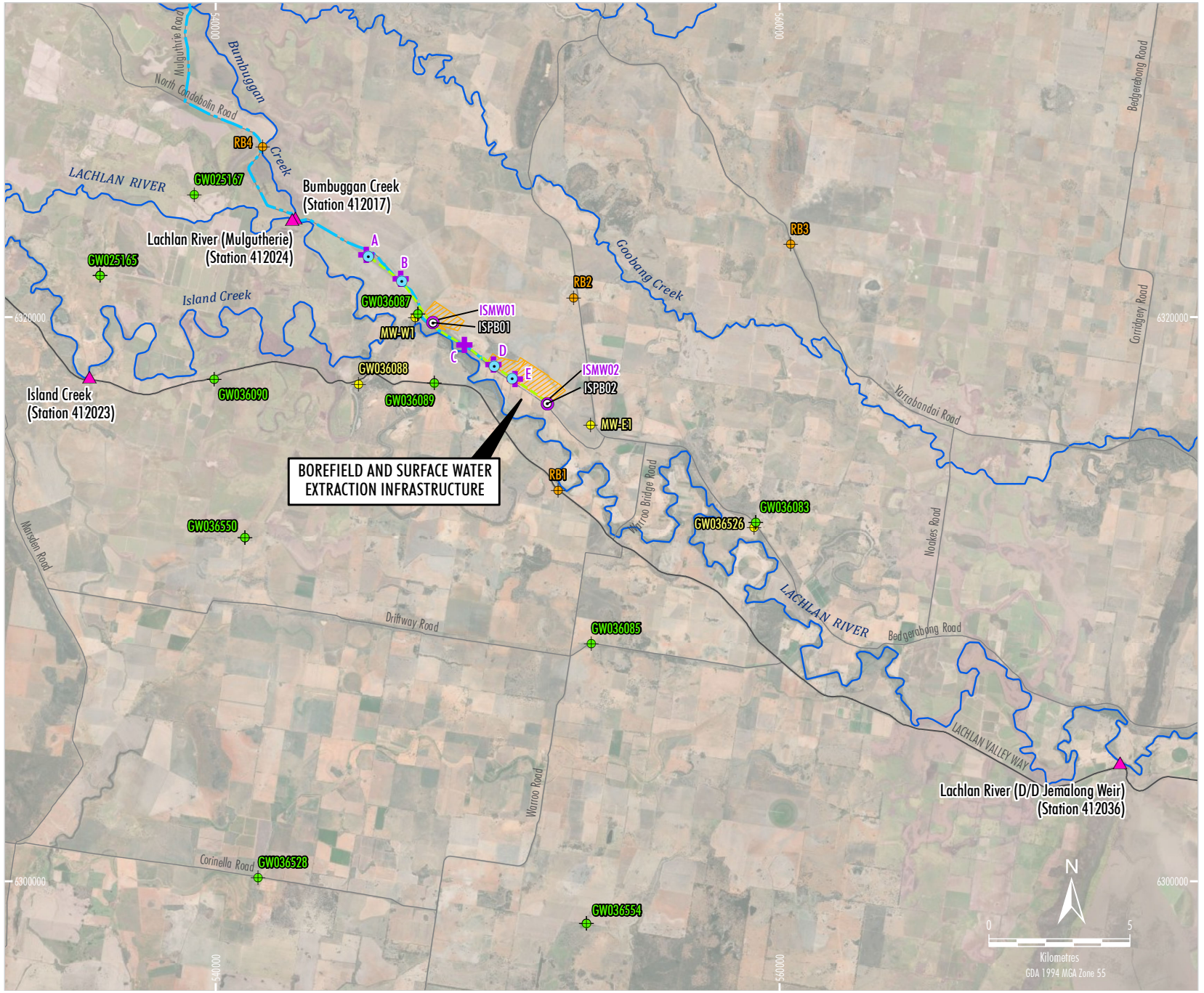
Monitoring Bore	Screened Formation	Frequency
Project Borefield Monitoring		
Existing Sites		
ISMW01	Lachlan	Continuous
ISMW02	Lachlan	Continuous
Proposed Sites		
Piezometers A, B, D and E	Lachlan	Continuous
Piezometer C	Upper Cowra Lower Cowra Lachlan	Continuous
Regional Monitoring		
Existing Sites		
GW025167*	Upper Cowra	Monthly
GW036083		Monthly
GW036528*		Monthly
GW036554*		Monthly
GW025165	Lower Cowra	Monthly
GW036083*		Monthly
GW036085*		Monthly
GW036087		Monthly
GW036089		Monthly
GW036550*		Monthly
GW025165*	Lachlan	Monthly
GW036087*		Monthly
GW036088		Monthly
GW036089*		Monthly
GW036090*		Monthly
GW036526		Monthly
MW-E1		Monthly
MW-W1		Monthly
Proposed Sites		
RB1	Upper Cowra Lower Cowra Lachlan	Monthly
RB2		Monthly
RB3		Monthly
RB4		Monthly

* As described in Section 6.1, trigger levels have been developed for these bores in consultation with DPIE – Water.

In addition to the above, the following monitoring is proposed to obtain aquifer recharge and surface water data for ongoing review and refinement of the groundwater model, including:

- meteorological monitoring data from BoM Stations 50052 (Condobolin Agricultural Research and Advisory Station) and 50020 (Waroo); and
- surface flow from existing gauging stations on the Lachlan River (Figure 13) to monitor daily flows.

A post-mining groundwater monitoring program will be developed in a future revision of the GWMP.



LEGEND

- Water Pipeline
- Borefield Infrastructure Corridor *
- Borefield Location
- Production Bore (not constructed)
- Production Bore (constructed)
- Existing Borefield Monitoring Piezometer
- Proposed Borefield Monitoring Piezometer
- Regional Monitoring Bore (Existing)
- Regional Trigger Level Monitoring Bores (Existing)
- Regional Monitoring Bore (Proposed) ^
- Surface Water Flow Gauge

* Infrastructure Corridor includes linking pipline, access road and electricity transmission line.

^ Indicative Location Only – Location to be confirmed in consultation with Natural Resources Access Regulator and relevant landholders.

Source: Ivanplats Syerston (2005); NSW Spatial Services (2020); NSW DPI - Water (2018)
NSW Imagery: Esri, DigitialGlobe (2017)

sunrise energy metals

SUNRISE PROJECT

Groundwater Monitoring Program - Borefield

Figure 13

CTL-17-03 MP 2021_GWMP_207C

9 CONTINGENCY PLAN

In accordance with Condition 3, Schedule 5 of Development Consent DA 374-11-00, SEM will assess and manage development-related risks to ensure that there are no exceedances of the criteria and/or performance measures. In the event a water management performance measure for the Project (detailed in Section 6) may not have been met or a performance indicator is considered to have been exceeded, SEM will implement the following Contingency Plan:

- SEM will report the likely exceedance in accordance with Section 10.1.
- SEM will apply adaptive management (Section 9.1).
- SEM will identify an appropriate course of action with respect to the identified potential impacts or environmental consequences (if any), in consultation with specialists and relevant government agencies, as necessary. For example, contingency measures, such as, but not limited to, those described in Section 9.2.
- SEM will submit the proposed course of action to the DPIE for approval.
- SEM will implement the approved course of action to the satisfaction of the DPIE.

9.1 ADAPTIVE MANAGEMENT

In accordance with Condition 3, Schedule 5 of Development Consent DA 374-11-00, where any exceedance of the criteria and/or performance measures outlined in Schedule 3 of Development Consent DA 374-11-00 occurs, at the earliest opportunity SEM will:

- take all reasonable and feasible measures to ensure that the exceedance ceases and does not recur;
- consider all reasonable and feasible options for remediation and submit a report to the DPIE describing these options and preferred remediation measures; and
- implement remediation measures as directed by the Secretary.

9.2 SPECIFIC CONTINGENCY MEASURES

Specific contingency measures for an exceedance of the water management performance measures may include:

- The conduct of additional monitoring (e.g. increase in monitoring frequency or additional sampling), which may inform further specific contingency measures.
- Provision of equivalent water supply or compensation for an impacted privately-owned bore (refer Section 7.5).
- The provision of a suitable offset (e.g. water infrastructure improvement works such as replacing open channels with pipelines) if there was an environmental consequence and/or adverse groundwater impacts were to result.
- Obtain additional entitlements for the Project under the Water Management Act if additional water supply is required.
- Adjust the scale of Project operations to match the available Project water supply.

SEM will also implement any preferred contingency measures identified to address an incident as directed by the Secretary (Sections 9.1 and 11.1).

10 REVIEW AND IMPROVEMENT OF ENVIRONMENTAL PERFORMANCE

10.1 ANNUAL REVIEW

In accordance with Condition 5, Schedule 5 of Development Consent DA 374-11-00, SEM will review the environmental performance of the Project by the end of March each year (for the previous calendar year) to the satisfaction of the Secretary.

In relation to water management, the Annual Review will (where relevant):

- describe the development that was carried out in the relevant calendar year, and the development that is proposed to be carried out during the following calendar year;
- include a comprehensive review of the monitoring results and complaints records of the development over the past year, which includes a comparison of these results against the:
  - relevant statutory requirements, limits or performance measures/criteria;
  - monitoring results of previous years; and
  - relevant predictions in the Project Environmental Impact Statement (Black Range Minerals, 2000) and subsequent environmental assessments;
- identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;
- identify any trends in the monitoring data over the life of the development;
- identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and
- describe what measures will be implemented over the next year to improve the environmental performance of the development.

The Annual Review will be made publicly available on the SEM website.

10.2 INDEPENDENT ENVIRONMENTAL AUDIT

In accordance with Condition 10, Schedule 5 of Development Consent DA 374-11-00, within one year of the commencement of the development after 6 May 2017, and every 3 years thereafter (unless the Secretary directs otherwise), SEM will commission and pay the full cost of an independent environmental audit of the Project. The independent environmental audit will be conducted by a suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Secretary.

The independent environmental audit will assess the environmental performance of the Project and review the adequacy of this GWMP, and include consultation with the relevant agencies such as DPIE - Water, NRAR and the EPA. If necessary, appropriate measures or actions to improve the environmental performance of the Project or this GWMP will be recommended.

The independent environmental audit, and SEM's response to the recommendations in the audit, will be made publicly available on the SEM website, in accordance with Condition 12, Schedule 5 of Development Consent DA 374-11-00.

11 REPORTING PROTOCOLS

In accordance with Condition 4(g), Schedule 5 of Development Consent DA 374-11-00, SEM has developed protocols for managing and reporting the following:

- incidents;
- complaints;
- non-compliances with statutory requirements; and
- exceedances of the impact assessment criteria and/or performance criteria.

These protocols are described in detail in SEM's Environmental Management Strategy (Clean TeQ, 2019).

In accordance with Condition 9, Schedule 5 of Development Consent DA 374-11-00, SEM will provide regular reporting on the environmental performance of the Project on the SEM website. The Annual Review will be made publicly available on the SEM website to address this requirement.

11.1 INCIDENT REPORTING

An incident is defined as a set of circumstances that causes or threatens to cause material harm to the environment and/or breaches or exceeds the limits or performance measures/criteria in Development Consent DA 374-11-00.

In the event that review of groundwater monitoring data indicates an incident has occurred, the incident will be reported in accordance with Condition 8, Schedule 5 of Development Consent DA 374-11-00. SEM will notify the Secretary and any other relevant agencies including the relevant Council immediately after it becomes aware of the incident. SEM will also notify any affected landholders of any incident that has caused, or threatens to cause, material harm to the environment.

Within seven days of the date of the incident, SEM will provide the Secretary and any other relevant agencies with a detailed report on the incident and such further reports as may be requested. The report will:

- describe the date, time and nature of the exceedance/incident;
- identify the cause (or likely cause) of the exceedance/incident;
- describe what action has been taken to date; and
- describe reasonable and feasible options to address the incident and identify the preferred option to address the incident (Section 9.1).

11.2 COMPLAINTS

SEM will maintain a Community Complaints Line (tel: 1800 952 277) and email address (community@sunriseem.com) for the sole purpose of receiving community contacts and complaints. The Community Complaints Line number will be available on the website and included in SEM's advertising and community communication tools. The Community Complaints line will be staffed 24 hours a day, seven days a week during construction and operations. SEM will respond to callers on the next business day. If the issue is urgent a member of the leadership team will be contacted immediately.

SEM has developed a procedure that outlines its commitment to receiving, resolving and recording complaints received from the community. Detailed records of each complaint resolution are kept in SEM's record management systems.

Complaints will be investigated within 24 hours of receipt. The cause of the complaint will be analysed and actions to resolve the complaint taken as soon as possible. In complex cases where resolution will take more than 48 hours, SEM will commit to update the community member regularly until the complaint is resolved.

In accordance with Condition 12(a), Schedule 5 of Development Consent DA 374-11-00, a complaints register will be made available on the SEM website and updated monthly.

11.3 NON-COMPLIANCES WITH STATUTORY REQUIREMENTS

A protocol for managing and reporting non-compliances with statutory requirements has been developed as a component of SEM's Environmental Management Strategy and is described below.

Compliance with all approvals plans and procedures is the responsibility of all personnel (staff and contractors) employed on or in association with SEM and the Project.

SEM will undertake regular inspections, internal audits and initiate directions identifying any remediation/rectification work required, and areas of actual or potential non compliance.

As described in Section 11.1, SEM will report incidents in accordance with Condition 8, Schedule 5 of Development Consent DA 374-11-00 and in accordance with the protocol for industry notification of pollution incidents under Part 5.7 of the POEO Act.

SEM will notify the Secretary and any other relevant agencies including the relevant Council immediately after the authorised person becomes aware of the incident which causes or threatens to cause material harm to the environment. Within seven days of the date of the incident, SEM will provide the Secretary and any other relevant agencies with a detailed report on the incident and such further reports as may be requested.

A review of compliance with all conditions in Development Consent DA 374-11-00, Mining Lease 1770 and any other relevant approvals and licences will be undertaken prior to (and included within) each Annual Review (Section 10.1).

Additionally, in accordance with Condition 10, Schedule 5 of Development Consent DA 374-11-00, an independent environmental audit (Section 10.2) will be conducted by a suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Secretary to assess whether SEM is complying with the requirements in Development Consent DA 374-11-00, and any other relevant approvals, EPLs, and/or mining leases.

11.4 EXCEEDANCES OF IMPACT ASSESSMENT CRITERIA AND/OR PERFORMANCE

A protocol for managing and reporting exceedances of impact assessment criteria and/or performance criteria is provided is Section 9.

12 REFERENCES

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ATTACHMENT 1

BASELINE WATER QUALITY RESULTS

Table B3
Baseline Analytical Data Summary - June 2018 to April 2021

Bore ID	Analytes	GAM01	GAM01	GAM01	GAM01	GAM01	GAM01	GAM02	GAM02	GAM02	GAM02	GAM02	GAM02	GAM03	GAM03	GAM03	GAM03	GAM03	GAM03
Sample Collection Date		12-Apr-21	15-Sep-20	17-Mar-20	13-Nov-19	28-Jul-19	07-Jun-18	12-Apr-21	15-Sep-20	17-Mar-20	11-Nov-19	24-Jul-19	07-Jun-18	12-Apr-21	15-Sep-20	16-Mar-20	11-Nov-19	24-Jul-19	08-Jun-18
Major Cations (mg/L)	Calcium	12	13	12	13	13	12	59	63	60	63	62	57	27	30	29	30	29	28
	Magnesium	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	<1	63	66	62	57	58	55	210	230	220	200	190	200
	Sodium	61	63	59	57	59	54	47	48	43	45	44	43	47	53	47	49	49	47
	Potassium	2.9	1.9	1.9	1.7	1.3	2.0	1.6	1.5	1.5	1.6	1.5	2.0	1.6	1.7	1.7	1.7	1.5	1.0
Major Anions (mg/L)	Sulphate	48	41	37	38	40	41	11	13	12	13	12	12	11	14	13	14	14	10
	Chloride	30	31	37	27	38	30	53	43	39	88	40	51	49	56	46	77	42	57
	Bicarbonate Alkalinity (as CaCO3)	65	78	76	77	78	75	480	360	310	470	450	412	1100	1000	710	1000	920	1010
	Carbonate Alkalinity (as CaCO3)	< 10	< 10	< 10	< 10	< 10	<1	< 10	< 10	< 10	< 10	< 10	23	23	< 10	< 10	24	40	<1
	Hydroxide Alkalinity (as CaCO3)	< 20	< 20	< 20	< 20	< 20	<1	< 20	< 20	< 20	< 20	< 20	<1	< 20	< 20	< 20	< 20	< 20	<1
	Total Alkalinity (as CaCO3)	65	78	76	82	78	75	480	370	310	470	450	435	1100	1000	710	1100	960	1010
Heavy Metals (Dissolved) (mg/L)	Aluminium	0.060	< 0.05	< 0.05	< 0.05	< 0.05	0.080	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.01	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.01
	Arsenic	0.001	0.002	0.001	0.002	0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001
	Boron	< 0.05	< 0.05	< 0.05	0.070	0.080	<0.05	0.070	0.070	< 0.05	0.100	0.090	0.080	0.110	0.110	< 0.05	0.130	0.110	0.110
	Cadmium	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	<0.0001	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	<0.0001	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	<0.0001
	Chromium	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	0.022	0.019	0.024	0.022	0.020	0.026	0.019	0.015	0.013	0.014	0.015	0.009
	Cobalt	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001
	Copper	< 0.001	< 0.001	< 0.001	0.002	< 0.001	0.009	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.012	< 0.001	0.002	< 0.001	< 0.001	< 0.001	0.007
	Iron	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.05
	Lead	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001
	Manganese	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.006	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.013	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	<0.001
	Mercury	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	<0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	<0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	<0.0001
	Nickel	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005	< 0.001	< 0.001	< 0.001	0.002	< 0.001	0.006	0.010	0.011	0.013	0.017	0.007	0.014
	Silver	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	<0.001	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	<0.001	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	<0.001
	Vanadium	0.007	0.008	0.009	0.011	0.011	<0.01	0.026	0.026	0.030	0.030	0.030	0.030	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	<0.01
	Zinc	< 0.005	< 0.005	< 0.005	0.020	< 0.005	0.008	0.005	0.006	0.006	< 0.005	< 0.005	0.026	< 0.005	0.012	0.006	< 0.005	< 0.005	0.008
Nutrients (mg/L)	Nitrate (as N)	1.20	1.50	1.60	1.70	1.80	1.30	0.46	0.51	0.51	0.51	-	-	0.56	0.61	0.57	0.58	-	-
	Nitrite (as N)	< 0.02	0.02	0.02	0.04	0.02	<0.01	< 0.02	< 0.02	< 0.02	-	-	-	< 0.02	< 0.02	< 0.02	-	-	-
	Ammonia (as N)	< 0.01	0.02	0.01	< 0.01	< 0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01	-	-	< 0.01	< 0.01	< 0.01	< 0.01	-	-
	Total Kjeldahl Nitrogen (as N)*	< 0.2	< 0.2	0.40	0.40	< 0.2	0.40	< 0.2	0.50	< 0.2	-	-	-	< 0.2	0.60	< 0.2	-	-	-
	Total Nitrogen (as N)	1.20	1.50	2.10	2.10	1.90	1.70	0.46	1.02	0.50	-	-	-	0.56	1.21	0.60	-	-	-
	Phosphate total (as P)	0.02	< 0.05	< 0.05	0.02	0.03	0.02	0.02	< 0.05	< 0.05	-	-	-	< 0.01	0.10	< 0.05	-	-	-
Others	TDS	180	180	170	190	210	214	380	490	440	500	510	452	890	1100	1700	980	800	812
	Electrical Conductivity (Lab)	320	300	350	350	350	340	960	740	900	860	830	822	1800	1400	1700	1600	1500	1620
	Total Organic Carbon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table B3
Baseline Analytical Data Summary - June 2018 to April 2021

Bore ID	Analytes	GAM04	GAM04	GAM04	GAM04	GAM04	GAM04	GAM05	GAM05	GAM05	GAM05	GAM05	GAM06	GAM06	GAM06	GAM06	GAM06	GAM06
Sample Collection Date		12-Apr-21	15-Sep-20	16-Mar-20	12-Nov-19	25-Jul-19	07-Jun-18	13-Apr-21	15-Sep-20	17-Mar-20	11-Nov-19	28-Jul-19	12-Apr-21	15-Sep-20	16-Mar-20	12-Nov-19	24-Jul-19	12-Jun-18
Major Cations (mg/L)	Calcium	72	85	85	82	84	75	50	60	52	54	56	260	340	320	300	320	66
	Magnesium	97	110	100	91	95	86	110	120	120	110	110	420	520	490	460	500	66
	Sodium	86	94	90	86	87	84	33	37	32	34	33	500	600	530	500	530	123
	Potassium	2.9	2.8	3.0	3.0	3.0	2.0	1.1	1.2	1.3	1.3	1.2	9.9	11	11	11	12	6.0
Major Anions (mg/L)	Sulphate	38	34	34	31	30	31	17	17	15	14	13	470	660	620	470	460	75
	Chloride	150	170	170	180	140	170	73	97	81	100	91	1700	2400	2400	2000	1700	332
	Bicarbonate Alkalinity (as CaCO3)	540	580	380	590	550	553	560	500	400	600	560	830	760	500	840	820	236
	Carbonate Alkalinity (as CaCO3)	< 10	< 10	< 10	< 10	< 10	<1	< 10	23	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	<1
	Hydroxide Alkalinity (as CaCO3)	< 20	< 20	< 20	< 20	< 20	<1	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	<1
	Total Alkalinity (as CaCO3)	540	580	380	590	550	553	600	520	400	600	560	830	760	500	840	820	236
Heavy Metals (Dissolved) (mg/L)	Aluminium	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.01	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.010
	Arsenic	< 0.001	0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001	0.002	< 0.001	< 0.001	<0.001
	Boron	0.130	0.110	< 0.05	0.130	0.130	0.110	0.060	0.060	< 0.05	0.090	0.060	0.190	0.170	0.060	0.200	0.180	0.100
	Cadmium	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	<0.0001	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	<0.0001
	Chromium	0.014	0.012	0.014	0.012	0.012	0.015	0.072	0.058	0.065	0.055	0.064	0.008	0.007	0.007	0.004	0.004	0.002
	Cobalt	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003
	Copper	0.002	0.001	< 0.001	0.001	0.002	0.009	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.007	0.006	0.005	0.008	0.013	0.013
	Iron	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.05
	Lead	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.001	0.001	0.010
	Manganese	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.003	< 0.005	< 0.005	0.005	0.014	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.129
	Mercury	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	<0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0003	0.0002	0.0001	< 0.0001	< 0.0001	<0.0001
	Nickel	0.002	0.002	0.003	0.008	0.003	<0.001	0.009	0.008	0.011	0.021	0.009	0.012	0.009	0.019	0.033	0.027	0.101
	Silver	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	<0.001	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	<0.001
	Vanadium	0.019	0.023	0.023	0.023	0.023	0.020	< 0.005	0.010	0.008	0.007	0.008	0.009	0.016	0.015	0.013	0.013	<0.01
	Zinc	0.012	0.100	0.014	0.011	0.011	0.006	0.008	0.011	0.006	0.006	0.010	0.019	0.028	0.009	0.019	0.013	0.029
Nutrients (mg/L)	Nitrate (as N)	3.90	3.90	4.70	4.60	-	-	1.60	1.60	1.40	1.40	-	0.16	0.19	0.18	0.14	-	-
	Nitrite (as N)	< 0.02	< 0.02	< 0.02	-	-	-	< 0.02	< 0.02	< 0.02	-	-	< 0.02	< 0.02	< 0.02	-	-	-
	Ammonia (as N)	< 0.01	< 0.01	0.02	< 0.01	-	-	< 0.01	0.01	0.02	< 0.01	-	< 0.01	< 0.01	0.01	< 0.01	-	-
	Total Kjeldahl Nitrogen (as N)*	< 0.2	< 0.2	0.20	-	-	-	< 0.2	< 0.2	0.40	-	-	< 0.2	< 0.2	< 0.2	-	-	-
	Total Nitrogen (as N)	3.90	3.90	4.90	-	-	-	1.60	1.60	1.80	-	-	< 0.2	0.20	< 0.2	-	-	-
	Phosphate total (as P)	0.01	< 0.05	< 0.05	-	-	-	0.01	< 0.05	< 0.05	-	-	0.02	< 0.05	< 0.05	-	-	-
Others	TDS	750	860	810	850	860	851	580	700	630	560	650	3500	4600	5300	4200	3700	763
	Electrical Conductivity (Lab)	1600	1200	1500	1400	1400	1460	1200	980	7000	1100	1100	7400	6000	7000	6700	6300	1480
	Total Organic Carbon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table B3
Baseline Analytical Data Summary - June 2018 to April 2021

Bore ID	Analytes	GAM07	GAM07	GAM07	GAM07	GAM07	GAM07	GAM08	GAM08	GAM08	GAM08	GAM08	GAM08	GAM09	GAM09	GAM09	GAM09	GAM09
Sample Collection Date		12-Apr-21	15-Sep-20	16-Mar-20	12-Nov-19	24-Jul-19	07-Jun-18	14-Apr-21	16-Sep-20	16-Mar-20	12-Nov-19	25-Jul-19	13-Jun-18	13-Apr-21	17-Sep-20	17-Mar-20	11-Nov-19	24-Jul-19
Major Cations (mg/L)	Calcium	4.6	2.6	0.9	1.0	0.9	2	53	56	120	120	130	111	1.6	1.6	0.9	1.3	2
	Magnesium	64	64	58	49	46	58	120	120	320	270	280	251	140	150	140	130	150
	Sodium	190	230	170	160	150	147	1000	1100	2200	2000	2100	1780	82	85	78	74	77
	Potassium	4.8	4.9	4.3	4.6	4.1	4.0	13	14	24	24	27	20	2.9	2.7	2.7	2.7	2.6
Major Anions (mg/L)	Sulphate	27	30	16	9.2	9.8	14	1000	1000	2400	2100	2000	2080	40	53	40	32	32
	Chloride	330	380	230	190	260	173	1200	1100	2300	2300	1900	2110	87	110	89	97	100
	Bicarbonate Alkalinity (as CaCO3)	310	280	200	270	260	348	540	520	670	1100	1000	949	570	570	430	530	650
	Carbonate Alkalinity (as CaCO3)	47	59	42	54	48	56	< 10	< 10	< 10	< 10	< 10	<1	32	31	< 10	< 10	11
	Hydroxide Alkalinity (as CaCO3)	< 20	< 20	<20	< 20	< 20	<1	< 20	< 20	< 20	< 20	< 20	<1	< 20	< 20	< 20	< 20	< 20
	Total Alkalinity (as CaCO3)	360	340	240	320	310	404	540	520	670	1100	1000	949	570	600	430	540	660
Heavy Metals (Dissolved) (mg/L)	Aluminium	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.01	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.01	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
	Arsenic	< 0.001	0.001	0.001	< 0.001	< 0.001	<0.001	0.002	0.003	0.002	0.002	0.002	0.002	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	Boron	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.05	0.170	0.130	< 0.05	0.160	0.140	0.130	0.100	0.090	< 0.05	0.110	0.090
	Cadmium	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	<0.0001	0.0005	0.0004	0.0010	0.0010	0.0021	0.0037	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
	Chromium	< 0.001	< 0.001	0.002	< 0.001	0.001	0.006	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	0.056	0.049	0.056	0.055	0.052
	Cobalt	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	0.003	0.003	0.004	0.006	0.004	0.008	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	Copper	0.002	0.001	< 0.001	< 0.001	< 0.001	0.008	0.068	0.027	0.021	0.004	0.033	0.098	0.011	0.004	0.002	< 0.001	< 0.001
	Iron	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
	Lead	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.006	< 0.001	< 0.001	0.002	< 0.001	< 0.001	<0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	Manganese	0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.009	0.160	0.230	0.090	0.190	0.087	0.052	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
	Mercury	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	<0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	<0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
	Nickel	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001	0.006	0.004	0.024	0.033	0.037	0.010	0.006	0.002	0.003	0.004	0.002
	Silver	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	<0.001	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	<0.001	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
	Vanadium	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	<0.01	0.012	0.019	0.012	0.013	0.017	0.020	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
	Zinc	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	<0.005	0.009	0.009	0.012	0.010	0.013	0.021	0.006	0.006	0.007	0.019	< 0.005
Nutrients (mg/L)	Nitrate (as N)	0.03	0.04	0.05	< 0.02	-	-	37.00	5.70	< 0.02	< 0.02	-	-	0.10	0.07	0.08	0.07	-
	Nitrite (as N)	< 0.02	< 0.02	< 0.02	-	-	-	< 0.02	< 0.02	< 0.02	-	-	-	< 0.02	< 0.02	< 0.02	-	-
	Ammonia (as N)	< 0.01	0.02	< 0.01	< 0.01	-	-	0.01	< 0.01	0.02	< 0.01	-	-	< 0.01	< 0.01	0.01	< 0.01	-
	Total Kjeldahl Nitrogen (as N)*	< 0.2	0.20	< 0.2	-	-	-	2.00	0.70	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	-	-
	Total Nitrogen (as N)	< 0.2	0.20	< 0.2	-	-	-	39.00	6.40	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	-	-
	Phosphate total (as P)	< 0.01	< 0.05	< 0.05	-	-	-	0.02	< 0.05	< 0.05	-	-	-	< 0.01	< 0.05	< 0.05	-	-
Others	TDS	570	800	610	520	470	588	3300	3500	6300	5900	5600	6020	570	730	690	670	730
	Electrical Conductivity (Lab)	1500	1200	1200	1100	1000	1180	6600	4400	10000	10000	9800	10400	1400	1100	1300	1100	1200
	Total Organic Carbon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table B3
Baseline Analytical Data Summary - June 2018 to April 2021

Bore ID	Analytes	GAM10	GAM10	GAM10	GAM10	GAM10	GAM10	GAM11	GAM11	GAM11	GAM11	GAM11	GAM11	GAM12	GAM12	GAM12	GAM12	GAM12	GAM12
Sample Collection Date		14-Apr-21	17-Sep-20	19-Mar-20	13-Nov-19	25-Jul-19	12-Jun-18	13-Apr-21	16-Sep-20	17-Mar-20	13-Nov-19	28-Jul-19	07-Jun-18	13-Apr-21	16-Sep-20	19-Mar-20	13-Nov-19	26-Jul-19	13-Jun-18
Major Cations (mg/L)	Calcium	180	200	190	190	200	90	350	430	420	430	400	347	100	62	50	54	52	46
	Magnesium	360	410	330	350	350	286	570	650	650	610	560	475	30	8.1	8.4	10	8.7	8
	Sodium	800	980	770	820	830	725	2200	2600	2600	2600	2400	2000	230	240	210	230	230	223
	Potassium	14	15	14	14	16	14	23	24	24	25	26	19	6.4	6.2	4.1	5.7	5.3	3.0
Major Anions (mg/L)	Sulphate	500	740	490	490	500	437	1600	2200	1900	1600	1500	1550	360	350	300	300	280	248
	Chloride	1900	2400	1800	1800	1600	1350	5800	6200	5400	4600	4700	4210	170	230	190	120	180	218
	Bicarbonate Alkalinity (as CaCO3)	860	760	630	910	840	788	970	810	540	850	800	814	47	110	130	120	130	137
	Carbonate Alkalinity (as CaCO3)	< 10	< 10	< 10	< 10	< 10	9	< 10	< 10	< 10	< 10	< 10	<1	20	< 10	< 10	< 10	< 10	<1
	Hydroxide Alkalinity (as CaCO3)	< 20	< 20	< 20	< 20	< 20	<1	< 20	< 20	< 20	< 20	< 20	<1	< 20	< 20	< 20	< 20	< 20	<1
	Total Alkalinity (as CaCO3)	860	760	630	910	840	796	970	810	540	850	800	814	67	110	130	120	130	137
Heavy Metals (Dissolved) (mg/L)	Aluminium	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.030	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.01	0.070	< 0.05	< 0.05	< 0.05	< 0.05	0.030
	Arsenic	< 0.001	0.002	< 0.001	< 0.001	< 0.001	<0.001	< 0.001	0.002	0.001	< 0.001	< 0.001	<0.001	0.003	0.009	0.008	0.010	0.007	0.006
	Boron	0.140	0.120	0.160	0.150	0.130	0.160	0.170	0.140	< 0.05	0.180	0.160	0.130	0.180	0.250	0.340	0.330	0.280	0.280
	Cadmium	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.0002	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	<0.0001
	Chromium	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001
	Cobalt	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	0.001	< 0.001	< 0.001	< 0.001	0.001	0.002	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001
	Copper	0.001	0.005	0.003	0.003	0.001	0.246	0.017	0.011	0.015	0.014	0.024	0.003	0.009	0.002	< 0.001	< 0.001	< 0.001	0.005
	Iron	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.120	< 0.05	0.210	0.370	0.490	0.260	<0.05
	Lead	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.011	< 0.001	< 0.001	0.002	< 0.001	< 0.001	<0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001
	Manganese	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.032	0.016	0.008	0.009	0.007	0.011	0.035	0.031	0.120	0.140	0.160	0.097	0.094
	Mercury	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	<0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	<0.0001	< 0.0001	< 0.0001	0.0001	< 0.0001	0.0002	<0.0001
	Nickel	0.003	0.003	0.012	0.011	0.053	0.143	0.035	0.006	0.017	0.049	0.110	0.002	0.002	0.002	0.004	0.009	0.020	<0.001
	Silver	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	<0.001	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	<0.001	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	<0.001
	Vanadium	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	<0.01	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	<0.01	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	<0.01
	Zinc	0.011	0.021	0.012	0.014	0.009	0.054	0.020	0.029	0.014	0.015	0.018	<0.005	0.008	< 0.005	< 0.005	< 0.005	< 0.005	0.010
Nutrients (mg/L)	Nitrate (as N)	0.16	0.16	0.11	0.12	-	-	2.10	2.40	2.50	2.40	2.40	2.33	0.05	< 0.02	< 0.02	< 0.02	-	-
	Nitrite (as N)	< 0.02	< 0.02	< 0.02	-	-	-	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	<0.01	< 0.02	< 0.02	< 0.02	-	-	-
	Ammonia (as N)	< 0.01	< 0.02	< 0.01	< 0.01	-	-	0.03	0.03	0.01	< 0.01	< 0.01	<0.01	0.39	0.41	0.23	0.12	-	-
	Total Kjeldahl Nitrogen (as N)*	< 0.2	< 0.2	0.80	-	-	-	1.10	< 0.2	< 0.2	0.30	< 0.2	<0.2	0.39	0.41	1.20	-	-	-
	Total Nitrogen (as N)	< 0.2	< 0.2	0.80	-	-	-	3.20	2.40	2.50	2.70	2.40	2.30	0.45	0.41	1.20	-	-	-
	Phosphate total (as P)	0.03	< 0.05	0.02	-	-	-	0.06	< 0.05	0.05	0.02	0.09	<0.02	0.02	< 0.05	0.02	-	-	-
Others	TDS	3700	4100	3800	4000	3300	3090	7500	8900	2100	8200	8800	10300	840	920	790	850	880	798
	Electrical Conductivity (Lab)	7400	5900	6600	6800	6400	5780	16000	13000	15000	15000	14000	14800	1600	1200	1300	1200	1400	1400
	Total Organic Carbon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table B3
Baseline Analytical Data Summary - June 2018 to April 2021

Bore ID	Analytes	GAM14A	GAM14A	GAM14A	GAM14B	GAM14B	GAM14B	GAM14C	GAM14C	GAM14C	GAM14C	GAM14C	GAM14C	GAM15	GAM15	GAM15	GAM15	GAM15	GAM15
Sample Collection Date		13-Apr-21	16-Sep-20	19-Mar-20	13-Apr-21	16-Sep-20	19-Mar-20	13-Apr-21	16-Sep-20	18-Mar-20	13-Nov-19	26-Jul-19	13-Jun-18	13-Apr-21	16-Sep-20	17-Mar-20	13-Nov-19	25-Jul-19	12-Jun-18
Major Cations (mg/L)	Calcium	66	77	59	63	65	35	50	55	49	66	55	54	99	120	110	110	120	114
	Magnesium	37	40	28	82	91	48	140	140	120	160	140	132	160	190	180	170	180	178
	Sodium	250	260	200	170	180	120	190	170	150	200	160	164	480	600	550	540	580	517
	Potassium	4.3	4.3	3.4	5.1	5.6	3.6	4.9	4.5	3.6	6.2	4.6	4.0	6.6	8.3	8.2	7.2	8.2	7.0
Major Anions (mg/L)	Sulphate	140	190	140	71	94	42	45	50	40	39	40	40	590	630	600	520	560	561
	Chloride	340	460	390	400	430	230	360	340	440	190	250	295	490	640	520	1200	560	708
	Bicarbonate Alkalinity (as CaCO3)	250	220	170	390	320	210	720	660	580	710	690	655	1100	960	660	1000	980	856
	Carbonate Alkalinity (as CaCO3)	< 10	< 10	< 10	26	18	< 10	< 10	< 10	< 10	< 10	< 10	<1	< 10	< 10	< 10	< 10	< 10	<1
	Hydroxide Alkalinity (as CaCO3)	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	<1	< 20	< 20	< 20	< 20	< 20	<1
	Total Alkalinity (as CaCO3)	260	220	170	420	340	210	720	660	580	710	690	655	1100	960	660	1000	980	856
Heavy Metals (Dissolved) (mg/L)	Aluminium	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.01	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.01
	Arsenic	0.002	0.003	0.002	< 0.001	0.002	< 0.001	0.002	0.002	0.002	0.002	0.002	0.002	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001
	Boron	0.400	0.320	0.370	0.220	0.190	0.190	0.200	0.170	0.220	0.240	0.190	0.220	0.150	0.130	< 0.05	0.200	0.150	0.130
	Cadmium	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	<0.0001	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	<0.0001
	Chromium	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.002	< 0.001	0.002	< 0.001	<0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001
	Cobalt	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.006
	Copper	< 0.001	0.001	< 0.001	0.004	0.007	< 0.001	0.004	0.003	0.008	0.004	0.003	0.011	0.002	0.001	< 0.001	< 0.001	< 0.001	0.007
	Iron	0.060	0.070	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.05	1.300	0.980	0.800	2.300	1.200	0.190
	Lead	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	0.003	0.002	0.001	0.015	< 0.001	< 0.001	0.001	< 0.001	< 0.001	0.002
	Manganese	0.200	0.160	0.180	0.950	0.520	0.600	< 0.005	< 0.005	0.008	< 0.005	0.012	0.057	0.140	0.110	0.100	0.170	0.120	0.193
	Mercury	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	<0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	<0.0001
	Nickel	0.002	0.002	0.001	0.009	0.012	0.190	0.015	0.003	0.840	0.004	0.016	0.004	0.006	0.003	0.004	0.028	0.040	0.002
	Silver	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	<0.001	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	<0.001
	Vanadium	< 0.005	< 0.005	< 0.005	0.016	0.018	< 0.005	0.014	0.017	0.018	0.023	0.019	0.020	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	<0.01
	Zinc	0.008	0.006	0.007	0.016	0.035	0.008	0.016	0.015	0.042	0.012	0.012	0.022	0.019	0.014	0.010	0.020	0.017	0.013
Nutrients (mg/L)	Nitrate (as N)	< 0.02	< 0.02	< 0.02	3.60	4.70	3.50	4.00	4.80	6.70	3.70	-	-	< 0.02	< 0.02	< 0.02	< 0.02	-	-
	Nitrite (as N)	< 0.02	< 0.02	< 0.02	1.50	1.10	< 0.02	< 0.02	< 0.02	< 0.02	-	-	-	< 0.02	< 0.02	< 0.02	-	-	-
	Ammonia (as N)	0.09	0.09	0.09	< 0.01	< 0.01	0.12	< 0.01	< 0.01	0.02	< 0.01	-	-	< 0.01	< 0.01	< 0.01	< 0.01	-	-
	Total Kjeldahl Nitrogen (as N)*	< 0.2	< 0.2	0.30	< 0.2	< 0.2	1.70	< 0.2	< 0.2	1.20	-	-	-	< 0.2	< 0.2	< 0.2	-	-	-
	Total Nitrogen (as N)	< 0.2	< 0.2	0.30	5.00	5.80	5.20	4.00	4.80	8.00	-	-	-	< 0.2	< 0.2	< 0.2	-	-	-
	Phosphate total (as P)	0.13	0.05	0.08	0.05	< 0.05	0.03	0.04	< 0.05	0.02	-	-	-	0.05	0.13	< 0.05	-	-	-
Others	TDS	910	970	1000	910	960	740	980	1000	1100	970	1100	934	2200	2200	2500	2300	2200	2420
	Electrical Conductivity (Lab)	1900	1500	1600	2000	1500	1200	2100	1600	1800	1900	1900	2070	4200	3300	3900	3700	3600	4230
	Total Organic Carbon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

* - TOC was measured from water collected in a clear p

Table B3
Baseline Analytical Data Summary - June 2018 to April 2021

Bore ID	Analytes	GAM16	GAM16	GAM16	GAM16	GAM16	GAM16	GAM100	GAM100	GAM100	GAM100	GAM100	GAM100	GAM101	GAM101	GAM101	GAM101	GAM101	GAM101
Sample Collection Date		14-Apr-21	17-Sep-20	19-Mar-20	13-Nov-19	24-Jul-19	08-Jun-18	14-Apr-21	17-Sep-20	19-Mar-20	13-Nov-19	24-Jul-19	08-Jun-18	12-Apr-21	15-Sep-20	16-Mar-20	12-Nov-19	25-Jul-19	08-Jun-18
Major Cations (mg/L)	Calcium	200	210	180	200	200	161	9.9	19	13	12	12	13	31	51	51	38	39	16
	Magnesium	420	550	410	440	440	339	68	130	67	78	71	67	110	130	130	110	120	38
	Sodium	460	590	430	460	470	399	1500	1800	1300	1500	1500	1380	1500	2100	1800	1700	1800	1440
	Potassium	16	18	15	17	18	12	28	52	19	24	27	24	20	22	20	18	20	17
Major Anions (mg/L)	Sulphate	200	300	190	190	180	160	460	580	470	450	390	419	610	750	660	640	650	584
	Chloride	2300	2800	2100	2600	1700	1420	1300	1600	1400	1400	1100	1060	1600	1900	1600	1700	1400	1420
	Bicarbonate Alkalinity (as CaCO3)	630	620	580	540	630	620	1600	1400	1100	1600	1500	1530	1600	1200	1100	1500	1400	704
	Carbonate Alkalinity (as CaCO3)	< 10	< 10	< 10	< 10	< 10	<1	< 10	< 10	< 10	< 10	< 10	<1	< 10	51	< 10	< 10	< 10	167
	Hydroxide Alkalinity (as CaCO3)	< 20	< 20	< 20	< 20	< 20	<1	< 20	< 20	< 20	< 20	< 20	<1	< 20	< 20	< 20	< 20	< 20	<1
	Total Alkalinity (as CaCO3)	630	620	580	540	630	620	1600	1400	1100	1600	1500	1530	1700	1300	1100	1500	1400	871
Heavy Metals (Dissolved) (mg/L)	Aluminium	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.01	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.01	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.080
	Arsenic	< 0.001	0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001	0.002	< 0.001	< 0.001	0.001	0.001	0.002	0.003	0.001	0.002	0.002	0.012
	Boron	0.200	0.160	0.220	0.230	0.190	0.180	0.130	0.120	0.150	0.160	0.110	0.140	0.140	0.140	< 0.05	0.170	0.150	0.070
	Cadmium	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	<0.0001	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	<0.0001	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	<0.0001
	Chromium	0.004	0.003	0.001	0.003	0.001	0.002	< 0.001	0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.009
	Cobalt	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	0.006	0.007	0.007	0.007	0.008	0.010	< 0.001	0.002	< 0.001	< 0.001	< 0.001	<0.001
	Copper	0.003	0.004	0.005	0.005	0.003	0.007	< 0.001	0.003	< 0.001	< 0.001	0.005	0.007	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.008
	Iron	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.05	0.060	0.060	0.100	< 0.05	< 0.05	<0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.05
	Lead	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001
	Manganese	< 0.005	0.007	< 0.005	0.006	< 0.005	0.002	0.540	0.540	0.630	0.640	0.270	0.652	0.200	0.250	0.037	0.180	0.150	0.039
	Mercury	< 0.0001	< 0.0001	< 0.0001	0.0001	< 0.0001	<0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	<0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	<0.0001
	Nickel	0.016	0.047	0.027	0.023	0.019	0.002	0.006	0.014	0.005	0.008	0.014	0.012	0.003	0.002	0.001	0.020	0.003	0.002
	Silver	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	<0.001	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	<0.001	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	<0.001
	Vanadium	< 0.005	0.007	< 0.005	0.007	0.005	<0.01	< 0.005	0.011	< 0.005	< 0.005	0.049	0.020	< 0.005	0.008	< 0.005	< 0.005	0.006	0.020
	Zinc	0.016	0.023	0.029	0.022	0.025	0.007	0.005	0.020	0.008	< 0.005	0.015	0.009	0.007	0.007	< 0.005	< 0.005	< 0.005	0.006
Nutrients (mg/L)	Nitrate (as N)	0.26	0.25	0.26	0.22	-	-	< 0.02	< 0.02	< 0.02	< 0.02	-	-	< 0.02	< 0.02	< 0.02	< 0.02	-	-
	Nitrite (as N)	< 0.02	< 0.02	< 0.02	-	-	-	< 0.02	< 0.02	< 0.02	-	-	-	< 0.02	< 0.02	< 0.02	-	-	-
	Ammonia (as N)	< 0.01	< 0.01	< 0.01	< 0.01	-	-	< 0.01	0.02	< 0.01	< 0.01	-	-	< 0.01	< 0.01	0.31	< 0.01	-	-
	Total Kjeldahl Nitrogen (as N)*	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	0.30	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	-	-	-
	Total Nitrogen (as N)	0.27	0.25	0.30	-	-	-	< 0.2	0.30	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	-	-	-
	Phosphate total (as P)	0.04	< 0.05	0.03	-	-	-	0.03	< 0.05	0.02	-	-	-	0.09	0.19	0.22	-	-	-
Others	TDS	4200	4000	4700	3000	3000	3540	3900	4600	4800	3800	3600	3980	1000	4600	2200	4200	3900	4080
	Electrical Conductivity (Lab)	6800	5800	6000	5800	5800	5430	7900	6300	6700	6400	6400	6320	8500	6900	8100	7300	7600	6910
	Total Organic Carbon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

lastic unpreserved container. The recommended container is a glass amber bottle (to minimise UV light exposure).

Table B3
Baseline Analytical Data Summary - June 2018 to April 2021

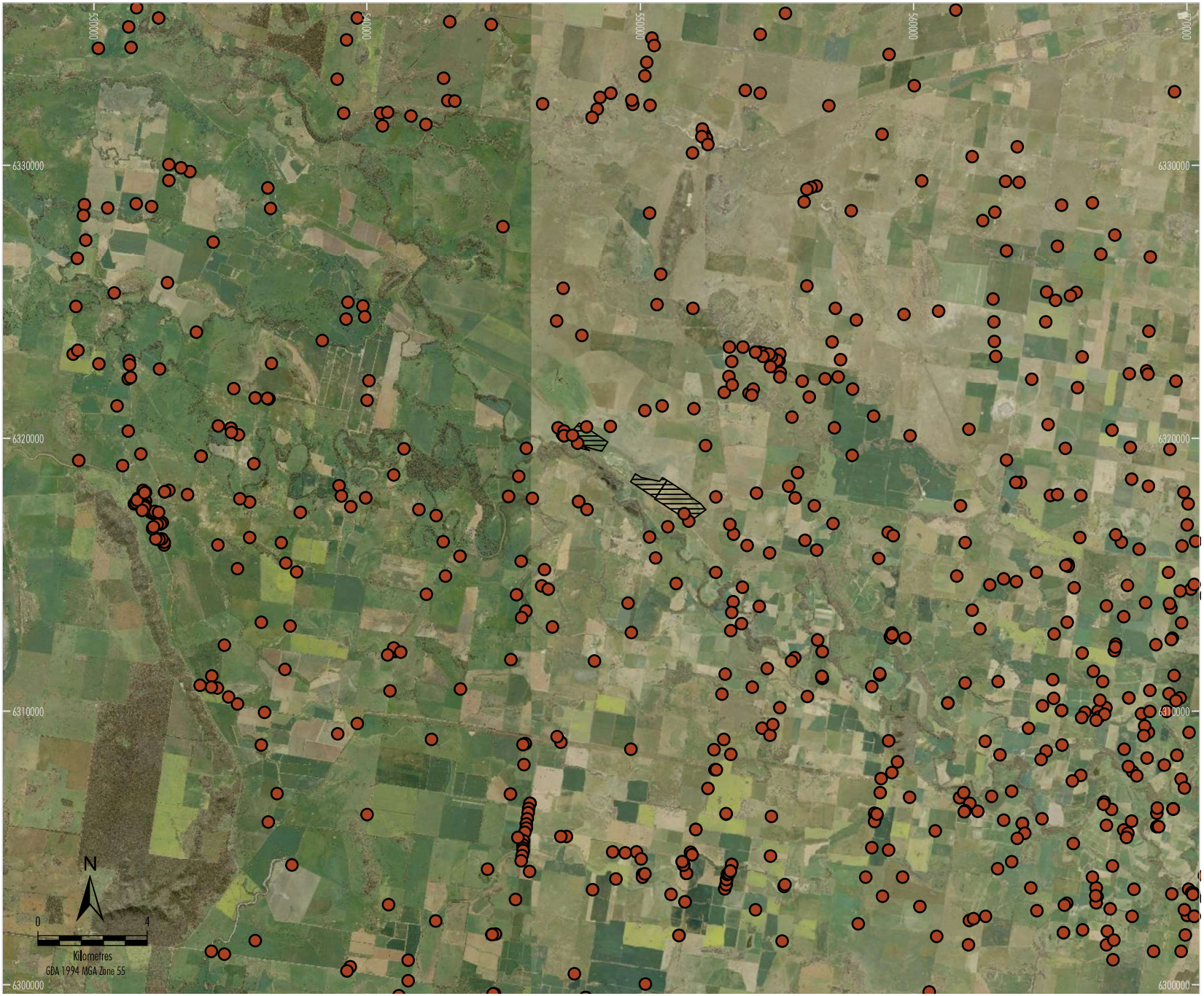
Bore ID	Analytes	ANDERSONS PIT	ANDERSONS PIT	ANDERSONS PIT	ANDERSONS PIT	ANDERSONS PIT	ANDERSONS PIT	ISMW01	ISMW01	ISMW01						
Sample Collection Date		14-Apr-21	22-Sep-20	17-Mar-20	13-Nov-19	28-Jul-19	07-Jun-18	16-Apr-21	30-Sep-20	10-Feb-20						
Major Cations (mg/L)	Calcium	6.1	3.6	2.6	2.7	2.3	4	26	30	25						
	Magnesium	6.6	7.5	9.4	8.6	7.7	8	25	28	23						
	Sodium	4.2	7.1	13	9.9	11	10	200	230	180						
	Potassium	8.5	10	14	13	8.3	6	2.8	3.2	< 5						
Major Anions (mg/L)	Sulphate	< 5	2.1	< 2	< 5	< 5	<1	67	130	63						
	Chloride	6.4	11	9.8	54	22	6	250	400	290						
	Bicarbonate Alkalinity (as CaCO3)	46	53	74	74	53	65	190	190	240						
	Carbonate Alkalinity (as CaCO3)	< 10	< 10	< 10	< 10	< 10	<1	< 10	< 10	< 10						
	Hydroxide Alkalinity (as CaCO3)	< 20	< 20	< 20	< 20	< 20	<1	< 20	< 20	< 20						
	Total Alkalinity (as CaCO3)	46	53	74	74	53	65	190	190	240						
Heavy Metals (Dissolved) (mg/L)	Aluminium	0.100	0.120	< 0.05	< 0.05	0.080	0.200	< 0.05	< 0.05	< 0.05						
	Arsenic	< 0.001	< 0.001	0.002	< 0.001	< 0.001	<0.001	< 0.001	< 0.001	< 0.001						
	Boron	< 0.05	0.060	< 0.05	0.120	0.060	<0.05	0.080	0.060	< 0.05						
	Cadmium	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	<0.0001	< 0.0002	< 0.0002	< 0.0002						
	Chromium	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001						
	Cobalt	0.002	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001	< 0.001	< 0.001						
	Copper	0.002	0.003	0.002	0.005	< 0.001	0.001	< 0.001	< 0.001	0.001						
	Iron	0.580	0.600	0.300	0.140	0.130	0.720	0.630	0.560	0.970						
	Lead	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001	< 0.001	< 0.001						
	Manganese	0.170	0.015	0.008	0.007	< 0.005	0.028	0.044	0.046	0.048						
	Mercury	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	<0.0001	< 0.0001	< 0.0001	< 0.0001						
	Nickel	0.002	0.002	0.002	0.001	< 0.001	0.002	0.003	0.004	0.001						
	Silver	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	<0.001	< 0.005	< 0.005	< 0.005						
	Vanadium	< 0.005	< 0.005	0.009	< 0.005	< 0.005	<0.01	< 0.005	< 0.005	< 0.005						
	Zinc	0.006	< 0.005	< 0.005	< 0.005	< 0.005	<0.005	0.006	0.014	< 0.005						
Nutrients (mg/L)	Nitrate (as N)	-	< 0.02	< 0.02	< 0.02	0.03	<0.01	< 0.02	< 0.02	< 0.02						
	Nitrite (as N)	-	< 0.02	< 0.02	< 0.02	< 0.02	<0.01	< 0.02	< 0.02	< 0.02						
	Ammonia (as N)	-	0.07	0.07	0.06	0.28	0.16	0.04	0.04	0.01						
	Total Kjeldahl Nitrogen (as N)*	-	1.00	2.30	0.80	0.90	0.70	< 0.2	< 0.2	< 0.2						
	Total Nitrogen (as N)	-	1.00	2.30	0.80	0.90	0.70	< 0.2	< 0.2	< 0.2						
	Phosphate total (as P)	-	< 0.05	< 0.05	0.02	0.02	<0.01	< 0.05	< 0.05	0.03						
Others	TDS	85	94	230	77	88	81	730	810	690						
	Electrical Conductivity (Lab)	110	110	180	160	140	140	1300	1200	1200						
	Total Organic Carbon	-	-	-	-	-	-	< 5	6.8	< 5						

Table B3
Baseline Analytical Data Summary - June 2018 to April 2021

Bore ID	Analytes	ISMW02	ISMW02	ISMW02	ISPB01	ISPB01	ISPB01	ISPB01	ISPB01	ISPB01	MWE1	MWE1	MWE1	MWW1	MWW1	MWW1	LACHLAN	LACHLAN	LACHLAN	LACHLAN	LACHLAN	LACHLAN
Sample Collection Date		16-Apr-21	30-Sep-20	10-Feb-20	16-Apr-21	30-Sep-20	17-Mar-20	14-Nov-19	15-Aug-17	19-Aug-06	16-Apr-21	30-Sep-20	10-Feb-20	16-Apr-21	30-Sep-20	10-Feb-20	16-Apr-21	30-Sep-20	17-Mar-20	14-Nov-19	26-Jul-19	15-Aug-17
Major Cations (mg/L)	Calcium	29	28	26	23	25	24	25	24	24	13	14	12	46	38	28	29	47	30	18	18	24
	Magnesium	24	23	22	22	22	24	23	21	22	13	14	11	32	27	23	19	29	20	15	16	17
	Sodium	190	190	170	190	190	200	190	188	188	33	36	31	96	87	69	39	61	36	31	33	35
	Potassium	3.2	3	2	2.8	2.9	2.9	3	3	3	1.7	1.7	0.7	2.1	2.2	1.1	7.5	4.5	9.6	3.5	3.1	2
Major Anions (mg/L)	Sulphate	54	100	57	54	95	71	69	52	67	8.2	18	6.8	59	51	41	19	72	38	19	17	26
	Chloride	260	380	370	220	320	260	770	235	240	27	61	25	170	130	100	63	190	80	110	77	61
	Bicarbonate Alkalinity (as CaCO3)	170	190	170	200	180	150	210	193	206	110	100	140	140	150	170	98	140	99	100	90	93
	Carbonate Alkalinity (as CaCO3)	< 10	< 10	< 10	< 10	< 10	< 10	< 10	<1	<1	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	<1
	Hydroxide Alkalinity (as CaCO3)	< 20	< 20	< 20	< 20	< 20	< 20	< 20	<1	<1	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	<1
	Total Alkalinity (as CaCO3)	170	190	170	200	180	150	210	193	206	110	100	140	140	150	170	98	140	99	100	90	93
Heavy Metals (Dissolved) (mg/L)	Aluminium	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.030	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.110	< 0.05	< 0.05	< 0.05	0.060	1.250
	Arsenic	0.001	0.001	0.002	< 0.001	< 0.001	0.001	< 0.001	< 0.001	-	< 0.001	< 0.001	< 0.001	0.004	0.003	0.002	0.002	< 0.001	0.002	< 0.001	< 0.001	0.001
	Boron	0.070	< 0.05	< 0.05	0.090	< 0.05	< 0.05	0.070	0.070	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.05
	Cadmium	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	<0.0001	-	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	<0.001
	Chromium	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002
	Cobalt	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	-	< 0.001	< 0.001	< 0.001	0.006	0.005	0.003	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001
	Copper	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001	0.002	0.002	0.002	0.003	< 0.001	0.003
	Iron	0.600	0.490	0.480	0.870	0.660	0.760	0.970	0.920	-	< 0.05	< 0.05	< 0.05	7.500	4.000	2.600	0.320	< 0.05	0.100	< 0.05	0.050	1.920
	Lead	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001
	Manganese	0.038	0.037	0.036	0.051	0.045	0.048	0.050	0.051	0.042	< 0.005	< 0.005	< 0.005	0.780	0.550	0.330	0.026	0.009	0.013	0.007	0.007	0.070
	Mercury	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	-	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	<0.0001
	Nickel	0.004	0.004	0.002	< 0.001	< 0.001	< 0.001	0.001	< 0.001	-	0.008	0.007	0.006	0.007	0.008	0.004	0.002	0.001	0.002	< 0.001	< 0.001	0.002
	Silver	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.001	-	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	<0.001
	Vanadium	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	<0.010	-	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.007	< 0.005	< 0.005	<0.01
	Zinc	0.005	0.012	< 0.005	0.013	< 0.005	0.006	< 0.005	< 0.005	-	0.010	0.019	< 0.005	0.017	0.024	0.016	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	<0.005
Nutrients (mg/L)	Nitrate (as N)	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	<0.01	<0.01	0.16	0.05	< 0.2	0.02	< 0.02	< 0.02	0.22	< 0.02	0.97	< 0.02	0.19	0.42
	Nitrite (as N)	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	-	<0.01	<0.01	< 0.02	< 0.02	< 0.2	< 0.02	< 0.02	0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	<0.01
	Ammonia (as N)	0.03	0.03	0.01	0.04	0.04	0.04	0.08	0.06	-	< 0.01	< 0.01	0.02	0.07	0.06	0.05	0.03	< 0.01	0.05	< 0.01	< 0.01	0.04
	Total Kjeldahl Nitrogen (as N)*	< 0.2	< 0.2	< 0.2	< 0.2	0.50	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	0.40	0.50	0.50	0.40	-
	Total Nitrogen (as N)	< 0.2	< 0.2	< 0.2	< 0.2	0.50	< 0.2	-	-	-	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 0.2	0.22	0.40	1.50	0.50	0.59	-
	Phosphate total (as P)	< 0.05	< 0.05	0.05	< 0.05	< 0.05	< 0.05	-	-	-	< 0.05	< 0.05	0.03	0.06	8.80	< 0.01	< 0.05	< 0.05	< 0.05	0.02	0.03	0.06#
Others	TDS	660	570	620	620	610	750	640	669	-	210	170	250	560	-	370	290	400	430	170	210	262
	Electrical Conductivity (Lab)	1100	1000	1000	1100	1000	1300	1200	1350	1280	290	270	290	890	770	650	430	610	510	360	360	4884
	Total Organic Carbon	< 5	5.8	< 5	< 5	6.7	< 5	< 5	-	-	< 5	5.5	< 5	5.7	7.8	< 5	14	11	15	6.5	5.1*	-

ATTACHMENT 2

BORE CENSUS (2018) AND REGISTERED BORE (2019) RECORDS FOR BOREFIELD AND SURROUNDS



LEGEND

Registered NSW PINNEENA Groundwater Bore

Potential Project Borefield Location

Source: NSW Department of Primary Industries, Office of Water (2014)
Ortho: NSW Department of Finance, Services and Innovation (2017)

sunrise energy metals

SUNRISE PROJECT

Registered Bore (PINNEENA) Records for Borefield and Surrounds

CTL-16-02_BC_Pinneena_Records_201A