Government of Western Australia
Department of Water and Environmental Regulation

Amendment Report

Application for Licence Amendment

Part V Division 3 of the *Environmental Protection Act 1986*

Licence Number	L5258/1991/11
Licence Holder	Pilbara Iron Company (Services) Pty Ltd
ACN	107 210 248
File Number	APP-0027371
Premises	Mt Brockman, Nammuldi and Silvergrass Iron Ore Mines AML70/4, ALM70/272, G47/01242, G47/01243, G47/1269, L47/139, L47/140, L47/141, L47/152, L47/160, L47/647, L47/786, LG848907 and LPL N050438 As defined by the coordinates in Schedule 2 of the revised licence MT SHEILA WA 6751
Date of Report	**19/02/2026 (FINAL)**
Decision	Revised licence granted

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1. Decision summary

Licence L5258/1991/11 is held by Pilbara Iron Company (Services) Pty Ltd (licence holder) for the Mt Brockman, Nammuldi and Silvergrass Iron Ore Mines (the premises), located approximately 60 km north-west of Tom Price, Western Australia.

This amendment report documents the assessment of potential risks to the environment and public health from proposed changes to the emissions and discharges during the operation of the premises. As a result of this assessment, revised licence L5258/1991/11 has been granted.

2. Scope of assessment

2.1 Regulatory framework

In completing the assessment documented in this amendment report, the department has considered and given due regard to its regulatory framework and relevant policy documents which are available at https://dwer.wa.gov.au/regulatory-documents.

2.2 Amendment summary

On 4 February 2025, the licence holder submitted an application to the department to amend licence L5258/1991/11 under section 59 and 59B of the *Environmental Protection Act 1986* (EP Act). The following amendments are being sought:

- Amend the premises details to remove LGE G848898 which has been replaced by General Purpose Lease G47/1269 and Miscellaneous Licence L47/786;
- Update Schedule 1, Figure 7 to include the reinjection bores as licensed discharge points to allow for a Managed Aquifer Recharge (MAR) scheme;
- Update Schedule 1, Figure 1 to expand the prescribed premises boundary to include the MAR scheme;
- Update Schedule 1, Figure 8 to accurately show the location of the licensed putrescible landfill; and
- Include Category 57 for the storage of up to 5,000 used tyres on the premises at any one time.

2.3 Legislative context

2.3.1 Part IV of the EP Act

In 1991 the Environmental Protection Authority (EPA) assessed Hamersley Iron Pty Limited's proposal for the Brockman No. 2 Detrital Iron Ore Mine at the level of a Consultative Environmental Review (CER). Environmental approval to implement the proposal was issued by the Minister for Environment on 17 April 1991 subject to Ministerial Statement (MS) 131. This mine commenced operations in 1992.

As part of a staged approach to the development of Marra Mamba deposits in the area, in 1998 Hamersley Iron Pty Limited referred to the EPA a proposal for a trial mining operation in the Nammuldi area, adjacent to the Brockman No. 2 mine. Due to the relatively small scale of this operation and a number of commitments given by the proponent, the EPA set the level of assessment at "Informal Review with Public Advice".

In September 1998 Hamersley Iron Pty Limited referred a proposal to the EPA for the next stage of development. The level of assessment was set at CER based on the size of the area to be affected (approximately 2,000 hectares (ha)) and the fact that much of the orebody was below the water table. The Nammuldi-Silvergrass Iron Ore Project was approved in November 2000 subject to the requirements of MS 558.

The EPA assessed a proposal to increase the scale of the mining operations at a level of Public Environmental Review in August 2010. MS 925 was granted on 11 January 2013 and superseded MS 558.

A significant amendment to the approved proposal was referred to the EPA in July 2019. The proposal included the extension and development of new above and below group water table deposits and associated activities to extend the life of the mining operations. The proposal included the amalgamation of Brockman Syncline 2 (authorised under MS 131 and MS 867), Brockman Syncline 4 (authorised under MS 1000) and Nammuldi-Silvergrass (authorised under MS 925) into a single approval. On 3 February 2025, MS 1246 was granted superseding MS 131, MS 867, MS 925 and MS 1000.

An Environmental Monitoring and Management Plan (EMMP) was submitted in March 2022 to meet the requirements of MS 925. The purpose of the EMMP is to manage potential impacts and protect groundwater dependent including vegetation, semi-permanent and permanent pools, and conservation of the aquatic fauna of Duck and Caves Creek. Version 3 of the EMMP was submitted on 7 February 2025 and is currently under assessment by EPA Services.

EPA Services wrote to the proponent requesting amendments to the EMMP and proposed several options for the inclusion of the MAR scheme, including via a Section 45C amendment to the approved proposal (subject to the provision of information that supports the implementation of the MAR would not result in significant impacts) or a Section 43A amendment to the Brockman Syncline Proposal that was under assessment. In response, the proponent advised that it considered that the EMMP is an appropriate pathway to approve the MAR scheme, and that the MAR does not form part of the Brockman Syncline Proposal and a Section 45C for MS 925 was not required. As a result, the MAR scheme has not been assessed or approved under Part IV of the EP Act.

Key findings:

The delegated officer considers that the MAR scheme can be regulated under licence L5258/1991/11 without duplicating or contradicting the condition of MS 1246.

2.3.2 Part V Division 2 of the EP Act (clearing)

Clearing for the proposed MAR scheme was granted on 18 April 2024 and is authorised under clearing permit CPS 9985/1. CPS 9985/1 allows for the clearing of no more than 30 ha of native vegetation for the purposes of establishing and operating a MAR scheme, fauna and flora monitoring access, groundwater and hydrogeological monitoring access, infrastructure access and Aboriginal heritage survey/access.

2.3.3 *Rights in Water and Irrigation Act 1914*

Groundwater licence GWL107421(26) allows for the abstraction of 55,000,000 kilolitres (kL) of water per annum for the purposes of dust suppression, earthworks, construction, exploratory drilling, general campsite use, mineral ore processing, mine dewatering, maintenance, potable water and other mining purposes.

Groundwater abstraction and quality is managed under the licence and the associated Brockman 2/Nammuldi and Silvergrass East Operations Groundwater Operating Strategy (GWOS).

An application to amend the groundwater licence to update the terms, conditions, and restrictions of the GWL to reference the revised GWOS and add the reinjection of groundwater as an authorised water use was submitted to the department on 16 January 2024. The department is still assessing the amendment application.

Approval to construct the reinjection bores was given by the department on 13 September 2024 authorised under CAW210842 and CAW210843.

2.3.4 *Mining Act 1978* (WA)

The Department of Mines, Petroleum and Exploration (DMPE, formally the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS)) approved a mining proposal (Registration ID: 38119) to authorise the operation of infrastructure and ancillary activities supporting the mining operation.

General Purpose Lease G47/1242, G47/1269 and G47/1243, Miscellaneous Licences L47/139, L47/159, L47/160, L47/178, L47/674, L47/855, L47/786 and Mining Lease 47/369, 47/370, 47/371 and 47/3 exist over the premises.

2.3.5 *Iron Ore (Hamersley Range) Agreement Act 1963*

The premises is subject to the *Iron Ore (Hamersley Range) Agreement Act 1963* (IO (HR) Act). The IO (HR) Act is a State Agreement between Hamersley Iron Pty Ltd and the State of Western Australia. The State Agreement allows for Hamersley Iron Pty Ltd and its related entities to develop and operate iron ore mines in the prescribed area through the granting of special leases.

State Agreement Mineral Leases 4SA and 272SA exist over the premises.

2.3.6 *Land Administration Act 1997* (WA)

The premises is subject to the Land Administration Act Lease G848907 granted under Sections 47 and 48 of the *Land Administration Act 1997.*

2.3.7 *Environment Protection and Biodiversity Conservation Act 1999*

A recent proposal to expand the existing operations was determined under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) to be a controlled action. The proposal was assessed by accredited assessment under the EP Act. Notification of approval decision was published on 6 March 2025 (EPBC Reference 2019/8518).

3. Amendment overview

3.1 Administrative amendments

As part of the amendment application, the licence holder has requested a number of administrative amendments to the licence as outlined in Sections 3.1.1 and 3.1.2.

3.1.1 Premises details

The licence holder has requested to remove LGE G848898 from the premises description and replace with General Purpose Lease G47/1269 and Miscellaneous Licence L47/786.

3.1.2 Putrescible landfill location

The licence holder has requested to update Figure 8 of the licence. Figure 8 incorrectly identifies the historical putrescible landfill as the location of the current putrescible landfill. An updated figure was provided as part of the application package.

Key findings:

The delegated officer considers proposed amendments outlined in Section 3.1 as administrative in nature and has excluded them from the risk assessment.

3.2 Category 57: Used tyre storage

On 28 August 2024, Environmental Officers from the department's Assurance Directorate (previously the Compliance and Enforcement Directorate) conducted a compliance inspection at the Yandicoogina Iron Ore Mine (Licence L7340/1997/9). During the inspection, Assurance Officer's noted that greater than 100 used tyres were being stored on the premises and informed the licence holder that Category 57: Used tyre storage is required to be included on all licences where greater than 100 used tyres are being stored on the associated premises.

As a result of the inspection, the licence holder has applied to add Category 57: Used tyre storage to the licence to allow for the storage of up to 5,000 used tyres on the premises at any one time.

The licence holder notes that tyres will be stored in accordance with *Guidance Note: GN02 Bulk Storage of Rubber Tyres Including Shredded and Crumbed Tyres* (DFES 2020).

3.3 Aquifer recharge reinjection scheme

3.3.1 Background

Dewatering at the Silvergrass East (SGE) Mine Operations commenced in 2016 and since commencing, dewatering impacts have been more extensive than originally conceptualised due to greater connection between the shallow aquifers and deeper fractured rock aquifer than originally theorised. Dewatering is drawing down groundwater levels beneath Narraminju (Caves Creek) and has affected the Jerithikunha (Cockle Spring) semi-permanent pool and potentially the Karingkulanha (Pancake Spring) permanent pool. Updated modelling suggests that Mallumallu (Palm Spring) will be impacted in 2029 unless those impacts are mitigated. As an interim mitigation measure, dewatering at SGE was paused in January 2024.

The proposed management strategy to support the future recommencement of below water table mining is to conduct managed aquifer reinjection at a site adjacent to Caves Creek targeting both the shallow and deeper fractured rock aquifers (herein referred to as the MAR scheme).

A figure showing the location of the proposed MAR scheme is shown in Figure 1 below.

Key findings:

1. Dewatering at the SGE Mine Operations is causing impacts to environmentally and culturally important receptors.
2. Pausing dewatering has prevented further drawdown impacts from occurring.
3. The licence holder intends to continue below water table mining at SGE and proposes to use aquifer reinjection to prevent further drawdown impacts to receptors and restore natural hydrogeological processes.

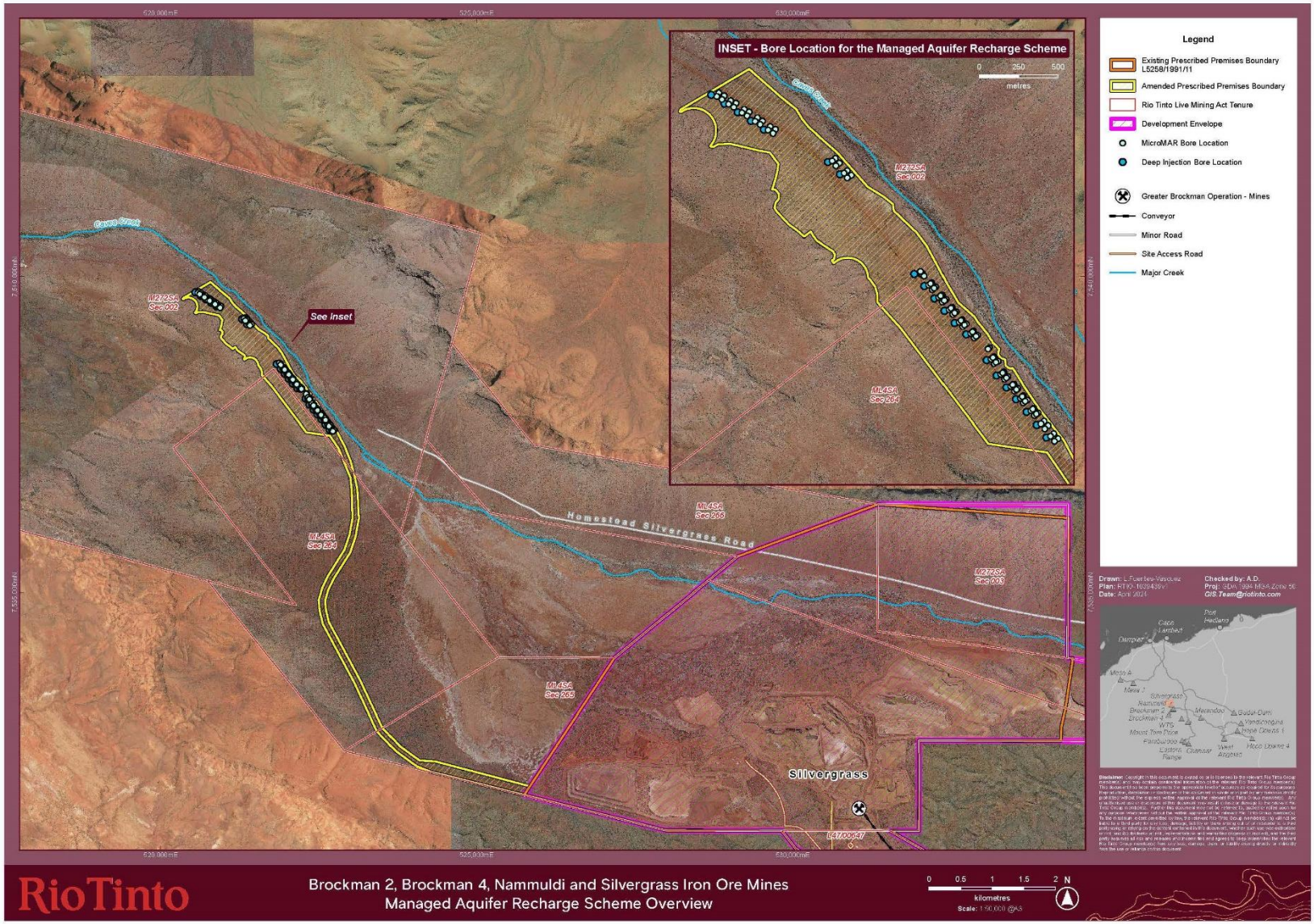

Figure 1: Location of proposed MAR scheme

Licence: L5258/1991/11

3.3.2 Detailed design and process

The MAR scheme proposes to use dewatering water abstracted from production bores at the SGE Mine Operations which will be transferred via the dewatering header pipeline to the MAR offtake. From the offtake, water will be conveyed to the proposed booster and filter pump station where it will pass through a pre-filter pump, screen filter and booster pump.

Backwash from the screen filters will be sent to a sedimentation pond for passive treatment via evaporation and infiltration. Solids/slurry from the screen filters will be transferred to a skip bin for removal.

The water will be dosed with sodium hypochlorite (to prevent biofouling on bore screens) at a treatment pad prior to the first reinjection pad. Free chlorine residuals will be monitored at the start and end of the MAR, with control of the dosing volumes to be based off a target free chlorine residual of 1 mg/L across the reinjection sites.

At the water treatment pad, dewatering water flows through a series of booster pumps which will allow for pressurisation of water. Water is then conveyed along the main 14 km long transfer pipeline to the reinjection bores. The pipeline is 650 mm in diameter and runs along a 2 to 5 m wide corridor parallel to an existing light vehicle access road. The pipeline includes specific provisions for air relief and scour operations. Rip rap is to be installed at each of the scour arrangements to prevent local ground erosion at each scour point. Additionally, the pipeline includes isolation valves at set intervals and leak detection in the form of flow meters (with leaks being detected when discrepancies between flow meters is identified).

The MAR scheme consists of a network of monitoring bores, shallow aquifer recharge bores and deep pressurisation recharge bores arranged on a series of recharge pads. Recharge pads will be designed to accommodate four shallow aquifer recharge bores, one deep pressurised recharge bore and monitoring bores each installed with a vibrating wire piezometer (VWP) to measure water level. Each pad will also include ancillary infrastructure including water source pipelines, backflush pipelines, headworks, control panels and generators to power the submersible pumps for backflushing.

3.3.3 Operation

The MAR scheme will initially operate under gravity, with gradual pressurisation of the deep injection wells as injection rates increase. Safe injection pressures have been calculated based on bore construction and site geology.

At regular intervals determined based on bore flow and pressure performance, the deep injection bores will perform a backflush cycle to clear the screens of any material buildup. Backflush water will be transferred via a pipeline to one of three sedimentation ponds where water will be disposed of via infiltration into the ground and evaporation. An overflow will be installed into the ponds, however, backflushing will be controlled in a manner that prevents excess water entering the ponds and causing an overflow event.

3.3.4 Aquifer reinjection water quality

Water for the MAR scheme will be sourced from 28 existing operational dewatering bores at SGE which primarily abstract groundwater from the deep fractured rock aquifer, specifically the Marra Mamba Formation (17 bores) and the Wittenoom Formation (six bores). Two of the bores abstract groundwater from the shallow Valley Fill Aquifer and the remaining 3 bores do not hold any data / aquifer type.

Water across the shallow and deep aquifers abstracted from the SGE dewatering bores is fresh to marginal with salinity in the form of Total Dissolved Solids ranging from 328 to 898 mg/L.

Aquifer reinjection water quality is discussed further in Section 5.3.2.

4. Siting and Location

4.1 Environmental siting

4.1.1 Climate and rainfall

The premises is located in the Central Pilbara region and is characterised as having a semi-arid to arid climate with hot summers between October and April and mild winters from May to September.

The Bureau of Meteorology (BoM) data for the nearest weather station, the Paraburdoo Aero weather station (Station no. 007185), located approximately 34 km east of the project, shows that the area in the vicinity of the premises has an average rainfall of 314.8 mm (based on data from 1974 to 2025), with the majority of the rainfall being between January and March. Rainfall averages are impacted by seasonal cyclones which affect the region between November and April.

The average maximum temperature is 33.7°C with January being the hottest month experiencing an average maximum temperature of 40.8°C and the average minimum temperature is 18.4 °C with July being the coldest month experiencing an average minimum temperature of 9.9°C. The monthly mean rainfall and maximum temperature is shown on Figure 2.

Future climate predictions for the Pilbara predict the mean annual temperature is set to increase by 0.6 – 1.4 °C compared to current conditions by 2030 and by 1.5 – 2.9°C by 2090 under intermediate emissions scenarios. Changes in rainfall show an increasing trend in summer rainfall with intermittent periods of wetter and drier conditions throughout the 20th century. The intensity of rainfall events is expected to increase with fewer but more intense tropical cyclones. Evapotranspiration is also expected to increase (DWER 2021c).

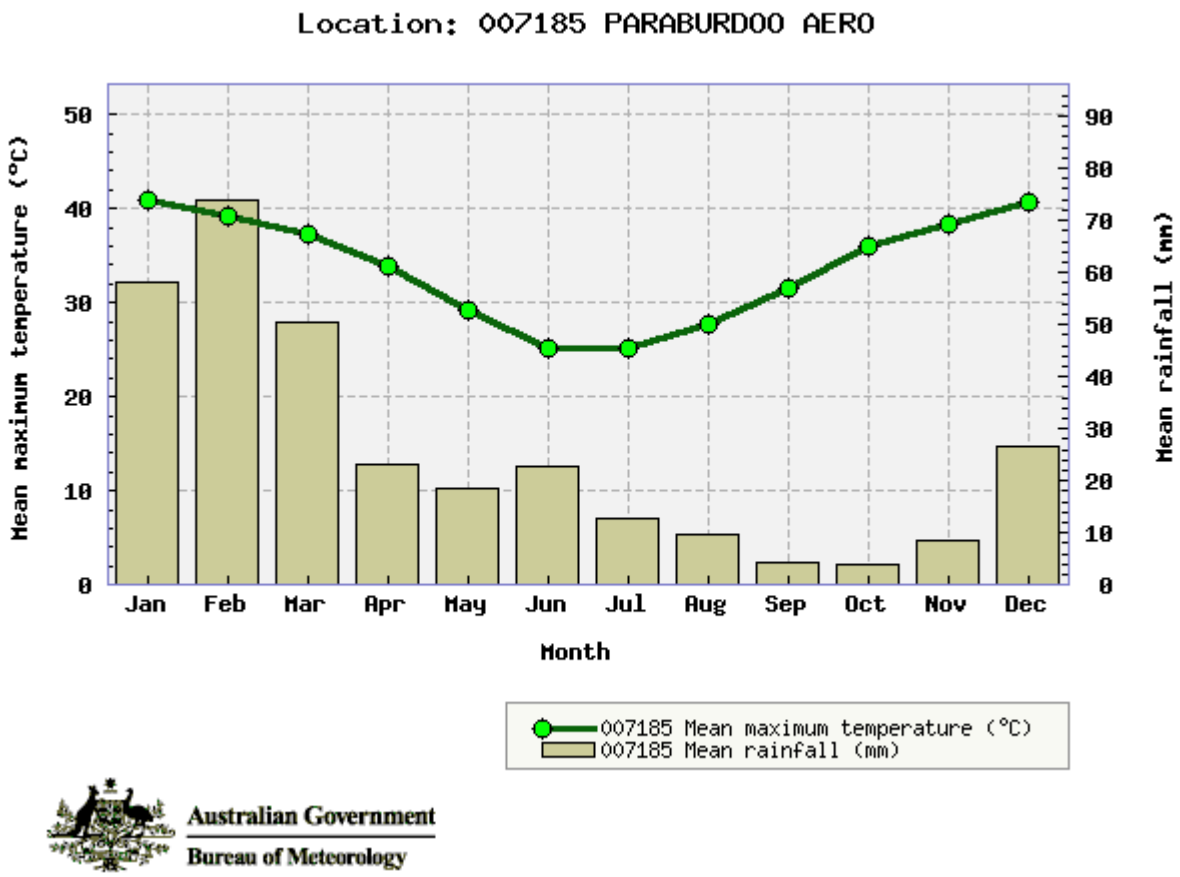

Figure 2: Rainfall and maximum temperature for Paraburdoo Aero (1974 - 2025) (Source: BoM Station No. 007185)

4.1.2 Hydrology

The MAR scheme is located adjacent to Caves Creek. Caves Creek is a major ephemeral watercourse that receives rainfall runoff from a number of ephemeral creeks and gullies. The system aligns with the Caves Creek Valley and extends from east to west across the greater SGE mining area.

Major expression of groundwater in the form of permanent and semi-permanent surface water features are located downstream of where the proposed MAR scheme is situated including Mallumallu (Palm Spring), Puntilanha (Shrek's Swamp), Jerithikunha (Cockle Spring) and Karingkulanha (Pancake Spring). These surface water expressions support a variety of aquatic and terrestrial groundwater dependent ecosystems.

Hydraulic connection exists between Caves Creek and both the shallow and deep groundwater aquifers based on similarities in the chemical composition. Carbon-14 tracer analysis shows upward hydraulic gradients and leakage of older groundwater occurs to the shallow Valley Fill Aquifer near Mallumallu (Palm Spring) (WSP 2024). Aquifer properties and the hydrogeology of the region is discussed further in Section 4.1.3.

4.1.3 Hydrogeology

The proposed MAR scheme area is underlain by a shallow unconfined aquifer consisting of valley fill and calcrete which sits above the unconfined to semi-unconfined freshwater fractured rock aquifer of the Marra Mamba Iron Formation. The aquifers are separated by a layer of shale and clay of varying thickness with some connection between the aquifers. An interpretation of a cross section of the regional hydrogeology is presented in Figure 3.

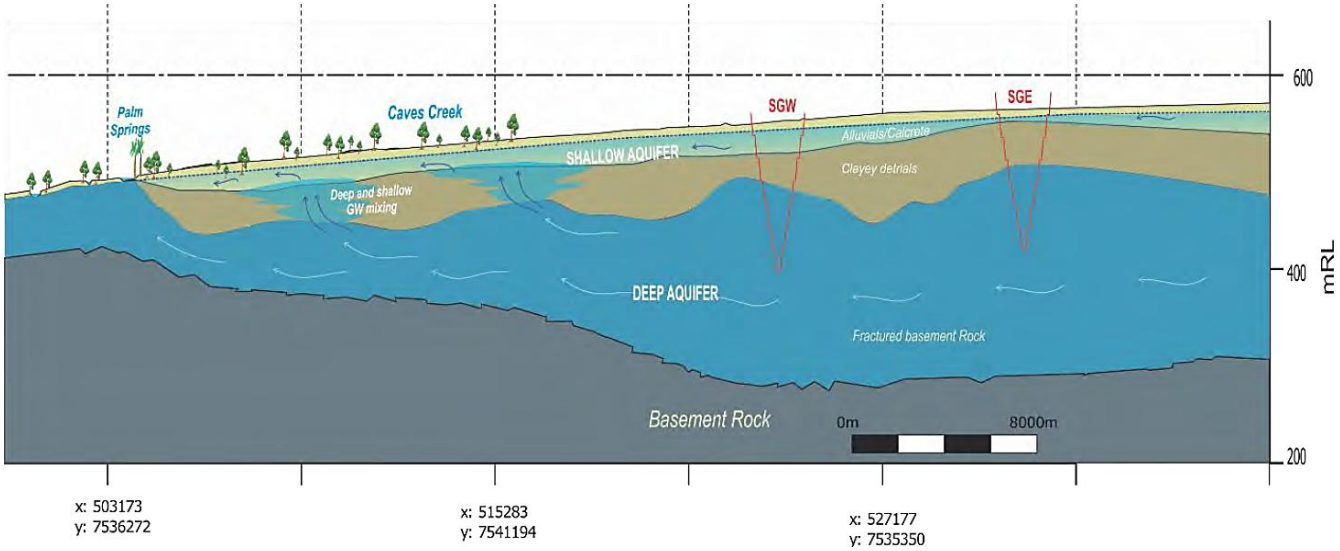

Figure 3: Regional hydrogeology of proposed project site (Source: WSP 2024)

The valley fill aquifer can be described as an unconsolidated sedimentary aquifer comprising of detritals (alluvial and colluvial sediments formed through weathering and erosion) with clays and interbedded sand and gravel lenses and/or cobbles (Johnson & Wright 2001). This aquifer has a saturated thickness varying between 15 and 30 m and is largely unconfined, however, may have areas that are confined or semi-confined due to layers of clay or other low permeability sediments within the sedimentary layers.

The calcrete aquifer has been chemically-deposited within tertiary drainages or palaeodrainages. The calcrete aquifer holds groundwater within secondary porosity networks within karst features, formed through the partial dissolution of the calcrete (Johnson & Wright 2001). The aquifer is unconfined with a thickness of approximately 15 m. This aquifer exists within weathered horizons within igneous units of the Fortescue Group and coincides with drainage channels.

The deep aquifer is comprised of fractured rock aquifers. Fractured rock aquifers hold groundwater within fractured or weathered zones within the rock that acts as conduits for water movement. There are three main types of fractured rock aquifers that exist in the region, dolomitic aquifers of the Wittenoom Formation in the West Angela Member which can contain high yielding fractured or cavernous zones which represent the primary target for groundwater supply in the region, Banded Iron Formation Aquifers in the Brockman and Marra Mamba Iron Formations in the Macleod and Mount Newman Members and the Hardey Sandstone aquifer comprising of primarily of sandstone and conglomerate with some shale, mudstone, siltstone, tuff and basalt.

A geological cross section of the MAR site is presented in Figure 4.

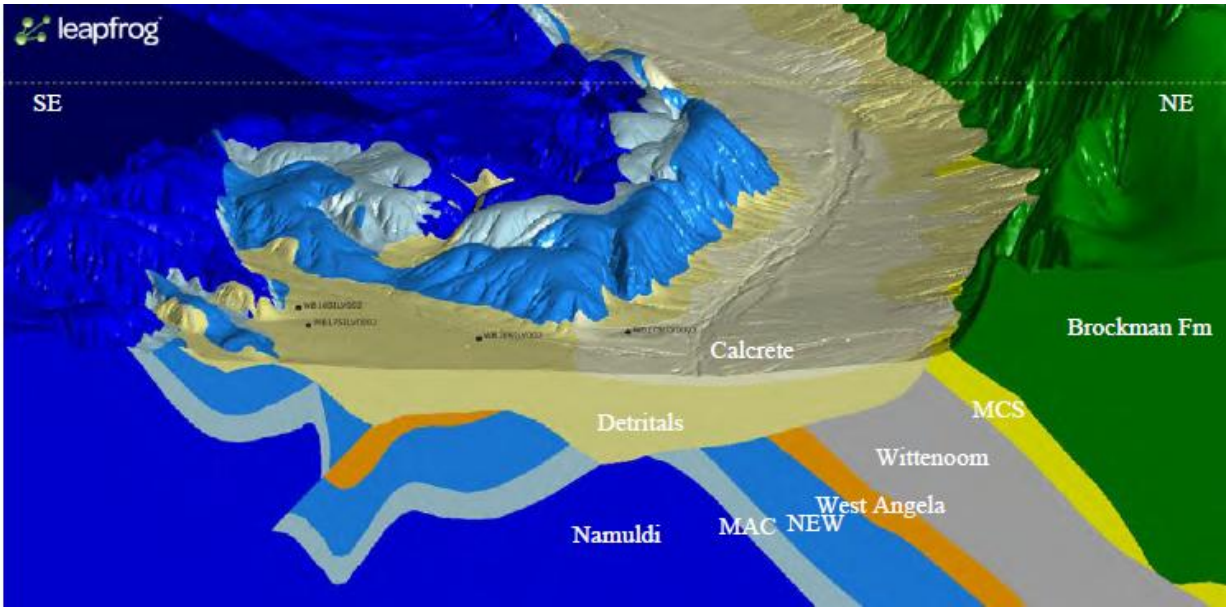

Figure 4: Geological cross-section of the proposed MAR site (Source: WSP 2024)

Pre-mining groundwater flow in the region was from east to west along the Caves Creek Valley, however, dewatering at the SGE Mine has reversed groundwater flow from west to east 8 km from SGE.

A comprehensive background groundwater quality study was conducted by EMM in 2023 for the Greater Brockman Operations (GBO). As discussed in the *H3 Hydrogeological and Risk Assessment* (WSP 2024), the key findings of the study were:

- The background groundwater in the GBO is characterised as fresh to marginal;
- It exhibits a near-neutral pH;
- The concentrations of metals and metalloids in the groundwater are low;
- Groundwater quality does not show significant variation based on spatial location;
- There is no substantial variation associated with screened geology;
- The low-permeability fractured rock aquifer in the Fortescue Group (the oldest Hydrostratigraphic Unit (HSU)) shows slightly higher salinity compared to other HSUs;
- The variability within HSUs is greater than the variability between them;
- Variability between different mining areas, particularly within HSU4 (Brockman Iron Formation) and HSU6 (Wittenoom Formation and Upper Mount Newman Member), where most samples were collected, does not exceed the variability between HSUs; and
- Groundwater from different mining areas within the same HSU is very similar, indicating that baseline analytes in major aquifers show no significant variation between different mine sites.

At the proposed MAR injection site, background groundwater quality has been established for each of the target aquifers. Background groundwater quality, compared against the minimum suite of parameters recommended in the *Guideline Water and environmental considerations for managed aquifer recharge operations in Western Australia* (DWER 2021b), is presented in Table 1.

Table 1: Background groundwater quality at the proposed MAR injection site

Parameter	Units	Valley Fill Aquifer			Marra Mamba Formation			Wittenoom Formation		
		Median	Min	Max	Median	Min	Max	Median	Min	Max
Temperature	°C	-	-	-	-	-	-	-	-	-
pH	-	7.8	6.85	8.4	7.72	6.57	8.43	7.76	6.83	8.09
Redox	mV	-	-	-	-	-	-	-	-	-
Electrical conductivity	µS/cm	1,300	1,030	2,810	1,300	1,200	1,400	1,300	1,200	1,400
Dissolved Oxygen	mg/L	6.15	3.7	8.2	4.8	2.5	5	5	3.3	7.6
Total dissolved solids	mg/L	770	632	1770	741	658	780	770	728	798
Total hardness (as $CaCO_3$)	mg/L	420	370	610	406	402	410	380	380	380
Total alkalinity (as $CaCO_3$)	mg/L	339.5	294	450	310	280	344	303	270	329
Calcium	mg/L	63	44	109	65	57	68	63	53	75
Magnesium	mg/L	61.5	44	137	57	51	60	58	53	66
Sodium	mg/L	126.5	85	340	133	110	150	116	93	140
Potassium	mg/L	10	8.7	18	9.1	8.1	10	10	8.7	13
Ammonium as N	mg/L	0.015	<0.005	0.02	0.3	0.01	3.74	-	-	-
Filterable Reactive Phosphorus as PO_4	mg/L	<0.01	<0.01	0.02	<0.01	<0.01	0.02	<0.01	<0.01	<0.01

Parameter	Units	Valley Fill Aquifer			Marra Mamba Formation			Wittenoom Formation		
		Median	Min	Max	Median	Min	Max	Median	Min	Max
Carbonate	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Bicarbonate	mg/L	400	360	550	370	340	390	350	320	400
Chloride	mg/L	196.5	119	577	190	160	213	190	170	216
Sulfate	mg/L	110	75	302	110	98	130	110	91	130
Silica	mg/L	68	47	83.5	27.5	26	28	46	46	46
Boron	mg/L	0.6	0.39	0.93	0.60	0.42	0.62	0.63	0.5	0.69
Bromide	mg/L	0.84	0.21	2.2	0.925	<0.1	1.1	0.93	<0.1	1.6
Aluminium	mg/L	<0.005	<0.005	0.02	<0.005	<0.005	0.02	<0.005	<0.005	0.01
Arsenic	mg/L	<0.0005	<0.0005	<0.01	<0.0005	<0.0005	0.01	<0.0005	<0.0005	0.01
Cadmium	mg/L	<0.0005	<0.0005	<0.005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chromium	mg/L	<0.005	<0.0005	0.01	<0.0005	<0.0005	<0.005	<0.0005	<0.0005	<0.005
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.0005	<0.0005	0.01
Iron	mg/L	<0.01	<0.0005	<0.025	0.01	<0.005	0.08	0.01	<0.005	0.03
Ferrous iron	mg/L	<0.025	<0.025	<0.025	0.0475	<0.025	0.07	<0.025	<0.025	<0.025
Ferric iron	mg/L	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	-	-	-
Lead	mg/L	<0.0005	<0.0005	<0.005	<0.0005	<0.0005	<0.005	<0.0005	<0.0005	<0.005
Manganese	mg/L	<0.005	<0.0005	0.23	0.13	0.01	0.63	0.06	0.01	0.07

Parameter	Units	Valley Fill Aquifer			Marra Mamba Formation			Wittenoom Formation		
		Median	Min	Max	Median	Min	Max	Median	Min	Max
Mercury	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Nickel	mg/L	0.0005	0.0005	0.01	<0.0005	<0.0005	0.01	<0.0005	<0.0005	0.01
Selenium	mg/L	0.00275	<0.0005	0.01	<0.0005	<0.0005	<0.005	<0.0005	<0.0005	<0.0005
Zinc	mg/L	0.02	<0.0005	0.1	0.02	0.01	0.05	0.015	0.01	0.04
Ammonia as N	mg/L	0.015	<0.005	0.04	0.03	0.02	3.81	0.02	0.02	0.02
Nitrate as N	mg/L	1.49	0.02	1.92	0.238	<0.005	0.47	1.74	<0.005	1.9
Nitrite as N	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total Kjeldahl Nitrogen	mg/L	0.5	0.3	1.2	0.7	0.2	4	-	-	-
Total Phosphorus	mg/L	0.03	<0.005	0.21	<0.025	0.01	0.51	0.0075	<0.005	0.01
Methane	mg/L	-	-	-	-	-	-	-	-	-
N-nitrosodimethylamine	mg/L	-	-	-	-	-	-	-	-	-
Total organic carbon	mg/L	-	-	-	-	-	-	-	-	-

Note: a '-' indicates that no data has been provided

4.2 Residential and sensitive receptors

The distance to residential and sensitive receptors are detailed in Table 2.

Table 2: Human receptors and distance from the prescribed activity

Human receptors	Distance from activity
Beneficial users of groundwater	There are four active groundwater abstraction licences within five km of the MAR scheme
Recreational users of Mallumallu (Palm Spring)	Approximately 17 km downstream of MAR scheme

4.3 Specified ecosystems and ecological receptors

Specified ecosystems are areas of high conservation value and special significance that may be impacted as a result of activities at, or emissions and discharges from, the premises. The description of specified ecosystems and distances from the premises are discussed in Table 3.

Table 3: Environmental values

Specified ecosystems and ecological receptors	Description and distance from activity
Fauna	
Terrestrial fauna (threatened and/or priority fauna)	Previously recorded within the immediate vicinity of the MAR scheme: • Pilbara Olive Python (*Liasis olivaceus barroni*) – Vulnerable (EPBC Act and *Biodiversity and Conservation Act 2016* (BC Act)) • Ghost Bat (*Macroderma gigas*) – Vulnerable (EPBC Act and BC Act) • Pilbara Lead-nosed Bat (*Rhinonicteris aurantia* (Pilbara form)) – Vulnerable (EPBC Act and BC Act) Potential to occur within the vicinity of the MAR scheme: • Northern Quoll (*Dasyurus hallucatus*) – Endangered (EPBC Act and BC Act) • Lakeland-downs Mouse (*Leggadina lakedownensi*) – Priority 4 • Lined Soil-crevice Skink (*Notoscincus butleri*) – Priority 4 • Western Pebble Mound Mouse (*Pseudomys chapmani*) – Priority 4 • Peregrine Falcon (*Falco peregrinus*) – Other specially protected (BC Act)
Aquatic fauna (threatened, priority and/or short-range endemic (SRE))	Potential to occur within Caves Creek downstream of the MAR scheme (WRM 2020):

Specified ecosystems and ecological receptors	Description and distance from activity
	Zooplankton: • *Eodiaptomus lumholtzi* – IUCN Vulnerable • Two potential new species of zooplankton (WRM 2020) Insecta: • Pilbara pin damselfly (*Eurysticta coolawanyah*) – IUCN Vulnerable • Pilbara emerald dragonfly (*Hemicordulia koomina*) – IUCN Vulnerable Vertebrata – fish: • Fortescue Grunter (*Leiopotherapon aheneus*) – IUCN Vulnerable and Priority 4
Subterranean fauna	Previous studies conducted within the Silvergrass project region reveal a rich, diverse assemblage of stygofauna and troglofauna occurring within the Caves Creek Paleochannel (Biologic 2022) Within 3.5 km of the MAR site, four species of troglofauna have been identified. A diverse range of stygofauna species have been documented within the broader Caves Creek area. Five amphipod species have been identified as consistently occurring across the survey area and are considered part of the core community and indicators of overall community health (WSP 2024)
Flora	
Threatened and Priority Ecological Communities (TEC / PEC)	Found within 4 km of the MAR scheme: • Riparian communities of springs and pools Pilbara (Priority 2) • Brockman Iron cracking clay communities of the Hamersley Ranges (Priority 1) • Themeda grasslands (*Themeda* sp. Hamersley Station (M.E. Trugen 11431)) in cracking clays (Hamersley Station, Pilbara) (BC Act Critically Endangered)
Threatened and Priority Flora	Found within 5 km of the MAR scheme: • *Gymnanthera cunninghamii* • *Eremophila magnifica subsp. Velutina* • *Glycine falcata* • *Vittadinia sp. Coondewanna Flats (S. van Leeuwen 4684)* • *Euphorbia inappendiculata var.*

Specified ecosystems and ecological receptors	Description and distance from activity
	queenslandica
Vegetation	Native vegetation immediately adjacent to the MAR scheme including riparian and other terrestrial vegetation Native vegetation units in the area are characterised by low woodlands and shrublands. The species encountered are noted as having negligible to 'low to moderate' dependence on groundwater
Groundwater	
Underlying groundwater	The current depth to the groundwater is approximately 15 m below ground level (mbgl) Background groundwater quality is described in Section 4.1.3
Rights in Water and Irrigation Act (RIWI Act) Proclaimed Groundwater – Pilbara Groundwater Area	The MAR scheme is located within the Pilbara Groundwater Area
Public Drinking Water Source Area – Priority 2 – Millstream Water Reserve	Located approximately 14 km north-east of the MAR scheme
Surface water bodies	
Caves Creek	Caves Creek is located adjacent to the MAR scheme. Caves Creek is described in Section 4.1.2
Rights in Water and Irrigation Act (RIWI Act) Proclaimed Surface Water Area – Pilbara Surface Water Area	The MAR scheme is located within the Pilbara Surface Water Area

4.4 Social and cultural values

4.4.1 Aboriginal heritage

The MAR scheme is located on the traditional lands of the Eastern Guruma people. Eastern Guruma country covers around 6,500 km^2 around Tom Price and Karijini National Park in the Eastern Pilbara region of Western Australia.

The Wintawari Guruma Aboriginal Corporation (WGAC) is the Native title body that represents the interests of the Eastern Guruma people.

A number of Aboriginal heritage sites and sites of significant cultural value occur within the vicinity of the premises. Cultural receptors that may be impacted by the proposed MAR scheme are identified in Table 4.

Table 4: Cultural values

Aboriginal heritage and sites of cultural significance	Distance from activity
Narraminju (Caves Creek) (Site ID: 14989) – creation / dreaming narrative	Located immediately adjacent to the MAR scheme
Hamersley Ranges 33 (Site ID: 6459) – artefacts / scatter	Located immediately adjacent to the MAR scheme
Hamersley Ranges 27 (Site ID: 7485) – artefacts / scatter; rock shelter	Approximately 1 km west of the MAR scheme
Jerithikunha (Cockle Spring)	Approximately 2.5 km downstream of MAR scheme
Karingkulanha (Pancake Spring)	Approximately 7.5 km downstream of MAR scheme
Mallumallu (Palm Spring)	Approximately 17 km downstream of MAR scheme

5. Risk assessment

The department assesses the risks of emissions from prescribed premises and identifies the potential source, pathway and impact to receptors in accordance with the *Guideline: Risk assessments* (DWER 2020).

To establish a risk event there must be an emission, a receptor which may be exposed to that emission through an identified actual or likely pathway, and a potential adverse effect to the receptor from exposure to that emission.

5.1 Source-pathways and receptors

5.1.1 Emissions and controls

The key emissions and associated actual or likely pathway during premises operation which have been considered in this amendment report are detailed in Table 5 below. Table 5 also details the proposed control measures the licence holder has proposed to assist in controlling these emissions, where necessary.

Table 5: Licence holder controls

Emission	Sources	Potential pathways	Proposed controls
Category 57: Used tyre storage			
Fire/smoke	Acceptance and storage of used tyres	Air / windborne pathway	Tyre storage will be in accordance with *Guidance Note: GN02 Bulk Storage of Rubber Tyres Including Shredded and Crumbed Tyres* (DFES 2020).
Construction of MAR scheme			
Dust	Construction of recharge pads,	Air / windborne	Dust suppression will be implemented (including use of water trucks, control of

Emission	Sources	Potential pathways	Proposed controls
	injection bores, pipeline and pump station	pathway	vehicle movements / restricted speeds, approved dust suppression products e.g. DustMag) during construction as required.
Noise		Air / windborne pathway	No proposed controls.
Discharge of drilling muds, potentially contaminated water and/or sediment laden stormwater		Overland runoff	• Flush water will be discharged at designated scour points along the pipeline; • Rip rap will be installed at these points to mitigate against ground erosion and mesh net will be installed at the outlet to capture construction waste material; and • Flushing will be undertaken in sections and water will be sourced from dewatering bores and will not be treated/chlorinated for flushing activities.
Contaminated water	Construction of deep injection bores (creating a pathway between the shallow and deep aquifer)	Vertical migration through groundwater	No proposed controls.
Commissioning and operation of MAR scheme			
Operation of MAR scheme	Groundwater / contaminated groundwater	Lateral and vertical migration through groundwater	• Abstracted water is piped from the offtake point via the water treatment pad to the recharge bores via an overland pipeline to eliminate potential water quality impacts; • Water filtration and treatment will be used to remove suspended and dissolved solids and other impurities to reduce biological activity in recharge bores and prevent biological clogging; • Adaptive management of water quality; • Reinjected water will be sourced from the same aquifer to ensure compatibility of source and receiving environment; • Establishment of water quality monitoring triggers such as pH and Electrical conductivity, the early response indicator and trigger and threshold criteria will be utilised, as per the EMMP (Revision 3); • Installation of groundwater monitoring bore network; and

Emission	Sources	Potential pathways	Proposed controls
			• Free chlorine residuals monitored at start and end of MAR scheme with a target of 1 mg/L across reinjection site.
		Changes in groundwater level	• Injection rates will be dependent on dewatering injection rates, aquifer responsiveness and infrastructure capacity; • Installation of groundwater monitoring bore network and VWPs for ongoing monitoring; and • Automated control and monitoring systems with telemetry capabilities will be installed to facilitate remote operations and access.
		Surface water discharge as a result of aquifer capacity exceedance causing overland runoff	• Injection rates will be dependent on dewatering injection rates, aquifer responsiveness and infrastructure capacity; • Installation of groundwater monitoring bore network and VWPs for ongoing monitoring; and • Adaptive management approach with continuous drawdown reviews and data.
		Pipeline failure resulting in discharge to land and overland runoff	• Pipelines are fitted with leak detection systems and will operate within standard design pressures; and • Control mechanisms will be implemented to automatically shut down pumps upon detecting a decrease in pressure of flow rate within the system.
		Inadequate reinjection pressure, water quality, flow rate and volumes resulting in physical structure impacts (fracturing or clogging) to the aquifer	• Injection will be undertaken under gravity where possible followed by gradual increase in pressure in deep reinjection bores; • Safe injection pressures have been calculated based on bore construction and site geology and evaluated during injection trial; • Injection will operate below the limit of safe injection bore pressures; and • Groundwater level rise in adjacent VWPs will be monitored to detect upward leakage.
Contaminated	Backflushing	Loss of	• Backflush transferred via pipeline to

Emission	Sources	Potential pathways	Proposed controls
groundwater and/or sediment laden stormwater	injection bores	containment / overland flow Infiltration to groundwater	sedimentation ponds for infiltration and evaporation.
Chemicals (acids, chlorine)	Treatment of water and maintenance of infrastructure	Loss of containment / overland flow	• Sodium hypochlorite will be stored in a tank within a bunded area.

5.1.2 Receptors

In accordance with the *Guideline: Risk assessments* (DWER 2020), the delegated officer has excluded employees, visitors and contractors of the licence holder's from its assessment. Protection of these parties often involves different exposure risks and prevention strategies, and is provided for under other state legislation.

Sections 4.2, 4.3 and 4.4 provide a summary of potential human, environmental and cultural receptors that may be impacted as a results of activities upon or emission and discharges from the prescribed premises *(Guideline: Environmental siting* (DWER 2020)).

5.2 Risk ratings

Risk ratings have been assessed in accordance with the *Guideline: Risk Assessments* (DWER 2020) for those emission sources which are proposed to change and takes into account potential source-pathway and receptor linkages as identified in Section 5.1. Where linkages are incomplete they have not been considered further in the risk assessment.

Where the licence holder has proposed mitigation measures/controls (as detailed in Section 5.1), these have been considered when determining the final risk rating. Where the delegated officer considers the licence holder's proposed controls to be critical to maintaining an acceptable level of risk, these will be incorporated into the licence as regulatory controls.

Additional regulatory controls may be imposed where the licence holder's controls are not deemed sufficient. Where this is the case the need for additional controls will be documented and justified in Table 6.

The revised licence L5258/1991/11 that accompanies this amendment report authorises emissions associated with the operation of the premises.

The conditions in the revised licence have been determined in accordance with *Guidance Statement: Setting Conditions* (DER 2015).

Table 6. Risk assessment of potential emissions and discharges (operations)

Risk Event					Risk rating[1] C = consequence L = likelihood	Licence holder's controls sufficient?	Conditions[2] of licence	Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Licence holder's controls**				
Category 57: Used tyre storage								
Acceptance and storage of used tyres	Fire / smoke	Air / windborne pathway causing impacts to cultural values and ecosystem function	Cultural receptors within 10 km Threatened and priority flora within 5 km TECs / PECs within 4 km	Refer to Section 5.1	C = Moderate L = Rare **Medium Risk**	Y	Condition 9 – Used tyre storage requirements	N/A
Construction of MAR scheme								
Construction of recharge pads, injection bores, pipeline and pump station	Dust	Air / windborne pathway impacting ecosystem health	Threatened and priority flora within 5 km TECs / PECs within 4 km	Refer to Section 5.1	C = Minor L = Possible **Medium Risk**	Y	N/A	Emission to be regulated under the general provisions of the EP Act
	Noise	Air / windborne pathway impacting ecosystem health	Threatened fauna within 5 km	Refer to Section 5.1	C = Minor L = Unlikely **Medium Risk**	No proposed controls	N/A	Emission to be regulated under the Environmental Protection (Noise) Regulations 1997
	Discharge of drilling muds, potentially contaminated water and/or sediment laden stormwater	Overland runoff impacting surface water quality and ecosystem health	Caves Creek north of injection site	Refer to Section 5.1	C = Minor L = Unlikely **Medium Risk**	Y	N/A	Emission to be regulated under the general provisions of the EP Act

Risk Event					Risk rating[1] C = consequence L = likelihood	Licence holder's controls sufficient?	Conditions[2] of licence	Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Licence holder's controls**				
Construction of deep injection bores (creating a pathway between the shallow and deep aquifer)	Contaminated water	Vertical migration through groundwater impacting groundwater quality	Groundwater dependent ecosystems Stygofauna	Refer to Section 5.1	C = Moderate L = Unlikely **Medium Risk**	No proposed controls	**Condition 31 – MAR Scheme construction requirements** **Condition 32 and 33- Compliance reporting requirements for construction works (Condition 31)**	Condition included to specify that injection bores must not be screen across the shallow and deep aquifers
Commissioning and operation of MAR scheme								
Operation of MAR scheme	Groundwater / Contaminated water	Lateral and vertical migration through groundwater resulting in changes in water quality impacting ecosystem health	Groundwater dependent ecosystems including TEC / PECs and threatened and priority flora Stygofauna / troglofaunal Caves Creek Millstream Water Reserve Mallumallu (Palm Springs)	Refer to Section 5.1	See detailed risk assessment outlined in Section 5.3			
		Changes in groundwater level impacting ecosystem function	Groundwater dependent ecosystems including TEC / PECs and threatened and priority flora	Refer to Section 5.1	C = Moderate L = Unlikely **Medium Risk**	Y	Condition 34 – Commissioning requirements Condition 35 and 36 – MAR Scheme operational	N/A

Risk Event					Risk rating[1] C = consequence L = likelihood	Licence holder's controls sufficient?	Conditions[2] of licence	Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Licence holder's controls**				
			Stygofauna / troglofauna Caves Creek Millstream Water Reserve Mallumallu (Palm Springs)				requirements Condition 37 and 38 – MAR Scheme monitoring requirements	
		Surface water discharge as a result of aquifer capacity exceedance causing increased discharges to creek lines and flooding	Threatened and priority flora within 5 km TECs/PECs within 4 km Caves Creek Mallumallu (Palm Springs)	Refer to Section 5.1	C = Major L = Unlikely **Medium Risk**	N	**Condition 40 – Management actions for trigger value exceedances**	The delegated officer considers that surface expressions of groundwater or creation of artesian conditions caused from the exceedance of aquifer capacity to be an unacceptable scenario. As a result, the delegated officer has included a management action specifying that if these conditions are observed, the licence holder is to immediately cease reinjection into the aquifer and investigate the cause of the event
		Pipeline failure resulting in discharge to land and overland runoff causing flooding and ecosystem disturbance	Threatened and priority flora within 5 km TECs / PECs within 4 km Caves Creek	Refer to Section 5.1	C = Minor L = Unlikely **Medium Risk**	Y	**Condition 31 – MAR Scheme construction requirements** Condition 34 – Commissioning requirements Condition 35 and 36 – MAR Scheme operational	N/A

Risk Event					Risk rating[1] C = consequence L = likelihood	Licence holder's controls sufficient?	Conditions[2] of licence	Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Licence holder's controls**				
							requirements Condition 37 and 38 – MAR Scheme monitoring requirements **Condition 39 – discharge limits**	
		Inadequate reinjection pressure, water quality, flow rate and volumes resulting in physical structure impacts (fracturing or clogging) to the aquifer causing impacts to habitat availability and ecosystem health	Groundwater dependent ecosystems Stygofauna / troglofauna	Refer to Section 5.1	C = Moderate L = Unlikely **Medium Risk**	Y	**Condition 31 – MAR Scheme construction requirements** Condition 34 – Commissioning requirements Condition 35 and 36 – MAR Scheme operational requirements Condition 37 and 38 – MAR Scheme monitoring requirements	N/A
Backflushing injection bores	Contaminated groundwater and/or sediment laden stormwater	Loss of containment resulting to discharge to land and overland runoff causing flooding and ecosystem disturbance	Threatened and priority flora within 5 km TECs / PECs within 4 km Caves Creek	Refer to Section 5.1	C = Minor L = Unlikely **Medium Risk**	Y	**Condition 31 – MAR Scheme construction requirements** Condition 35 and 36– MAR Scheme operational requirements Condition 37 and	N/A

Risk Event					Risk rating[1] C = consequence L = likelihood	Licence holder's controls sufficient?	Conditions[2] of licence	Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Licence holder's controls**				
							38 – MAR Scheme monitoring requirements **Condition 39 – discharge limits**	

Note 1: Consequence ratings, likelihood ratings and risk descriptions are detailed in the *Guideline: Risk assessments* (DWER 2020).

Note 2: Proposed licence holder's controls are depicted by standard text. **Bold and underline text** depicts additional regulatory controls imposed by department.

5.3 Detailed risk assessment for groundwater contamination from aquifer injection

5.3.1 Description of contaminated groundwater from aquifer injection

Injection of water into an aquifer has the potential to change the receiving aquifer's water quality. Contamination can be caused by poor source water quality, additives from the treatment process, changes in aquifer geochemistry, unintended flow paths or from chemical spills and leaks across mining activities. Aquifer injection schemes must be accompanied by comprehensive hydrological assessments, water quality testing, geochemical modelling and risk management strategies that prevent unintended consequences from injection.

5.3.2 Identification and general characterisation of emission

There are a number of different factors which influence the quality of reinjection water including the quality of the source water and also the processes that water is subject to prior to reinjection. The licence holder proposes to abstract water from the SGE dewatering bores which draw from three different aquifers, the shallow valley fill aquifer and the deep Marra Mamba Formation and Wittenoom Formation. Abstracted water will be mixed, filtered, treated and conveyed along a 14 km pipeline prior to injection into either the shallow or deep aquifer at the injection site. An overview of the water quality from dewatering bores at the three source aquifers, compared against the minimum suite of parameters recommended in the *Guideline Water and environmental considerations for managed aquifer recharge operations in Western Australia* (DWER 2021), is presented in Table 7.

Table 7: Background water quality of abstraction water

Parameter	Units	SGE – Valley Fill Aquifer			SGE – Marra Mamba Formation			SGE – Wittenoom Formation		
		Median	Min	Max	Median	Min	Max	Median	Min	Max
Temperature	°C	-	-	-	-	-	-	-	-	-
pH	-	8.13	7.79	8.64	8.19	7.6	8.62	8.2	7.73	9.3
Redox	mV	-	-	-	-	-	-	-	-	-
Electrical conductivity	µS/cm	1,250	110	1,420	1,210	501	1,490	1,240	980	1,470
Dissolved Oxygen	mg/L	1.3	<0.5	2.1	2.45	1.5	8.2	1.3	<0.5	2.1
Total dissolved solids	mg/L	756	590	838	748	328	896	751	510	974
Total hardness (as $CaCO_3$)	mg/L	382	330	419	385	143	461	382.5	230	447
Total alkalinity (as $CaCO_3$)	mg/L	324	255	390	310	140	369	304.5	200	380
Calcium	mg/L	63	43	72	64	7.2	79	62	6.3	75
Magnesium	mg/L	54	47	58	54	19	65	54	47	64
Sodium	mg/L	126	110	160	126	44	150	127	114	150
Potassium	mg/L	8	7	10	8	7.3	12	8	7	12
Ammonium as N	mg/L	0.015	<0.005	0.08	<0.005	<0.005	0.74	1.75	<0.5	9.8
Filterable Reactive Phosphorus as PO_4	mg/L	0.9	0.8	1	0.02	0.01	0.33	<0.005	<0.005	<0.005

Parameter	Units	SGE – Valley Fill Aquifer			SGE – Marra Mamba Formation			SGE – Wittenoom Formation		
		Median	Min	Max	Median	Min	Max	Median	Min	Max
Carbonate	mg/L	<0.5	<0.5	41	<0.5	0.5	40	4.5	<0.5	58
Bicarbonate	mg/L	400	350	470	375	170	440	330	190	460
Chloride	mg/L	177	140	209	177	30	236	180	150	227
Sulfate	mg/L	100	33	114	100	32	126	106	23	138
Silica	mg/L	75.4	65.4	82.5	70.8	26.4	88.5	68.2	56.8	83.5
Boron	mg/L	0.6	0.52	0.93	0.6	0.34	0.74	0.6	0.21	0.71
Bromide	mg/L	0.735	0.49	0.9	0.87	0.55	1.3	0.84	0.54	1.3
Aluminium	mg/L	<0.005	<0.0005	0.01	<0.005	<0.0005	0.08	<0.005	<0.0005	0.01
Arsenic	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cadmium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.03	<0.0005	<0.0005	<0.0005
Iron	mg/L	0.025	0.025	4.5	<0.025	<0.0005	1.1	<0.025	0.01	3.3
Ferrous iron	mg/L	-	-	-	-	-	-	-	-	-
Ferric iron	mg/L	-	-	-	-	-	-	-	-	--
Lead	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Manganese	mg/L	0.0053	<0.0005	0.41	<0.0005	<0.0005	0.38	0.01	<0.0005	0.62

Parameter	Units	SGE – Valley Fill Aquifer			SGE – Marra Mamba Formation			SGE – Wittenoom Formation		
		Median	Min	Max	Median	Min	Max	Median	Min	Max
Mercury	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Nickel	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.02	<0.0005	<0.0005	0.04
Selenium	mg/L	<0.005	<0.0005	<0.005	<0.005	<0.0005	<0.005	<0.005	<0.0005	<0.005
Zinc	mg/L	0.01	<0.005	0.4	0.01	<0.005	7.81	0.01	<0.005	0.61
Ammonia as N	mg/L	0.015	<0.005	0.08	0.01	<0.005	0.75	<0.005	<0.005	0.57
Nitrate as N	mg/L	2.75	2.54	2.96	2.79	1.89	6.64	2.63	1.97	3.33
Nitrite as N	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	0.44	0.005	<0.005	0.07
Total Kjeldahl Nitrogen	mg/L	0.5	0.3	1	0.6	0.2	1.5	0.5	<0.25	1.8
Total Phosphorus	mg/L	<0.01	<0.005	2.3	0.1	<0.005	0.92	<0.01	<0.005	0.76
Methane	mg/L	-	-	-	-	-	-	-	-	-
N-nitrosodimethylamine	mg/L	-	-	-	-	-	-	-	-	-
Total organic carbon	mg/L	-	-	-	-	-	-	-	-	-

Note: a '-' indicates that no data has been provided

Table 7 outlines the typical background groundwater quality at the point of abstraction. In addition to the parameters listed above, mining operations have the potential to cause contamination and a degradation of groundwater quality. Typical contaminants that are associated with mining operations include (DWER 2021a; HEPA 2025):

- Per- and polyfluoroalkyl substances (PFAS)
- Hydrocarbons
- Monocyclic aromatic hydrocarbons (MAHs) (benzene, toluene, ethylbenzene and xylenes)
- Polycyclic aromatic hydrocarbons (PAHs)
- Volatile organic compounds and semi-volatile organic compounds (VOCs and SVOCs)
- Metals
- Nutrients
- Pathogens

No monitoring data has been provided for PFAS, hydrocarbons, MAHs, PAHs, VOCs/SVOCs or pathogens.

As part of the maintenance of the MAR infrastructure, a number of chemical treatment methods are being implemented. A list of chemicals used for treatment or maintenance is presented in Table 8.

Table 8: Chemicals utilised in the MAR scheme for infrastructure maintenance

Chemical	Use
Sodium hypochlorite (chlorine)	Disinfectant to prevent biofouling of bore screens
Acid (hypochloric, phosphoric, sulphamic)	Descaling injection bores and infrastructure
Polyphosphates Sodium hexametaphosphate (Calgon)	Dispersing agent preventing the build-up of scale

In addition to contamination that can occur during the abstraction, treatment and conveyance process, injection of water into an aquifer can cause a series of geochemical processes that may cause a secondary source of contamination within the aquifer. Table 9 outlines a number of geochemical processes that may take place within the aquifers that can cause a secondary source of contamination.

Table 9: Geochemical model

Parameter	Geochemical process
Pressure	Depressurisation during abstraction may lead to degassing of CO_2, an increase of pH and precipitation of calcite and magnesite
Temperature	Increase in temperature can lead to the dissolution of carbonate minerals within the aquifer Increased temperature reduces oxygen solubility
Oxygen	An introduction of oxygen during the abstraction and conveyance of groundwater may cause the precipitation of iron oxide Increased oxygen may lead to arsenic release from aquifer sediments

Parameter	Geochemical process
pH	Changing pH may cause the release of manganese and/or iron from aquifer sediments Changing pH may cause the precipitation of minerals

5.3.3 Description of potential adverse impacts from the emission

Receptors that may be impacted by contaminated groundwater include groundwater dependent native vegetation (including threatened and priority flora), beneficial users of groundwater, stygofauna, Caves Creek and Mallumallu (Palm Springs). Groundwater may become contaminated through the injection of contaminated water (either contaminated at the source, via the conveyance network or through improper treatment of the water), during infrastructure maintenance or through geochemical processes that occur during the mixing of native groundwater with injected water.

Groundwater is to be injected into the shallow valley fill aquifer and the deeper fractured rock aquifers of the Marra Mamba Formation and the Wittenoom Formation.

Pre-mining groundwater flow in the region was from east to west along the Caves Creek Valley, however, dewatering at the SGE Mine has reversed groundwater flow from west to east 8 km from SGE.

Modelling suggests that the majority of injected water will flow back towards SGE, driven by the steep hydraulic gradients created from mine dewatering, with a portion expected to migrate towards Jerithikunha (Cockle Spring). A figure showing the results of particle tracking analysis is shown in Figure 5. Based on this tracking, groundwater velocity is approximately 43 m per year in the northern direction and 50 m per year in the southern direction. The time for MAR water to reach Jerithikunha (Cockle Spring) is 60 years and 130 years to reach SGE (WSP 2024).

There are a number of complex geochemical and geophysical interactions that can occur from the injection of groundwater which may impact receptors in diverse ways. A conceptual site model has been developed to assess the risk to receptors that may be adversely impacted from contaminated groundwater and screen out interactions from further assessment where there is no complete source-pathway-receptor linkage. The conceptual site model is detailed below in Table 10.

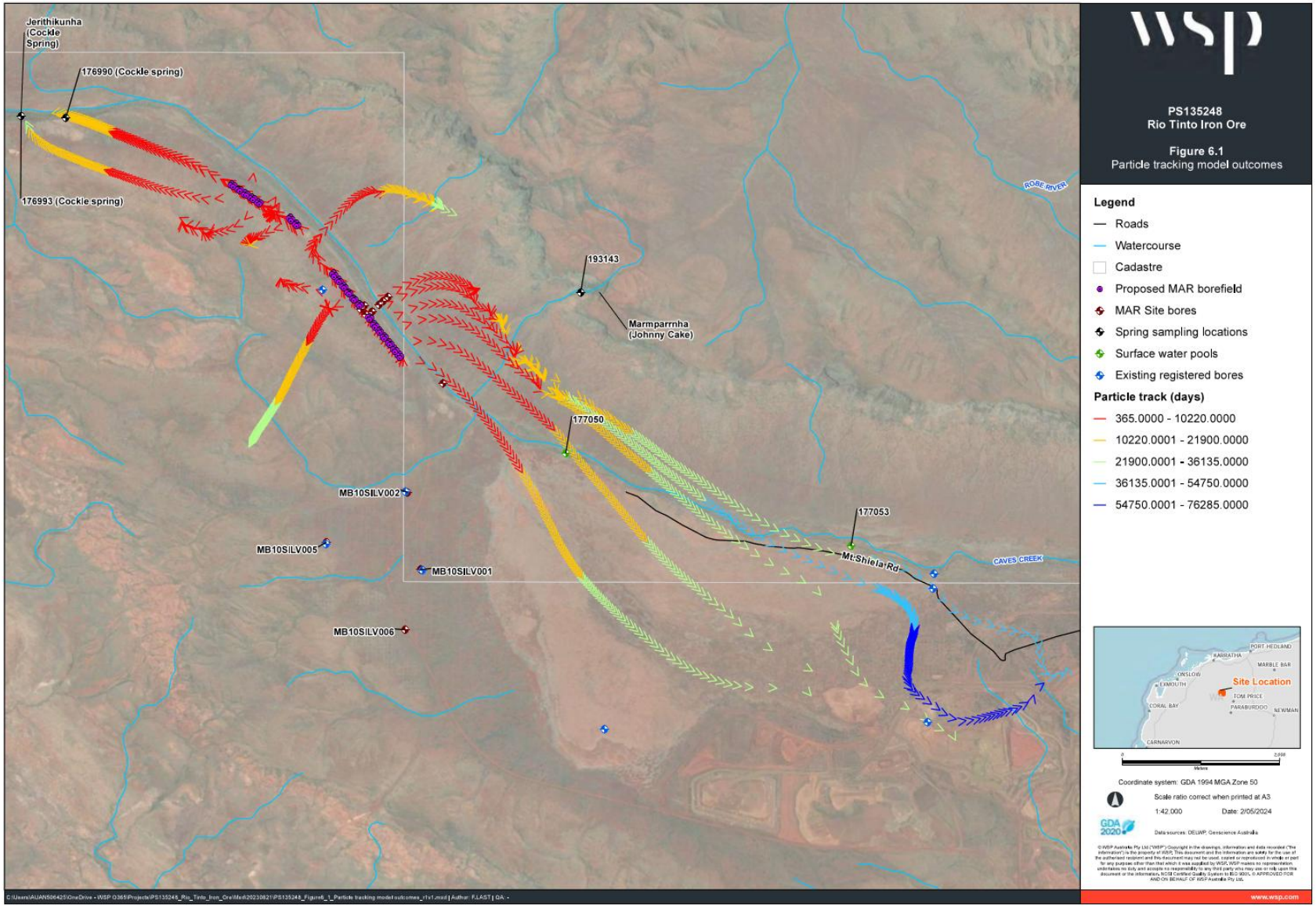

Figure 5: Particle tracking model outcomes

Licence: L5258/1991/11

Table 10: Source-pathway-receptor linkages / impacts from groundwater injection

Source	Pathway	Receptor	Complete pathway (Y/N)?	Description of potential impact
• Water contaminated from mining operations prior to abstraction at SGE • Water temperature changes occurring across the 14 km long conveyance network • Water contaminated through treatment of groundwater prior to injection • Water contaminated during MAR infrastructure maintenance • Injection of water resulting in geochemical processes within target	Injection into shallow and deep aquifers Lateral and vertical migration through the aquifers Loss of containment/overland flow	Groundwater dependent ecosystems including TEC / PECs, threatened and priority flora and native vegetation	Y	The majority of water injected during the MAR scheme is predicted to flow back towards the SGE mining operations, passing under TECs and native vegetation. Vegetation in the region has been classified as having low to moderate dependency on groundwater. Contaminated groundwater may therefore come into contact with the root zones of native vegetation and cause impacts to vegetation health or cause vegetation mortality.
		Stygofauna	Y	Water quality factors that have the potential to impact stygofauna are outlined below: <u>Temperature:</u> Temperature plays a major role in stygofauna viability and it is possible that changes in aquifer temperature may cause a decline in stygofauna population. Water abstracted at SGE is conveyed along a 14 km long pipeline before reaching the injection site and it is considered that, especially in warmer months, a significant amount of heating may occur. The receiving aquifers are considered to have a high thermal buffering capacity, however, it is still expected that there may be localised heating creating unsuitable conditions for stygofauna. Given the buffering capacity of the aquifer, it is not considered likely that temperature changes will create an impact beyond the zone of influence. <u>pH:</u> Changes in pH may negatively impact stygofauna populations, especially though the addition of acidic descaling agents into injection bores. Native groundwater and injection water are both neutral to slightly alkaline and the aquifer is considered to have some buffering capacity. It is not considered that pH will create an impact beyond the zone of influence. <u>Salinity:</u> Changes in salinity may negatively impact stygofauna populations. The

Source	Pathway	Receptor	Complete pathway (Y/N)?	Description of potential impact
aquifer causing secondary contamination				salinity of the native groundwater and the injection water are considered similar and it is unlikely there will be major changes in salinity. Dissolved Oxygen: It is considered that during the abstraction, treatment and conveyance of groundwater prior to injection, dissolved oxygen concentrations in injection water will increase. Increasing dissolved oxygen concentrations may change geochemical processes in the receiving aquifers which in turn may impact stygofauna populations. Chlorine: Injection water will be treated with sodium hypochlorite prior to reinjection. Chlorine can be toxic to stygofauna and improper treatment of injection water resulting in excess concentrations of free chlorine residuals may cause stygofauna mortality within the zone of influence. Metals: Increasing concentrations of metals/metalloids from the source water, conveyance, treatment of, through changes in aquifer geochemistry may impact stygofauna populations. Metal concentrations within the aquifer may change as metals are released from aquifer sediments. It is considered that this geochemical change will not extend beyond the zone of influence. Nutrients: The potential impacts from varying levels of nutrients on stygofauna populations are largely unknown. Groundwater is abstracted from within the mine pit and adjacent to the mine pit, therefore, it is considered that there is a likely pathway for additional nutrients to enter the injection water. PFAS: Mining operations are often a source of PFAS contamination and, due to the highly mobile nature of PFAS, a potential source for PFAS cannot be dismissed (i.e. minor concentrations in the injection water may occur). There is limited information available on the toxic effects of PFAS to stygofauna, however, studies have shown stygofauna mortality increases

Source	Pathway	Receptor	Complete pathway (Y/N)?	Description of potential impact
				with increasing PFAS concentrations (CRC CARE 2022). PFAS are also considered highly mobile in the environment and bioaccumulate. No monitoring data for PFAS in the injection water or native groundwater for the MAR scheme has been provided. Should a PFAS source occur, it is expected that concentrations will increase and bioaccumulate at the injection site with concentrations of PFAS also migrating away from the injection site.
		Troglofauna	N	The MAR scheme will result in the reinstatement of groundwater levels to pre-mining conditions and should not impede on troglofauna habitat. The injection water is not considered to contain any volatile contaminants and it is not considered likely that the injection water could become contaminated during operations with significant enough concentrations of volatile compounds that could impact troglofauna. The pathway is therefore considered incomplete.
		Aquatic fauna	Y	Caves Creek contains a number of groundwater fed semi-permanent and permanent pools that form habitat for aquatic fauna. In general, injection water is of a similar water quality to that found in Caves Creek and the distance between the injection site and Caves Creek allows for some degree of natural attenuation to occur. It is possible that some more persistent, mobile contaminants, such as PFAS, may reach the pools of Caves Creek and impact aquatic fauna.
		Beneficial users of groundwater (bore water users)	N	Receptor is outside of the modelled groundwater flow area. Incomplete pathway.
		Millstream Water Reserve	N	Receptor is outside of the modelled groundwater flow area. Incomplete pathway.
		Caves Creek including Jerithikunha (Cockle Spring)	Y	The modelled time for injected water to reach Jerithikunha (Cockle Spring), is 60 years. It is considered that there is sufficient spatial and temporal distance between the MAR site and the ecologically and culturally important semi-permanent and permanent Caves Creek to allow for the sufficient

Source	Pathway	Receptor	Complete pathway (Y/N)?	Description of potential impact
		and Karingkulanha (Pancake Spring)		natural attenuation and dilution of any contaminants. Some more persistent, mobile contaminants, such as PFAS, may reach these pools and bioaccumulate to concentrations where impacts may start to occur.
		Mallumallu (Palm Springs)	Y – with temporal limitations	The modelled time for injected water to reach Mallumallu (Palm Springs) is greater than 130 years. It is considered that there is sufficient spatial and temporal distance between the MAR site and Mallumallu to allow for the sufficient natural attenuation and dilution of any contaminants. Some more persistent, mobile contaminants, such as PFAS, may reach these pools and bioaccumulate to concentrations where impacts may start to occur.

Key findings:

The delegated officer considers that the MAR scheme will create a zone of influence where native water quality and geochemical processes will be altered. It is expected that there will be some impact to stygofauna populations within the zone of influence.

5.3.4 Criteria for assessment

Where available, site-specific data or relevant academic research will be used to derive criteria for assessment. Where no site-specific data or relevant values in published scientific papers exists, the guideline that is considered appropriate assessment criteria to assess the potential impact on groundwater dependent and freshwater ecosystems and stygofauna is the Australian and New Zealand guidelines for fresh and marine water quality (2018).

5.3.5 Licence holder controls

The licence holder's proposed controls are detailed in Section 5.1.

5.3.6 Key findings

Key findings:

The delegated officer has reviewed the conceptual site model and has found that:

1. The MAR scheme will result in a zone of influence and within the zone of influence, it is likely there will be a degradation of water quality through the alteration of aquifer geochemistry.
2. There will likely be impacts to stygofauna populations within the zone of influence.
3. There is uncertainty as to the extent of the zone of influence.
4. A pathway exists whereby highly mobile and persistent contaminants may reach, and cause impact to, the permanent and semi-permanent pools of Caves Creek.
5. Despite the predicted impacts within the zone of influence, the delegated officer considers that the MAR scheme provides a net positive environmental outcome.
6. The delegated office does not consider it appropriate for impacts to occur outside of the zone of influence.

5.3.7 Risk assessment

In line with the department's regulatory framework, to determine the consequence and likelihood of a risk event, the department will take into account any controls the applicant has proposed. Where those controls lower the likelihood or consequence of a risk event, the department will include the controls in conditions in the regulatory instrument.

To determine the consequence rating of a risk event, the delegated officer will apply consequence criteria to the receptor considered most effected by the emission including considering the nature, value and sensitivity of the receptor.

Acknowledging that the MAR scheme will result in a zone of influence, the delegated officer has considered risk to receptors within the zone of influence and outside of the zone of influence separately.

Within the Zone of Influence the delegated officer has:

- considered that the **consequence** to receptors exposed to potentially contaminated groundwater through the MAR scheme could have major impacts to stygofauna populations within the MAR zone of influence;

- considered that the **likelihood** of impacts to receptors is likely based on the controls proposed by the licence holder; and
- determined that the **overall rating** for the risk of impacts from contaminated groundwater, based on a consequence of major and a likelihood of likely, is **high**.

Outside of the Zone of Influence the delegated officer has:

- considered that the **consequence** to receptors exposed to potentially contaminated groundwater through the MAR scheme could have major impacts to stygofauna populations within the MAR zone of influence;
- considered that the **likelihood** of impacts to receptors is unlikely based on the controls proposed by the licence holder; and
- determined that the **overall rating** for the risk of impacts from contaminated groundwater, based on a consequence of major and a likelihood of unlikely, is **medium**.

5.3.8 Regulatory controls

The delegated officer considers that the MAR scheme will create a zone of influence around the injection area and within the zone of influence, some impacts to stygofauna may occur. In considering the licence holders controls as listed in Section 5.3.5 and the findings of the risk assessment, the delegated officer considers the risk to groundwater quality (and by extension stygofauna and groundwater connected ecosystems) through the injection of water into the shallow and deep aquifers to be acceptable, subject to the application of additional regulatory controls.

As described in *Australian Guidelines for Water Recycling Managed Aquifer Recharge* (NRMMC 2009), it is expected that a level of attenuation, the reduction of hazard concentrations by natural processes, will occur. The area in which attenuation takes place is known as the attenuation zone and it is expected that outside the attenuation zone, all pre-existing environmental values are met. A depiction of an attenuation zone is show in Figure 6. It is important to note, however, that not all chemicals naturally attenuate, and these chemicals should meet acceptable concentrations before injection.

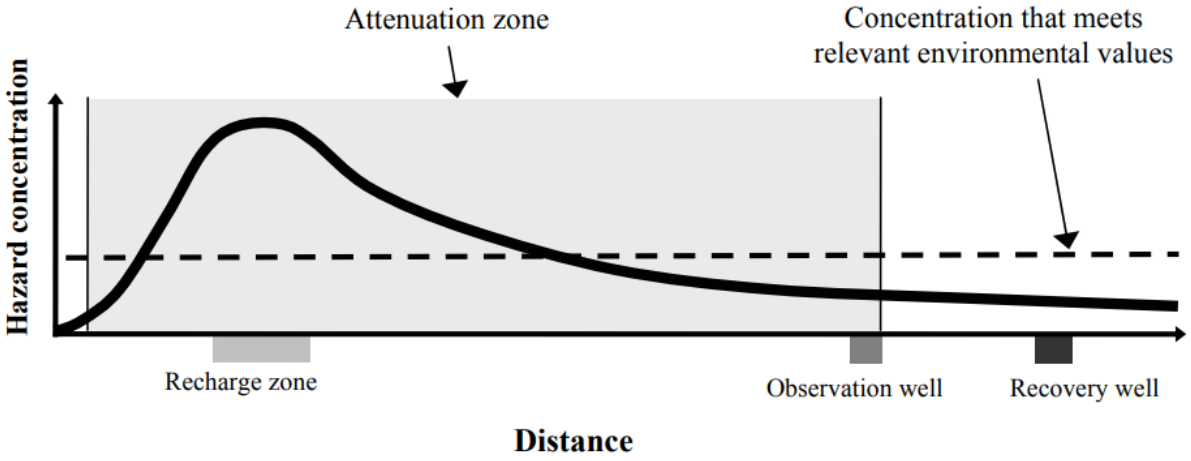

Figure 6: Hazard concentration on a transect through the aquifer showing attenuation zone (NRMMC 2009)

In considering this, the delegated officer finds it appropriate to condition water quality discharge limits for the injection water, and trigger values for surrounding groundwater monitoring bores. This acknowledges that some degradation of water quality may exist within the zone of influence/attenuation zone, but, ensures that water quality objectives and environmental values are being maintained outside of this zone.

Discharge limits, trigger values and where the value has been derived from is outlined in Table 11.

The values were originally derived from a combination of statistical analysis based on the 95th percentile calculated from background data (WSP 2024), guideline values, or stygofauna protection values derived from stygofauna toxicology studies.

Since finalising *WSP 2024*, the licence holder has completed an expanded drilling program and un updated review of groundwater quality in the receiving environment. *WSP 2026* incorporated a broader dataset, including recent results from pre-existing and new monitoring bores and installed MAR injection bores. The updated dataset should provide a more comprehensive representation of native groundwater conditions across the Valley Fill, Marra Mamba and Wittenoom aquifers.

The department has updated Table 11, following consultation with the licence holder (refer to Table 13, Appendix 1 and Appendix 2).

Table 11: Discharge limits and trigger values for MAR scheme

Parameter[1]	Discharge limit	Derivation	Trigger Value	Derivation
Temperature	37.5 °C	The licence holder has stated that on further review of discharge monitoring data from Duck Creek temperatures of up to 35.7°C during summer have been identified. The department has set the limit at 37.5°C.	-	-
pH	6.5 – 8.7	Limit revised in *WSP 2026* to reflect native alkaline conditions	-	-
Dissolved oxygen	-	-	7.84 mg/L	95th percentile value for the Valley Fill Aquifer at the injection site (WSP 2024)
Electrical conductivity	-	-	2,238 µS/cm	95th percentile value for the Valley Fill Aquifer at the injection site (WSP 2026)
Total alkalinity (as $CaCO_3$)	-	-	449 mg/L	95th percentile value for the Valley Fill Aquifer at the injection site (WSP 2026)
Residual chlorine	1 mg/L	Limit proposed in application (WSP 2024)	-	-
Nitrate (as N)	7.6 mg/L	Limit revised in *WSP 2026* to reflect hardness-adapted value specific to the Pilbara (van Dam, 2022)	-	-

Parameter[1]	Discharge limit	Derivation	Trigger Value	Derivation
Total Phosphorous	-	-	0.44 mg/L	95th percentile value for the Marra Mamba Aquifer at the injection site (WSP 2024)
Sulfate	-	-	222 mg/L	95th percentile value for the Valley Fill Aquifer at the injection site (WSP 2024)
Arsenic	-	-	0.01 mg/L	95th percentile value for the Valley Fill Aquifer at the injection site (WSP 2024)
Cadmium	-	-	0.001 mg/L	95th percentile value for the native groundwater at the injection site (WSP 2024)
Cobalt	-	-	0.23 mg/L	95th percentile value for the Marra Mamba Aquifer at the injection site (WSP 2026)
Copper	-	-	0.009 mg/L	95th percentile value for the Wittenoom Formation at the injection site (WSP 2024)
Iron	-	-	0.84 mg/L	Revised trigger value, equivalent to the highest representative background concentration observed in the expanded dataset at the point of recharge (WSP 2026)
Molybdenum	-	-	0.034 mg/L	95th percentile freshwater guideline value (ANZG 2018) (WSP 2026)
Nickel	-	-	0.018 mg/L	95th percentile value for the Valley Fill Aquifer at the injection site (WSP 2026)
Selenium	-	-	0.01 mg/L	95th percentile value for the Valley Fill Aquifer at the injection site (WSP 2024)
Uranium	-	-	0.004 mg/L	95th percentile of updated dataset (WSP 2026)

Parameter[1]	Discharge limit	Derivation	Trigger Value	Derivation
Zinc	-	-	0.086 mg/L	95th percentile value for the Valley Fill Aquifer at the injection site (WSP 2024)
Manganese	-	-	1.9 mg/L	95th percentile freshwater guideline value (ANZG 2018) (WSP 2026)
Total recoverable hydrocarbons	0.15 mg/L	Freshwater criterion for the protection of freshwater aquatic ecosystems for TPH (diesel) (Hobbs et al. 2018)	-	-
PFOS	0.00031 mg/L	Internally developed criterion for the protection of stygofauna on Barrow Island.	-	-

Note 1: All metals are dissolved metals

The delegated officer considers that while generic assessment levels may be suitable in the absence of more specific data, site-specific discharge limits and trigger values derived from specialised contaminant fate and transport modelling and stygofauna toxicity assessment are more appropriate. Should the licence holder wish to revise the values listed in Table 11 in the future, the delegated officer will assess the proposed changes following the completion of a Tier 3 risk assessment.

It is considered appropriate, especially considering the uncertainty regarding the extent of the zone of influence, that hydrogeological and geochemical models are continually updated and verified as more data becomes available. As such the licence holder will be required to conduct a suite of groundwater monitoring, and, as part of the licence holder's annual reporting requirements, provide a summary of the data and an update to the models. The delegated officer considers that if the specified trigger values are exceeded for three consecutive monitoring events, then an investigation into the exceedances will be required including an investigation to identify if any environmental impacts have occurred. A summary of all additional regulatory controls applied to the licence have been presented in Table 12.

Table 12: Summary of additional regulatory controls

Condition number	Regulatory control
33	Requirement to provide a set of background data for groundwater, surface water quality, vegetation health and stygofauna population data to be used as reference data to compare future operational monitoring data to.
37	Requirement to monitor a suite of parameters prior to reinjection on a continuous, monthly or quarterly basis.
38	Groundwater monitoring requirements for MAR scheme (including specification of trigger values).
39	Discharge limits for reinjection water.

Condition number	Regulatory control
40	Management actions in case of a discharge limit exceedance, three consecutive trigger value exceedances or surface expressions of groundwater and/or artesian conditions observed.
44	Requirement to annually validate the hydrogeological and chemical models for the MAR scheme.

6. Consultation

Table 13 provides a summary of the consultation undertaken by the department.

Table 13: Consultation

Consultation method	Comments received	Department response
Application advertised on the department's website 12 May 2025	None received	N/A
Shire of Ashburton advised of proposal 14 May 2025	None received	N/A
Department of Mines, Petroleum and Exploration (DMPE; formally Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) advised of proposal 14 May 2025	None received	N/A
Wintawari Guruma Aboriginal Corporation advised of proposal 14 May 2025	None received	N/A
Licence holder was provided with draft amendment on 28 August 2025	The licence holder provided comments on 25 September 2025 Refer to Appendix 1	Refer to Appendix 1
Licence holder was provided with a 2nd draft amendment on 24 December 2025	The licence holder provided comments on 4 February 2026 Refer to Appendix 2	Refer to Appendix 2
Licence holder was provided with a 3rd draft amendment on 12 February 2026.	The licence holder provided the following comments on 19 February 2026: • Condition 38, Table 9 Note 2 to include the word 'bore' • Condition 38, Table 9 for Nitrate (NO_3) as N trigger value of 2.4 mg/L. The licence holder	The department has updated Note 2 to read – Where a monitoring bore is damaged, destroyed or rendered inaccessible for monitoring purposes, a representative monitoring bore can be used in the

Consultation method	Comments received	Department response
	has requested the department's consideration to update the nitrate trigger value from 2.4 mg/L to 7.6 mg/L. To align the nitrate trigger value with the Pilbara-specific hardness-adjusted value of 7.6 mg/L (van Dam, 2022)	interim while a replacement monitoring bore is installed Condition 39, Table 10 already has Nitrate (as N) limit of 7.6 mg/L. It is not practicable to have the same limit and trigger value The department has retained the Nitrate limit of 7.6 mg/L (in Table 10) and removed the Nitrate (NO_3) as N trigger value of 2.4 mg/L from Table 9 (the Licence Holder concurred with this approach on 19/02/2026).

7. Conclusion

Based on the assessment in this amendment report, the delegated officer has determined that a revised licence will be granted, subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

7.1 Summary of amendments

Table 14 provides a summary of the proposed amendments and will act as record of implemented changes. All proposed changes have been incorporated into the revised licence as part of the amendment process. Additionally, while amending the licence, the delegated officer has updated the structure of the licence and reordered the existing condition set for readability. In updating the structure of the existing condition set, the delegated officer has not changed the intention or function of the existing condition set.

Table 14: Summary of licence amendments

Previous condition	Condition summary	Revised licence condition	Conversion notes
Front page	DWER file number	Front page	Updated DWER file number
Front page	Premises details	Front page	Updated premises details to reflect updated prescribed premises boundary and changing tenure details
N/A	Assessed prescribed premises categories	Front page	Addition of Category 57
2	Mobile crushing and screening	1	Updated numbering
6	Stormwater management	2	Updated numbering
7	Surface water discharge limit	3	Updated numbering
10	Spill clean-up requirements	4	Updated numbering

Previous condition	Condition summary	Revised licence condition	Conversion notes
11	Spill material disposal requirements	5	Updated numbering
12	Recovery and treatment equipment requirements	6	Updated numbering
14	Prevention of discharge of detergents	7	Updated numbering. Updated condition wording for improved clarity and readability
28	Hydrocarbon treatment requirement	8	Updated numbering
N/A	Used tyre storage	9	Addition of used tyre storage requirements
3	Treated wastewater discharge authorisation	10	Updated numbering
4	Record of WWTP discharge volumes	11	Updated numbering
5	WWTP monitoring requirements	12	Updated numbering. Additional column for units added to improve readability
8	Waste fines storage groundwater monitoring	13	Updated numbering. Additional column for units added to improve readability. Unit for depth to water updated to mbgl and mAHD to improve clarity of condition
9	Waste fines storage facility freeboard	14	Updated numbering
15	Dewatering water discharge	15	Updated numbering. Included that condition doesn't apply to dewatering water used for the MAR scheme
16	Duck Creek discharge volume monitoring	16	Updated condition wording for improved clarity and readability
29	Incremental tonnes plant infrastructure requirements	28	Updated numbering
30	Incremental tonnes plant compliance report	29	Updated numbering
31	Incremental tonnes plant departure requirements	30	Updated numbering
N/A	MAR scheme construction requirements	31	Added authorisation to construct MAR scheme
N/A	MAR scheme construction report	32	Added requirement to submit a report at the completion of construction of the MAR scheme

Previous condition	Condition summary	Revised licence condition	Conversion notes
N/A	MAR scheme construction report requirements	33	Added requirements for MAR scheme compliance report
N/A	MAR scheme commissioning and operation requirement	34	Added authorisation to begin commissioning and operation of the MAR scheme after the submission of the compliance report
N/A	MAR scheme operational infrastructure requirements	35	Added MAR scheme operational infrastructure requirements
N/A	MAR scheme authorised discharge points	36	Added MAR scheme authorised discharge points
N/A	MAR scheme emission and discharge monitoring	37	Added MAR scheme emission and discharge monitoring requirements
N/A	MAR scheme groundwater monitoring	38	Added MAR scheme groundwater monitoring requirements
N/A	MAR scheme discharge limits	39	Added MAR scheme discharge requirements
N/A	MAR scheme management actions	40	Added MAR scheme management action requirements
32	Monitoring standards	41	Updated numbering
33	Monitoring frequency standard	42	Updated numbering
34	Complaint records	43	Updated numbering
35	Annual Environmental Report	44	Updated numbering. Updated wording for improved clarity and readability. Inclusion of annual reporting requirements for MAR scheme
36	Annual Audit Compliance Report	45	Updated numbering
37	Auditable book	46	Updated numbering
38	Auditable book requirements	47	Updated numbering
Figure 1	Prescribed premises boundary	Figure 1	Updated figure with updated prescribed premises boundary
Figure 2	WWTPs and associated irrigation sprayfields	Figure 2	Updated figure with updated prescribed premises boundary

Previous condition	Condition summary	Revised licence condition	Conversion notes
Figure 3	Plant location	Figure 3	Updated figure with updated prescribed premises boundary
Figure 4	WFSF groundwater monitoring locations	Figure 4	Updated figure with updated prescribed premises boundary
Figure 5	Primary crusher and conveyor	Figure 5	Updated figure with updated prescribed premises boundary
Figure 6	Fuel storage facility	Figure 6	Updated figure with updated prescribed premises boundary
Figure 7	Dewatering monitoring sites	Figure 7	Updated figure with updated prescribed premises boundary
Figure 8	Landfill locations	Figure 8	Updated figure with correct locations
Figure 9	Silvergrass East Waste Dump	Figure 9	Updated figure with updated prescribed premises boundary
-	MAR scheme injection bores	Figure 10	Added figure showing location of MAR scheme injection bores overview
-	MAR scheme injection bores (Map 1)	Figure 11	Added figure showing insert of Figure 10
-	MAR scheme injection bores (Map 2)	Figure 12	Added figure showing insert of Figure 10
-	MAR scheme injection bores (Map 3)	Figure 13	Added figure showing insert of Figure 10
-	MAR scheme injection bores (Map 4)	Figure 14	Added figure showing insert of Figure 10
-	MAR scheme monitoring bore network	Figure 15	Added figure showing location of MAR scheme monitoring bore network
-	MAR scheme infiltration basins	Figure 16	Added figure showing location of MAR scheme infiltration basins
-	MAR scheme sedimentation pond	Figure 17	Added figure showing location of MAR scheme sedimentation pond

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18. WSP 2024, *Caves Creek Managed Aquifer Recharge Project H3 Hydrogeological and Risk Assessment*, Adelaide, South Australia.
19. WSP 2026, *Review of Draft Licence Trigger Values for the SGE MAR Scheme*, Adelaide, South Australia.

Appendix 1: Summary of licence holder's comments on 1st draft amendment report and draft conditions

Condition	Licence holder's comment		Department's response
	Suggested amendment	**Summary of licence holder comment**	
Duration	~~28/05/2025~~ 25/05/2030	The licence holder seeks to amend the licence expiry date to align with the extended term granted through the DWER-initiated amendment, authorised on 5 March 2025.	Amended.
Premises details	DWER information request as part of draft package: **[1. Licence holder to confirm correct premises details and provide updated list of tenements]** **[2. Applicant to provide updated coordinates]**	The tenements associated with the premises are confirmed in the following tenement list: Tenements - AML 70/04, AML 70/272, G47/01242, G47/01243, G47/1269, L47/00139, L47/00140, L47/00141, L47/00152, L47/00160, L47/00647, L47/00786, LG848907 and LPL N050438 The coordinates for the amended prescribed premises boundary are provided as an attachment.	Noted and amended.
9	Used tyre storage and disposal The licence holder must ensure that used tyres are stored in accordance with the following requirements: (a) No more than 5,000 tyres must be stored at the premises at any one time; ~~(b) Tyres should be stored in stacks that are no more than 60 m^2 and 3.7 m high;~~ ~~(c) Stacks of tyres should have a minimum spacing of 2.5 m between the base of each stack; and~~ ~~(d) There must be a minimum spacing of 18 m between every four stacks of tyres.~~	The Department of Fire and Emergency Services (DFES) provides guidance for the storage of tyres, focusing on fire risk mitigation through measures like: • Limiting stack area and height; • Providing clear separation distances between stacks; and • Ensuring access for firefighting While these principles are appropriate for high-risk urban settings, applying DFES guidance without adaptation for remote Pilbara mines leads to unnecessary clearing (to accommodate the enormous size: OTR haul truck tyres used on Pilbara mines are not like standard tyres, they measure 3.5 – 4.0 metres in diameter, 1.2 – 1.5 metres wide and weigh 3,500 – 5,500 kg), causing more extensive environmental impact than fire risk posed by tyre storage (OTR haul truck tyres are dense and have a significantly lower ignition risk than standard tyres. The ignition risk in the Pilbara is also inherently low due to the region's open and arid environment, where ignition sources are limited and any fire is unlikely to spread widely). The Licence holder requests to amend Condition 9 to remove the limitations on tyre stacking area and height, instead requesting: *b) tyre storage (number of tyres in stacks, area and height of stacks, separation distances between stacks) will be designed to limit the extent of spread of an established fire, to balance the environmental impacts of clearing against the low fire risk from the storage of OTR haul truck tyres.* The license holder also requests to amend Condition 9 to include the following requirements to manage the risk of fire and firewater from the storage of used tyres on the premises, consistent with other licences for our Pilbara operations: *c) Not located in Environmentally Sensitive Areas;* *d) Storage areas must be level, clear of vegetation, putrescible rubbish and other combustible material to mitigate the risk of fire;* *e) A firebreak at least 3 meters in width must be maintained around the boundary of tyre storage areas;* *f) Firefighting resources and water supply must be available on the prescribed premises with capacity to extinguish an established fire in tyre storage areas;* *g) Storage areas must include bunding and sumps sufficient to contain any water resulting from the fighting of tyre fires, and following the extinguishing of a fire, firewater must be contained to avoid discharges to the environment; and* *h) Used tyres must be stacked on their side walls or if stored on their treads, area baled with a securing device made from a non-combustible material*	The delegated officer considers that the licence holder's proposed controls meet the same outcome and intent of the original conditions. The delegated officer has adopted the licence holder's proposed conditions in part.
15	The licence holder must only discharge dewatering water ~~unless~~	The Licence holder requests to amend Condition 15 to explicitly authorise the SGE MAR scheme	The delegated officer notes that the licence holder's proposed wording

Condition	Licence holder's comment		Department's response
	Suggested amendment	**Summary of licence holder comment**	
	~~otherwise specified in Condition 36~~, from the Duck Creek discharge point as depicted in Schedule 1, Figure 7 *and/or from the SGE Managed Aquifer Recharge scheme reinjection points*.	as a dewatering discharge point.	meets the same intent, however, creates ambiguity and potentially contradicts Condition 36. The condition has not been updated.
31 Table 5: Design and construction installation requirements	Water filtration and treatment system • Must consist of a primary filtration system, ~~inclined plate settler and chemical dosing system for flocculant~~, chlorination *system and sedimentation pond*; • Must contain *concrete* bunded areas for the storage of chemicals and waste; and • Bunded areas must be capable of containing 110% of the volume of the largest container stored within.	The design for the SGE MAR scheme treatment system has been further refined by the engineering team during the assessment of the licence amendment application. As part of this design optimisation, the previously proposed treatment system, which included an Inclined Plate Settler (IPS) and flocculant dosing, is no longer required. Flocculants are effective at settling suspended solids however, they can also introduce residual compounds that may impact water quality. Eliminating the use of flocculent removes this potential contamination pathway. Instead, a sedimentation pond will be constructed to manage backflush water from the screen filters. The backflush water, containing entrained particulates, will be directed to a sedimentation pond for passive treatment via evaporation and infiltration. No chemical dosing is applied to the backflush water prior to discharge into the sedimentation pond. This approach eliminates the risk of flocculant or residual compounds being present in the injected water, ensuring that the injected water quality is inherently compatible with the receiving environment. The licence holder requests to amend Condition 31, Table 5 to reflect the design optimisation of the MAR scheme treatment system.	Noted. The delegated officer has updated the licence and amendment report to reflect the change in design.
	MAR scheme bores and recharge pads • Each recharge pad to accommodate ~~four~~ recharge bores ~~and a~~ and monitoring bore/s with a vibrating wire piezometer (VWP); • Must be installed with telemetry systems and remote control access; and • Injection bores and monitoring bores must be constructed in a manner that ensures no surface expression of groundwater ~~no pathway is created between the shallow and deep aquifer~~.	The requirement for each recharge pad to accommodate a defined number of reinjection and monitoring bores limits the opportunity to optimise the operational performance and environmental outcomes of the MAR scheme. Testing activities conducted under the 26D have identified bores with higher individual recharge capacities, as a result the configuration of each recharge pad may be adjusted during operation to account for individual bore performance. The MAR scheme will continue to operate within the approved design capacity, and any adjustments to the number of reinjection and monitoring bores on each pad will not result in an increase in total recharge volume beyond what has been assessed and approved. Comprehensive monitoring infrastructure, including standpipe monitoring bores and Vibrating Wire Piezometers (VWPs), will also be in place to assess recharge response across the scheme. Monitoring bores will be installed as required to ensure that groundwater response is effectively tracked and reported in accordance with regulatory and internal standards. As such, the licence holder requests that the requirement specifying the number of reinjection and monitoring bores on each pad be removed. In addition, the licence holder requests to amend the following design requirement. • Injection bores and monitoring bores must be constructed in a manner that ensures no surface expression of groundwater ~~no pathway is created between the shallow and deep aquifer~~. A degree of hydraulic connectivity was observed between the shallow and deep aquifer systems during test pumping, suggesting that some natural movement of water occurs between them. However, assessments indicate that the observed connectivity is limited and does not adversely affect the quality or stability of the aquifers. Nor does it compromise the operational integrity or environmental performance of the MAR scheme. To better reflect the existing nature of the aquifers and the negligible risk posed by the MAR scheme, the licence holder proposes to revise the design requirement to focus on the environmental outcome: ensuring no surface expression of groundwater.	The department sent a request for information to the licence holder on 29 October 2025 to seek clarity on what has already been constructed and confirm that no pathway was created between the shallow and deep aquifer upon bore construction. The licence holder provided a response on 12 November 2025 stating that: • Four shallow infiltration bores, one deep injection bore and a VWP has been constructed on each pad; • The licence holder confirmed that none of the MAR bores are screened across multiple aquifers. As the bores have already been constructed, the construction requirements have been removed from the licence.
	Deep pressurised reinjection bore backflush system • Must be constructed so that backflush is directed to ~~one of three~~ an infiltration basin.	As per previous comments, the requirement for water to be directed to a defined number of infiltration basins limits the opportunity to optimise the operational performance and environmental outcomes of the MAR scheme. Backflush flows are currently distributed across the three infiltration basins, with operational flexibility allowing each bore to discharge to any basin as required. The allocation of flows can be adjusted in response to operational factors such as basin water levels, available storage capacity, and basin depth. All basins are fitted with water level monitoring systems to support adaptive management, optimising water distribution between the basins. However, the number and configuration of infiltration basins may be required to change during the operational life of	The licence authorises specific discharge points, as such, if the licence holder wishes to construct additional infiltration basins in the future, then a licence amendment will need to be submitted so the new discharge point can be risk assessed. The construction requirement for this infrastructure has been removed.

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		the MAR scheme, depending on recharge performance and maintenance requirements. Adaptive management, including how and where water is directed is essential to support the site to optimise the operational performance and environmental outcomes of the MAR scheme. As such, the License holder requests that the requirement specifying the number of infiltration basins be removed. Any additional clearing required for the MAR scheme will be authorised under Native Vegetation Clearing Permit CPS 9985/1.	
32	The licence holder must within 30 calendar days of all items of infrastructure and equipment required by condition 31 being constructed and/or installed: (a) undertake an audit of their compliance with the requirements of conditions 31; and b) prepare and submit to the CEO an Environmental Compliance Report on that compliance.	The licence holder notes that the reinjection bores and recharge pads described under Condition 31 have been constructed and/or installed. Each recharge pad has been constructed to accommodate recharge bores and monitoring bores. The deep reinjection bore and microMAR bores were drilled under licences CAW210842 and CAW210843, granted under the *Rights in Water and Irrigation Act 1914* (RIWI Act). Drilling and test pumping commenced in Q4 2024, as this data was critical to inform the final design of the MAR scheme. Reinjection testing was subject to the provision of the Pilbara Groundwater Allocation Plan, which provides for test pumping of up to 50,000 kL per bore, up to a cumulative volume of 200,000 kL. The bore logs are attached as evidence of compliance and completion (Attachment 3).	The delegated officer notes that construction of the reinjection bores and recharge pads occurred prior to the licence amendment submission. Bore logs were received on 26 September 2025. While the above infrastructure has been removed from the construction requirements, the requirement to undertake a compliance audit has been retained for the infrastructure yet to be constructed (i.e. header pipeline and water filtration and treatment system).
33	The Environmental Compliance Report required by condition 33, must include as a minimum the following: (a) certification by a suitably qualified ~~hydrogeologist~~ *engineer* that the items of infrastructure or component(s) thereof, as specified in condition 31, have been constructed in accordance with the relevant requirements specified in condition 31; (b) as constructed plans, ~~bore logs~~ and a detailed site plan for the items of infrastructure or component of infrastructure specified in condition 31; (c) ~~a set of background data for the~~ *information collected prior to the commencement of the MAR scheme* including ~~background~~ groundwater quality data, surface water quality *data*, a vegetation health *report* and stygofauna population health *data*; **[3. Applicant to note: this data will be used as reference data to compare future operational monitoring data to]** ~~(d) Construction bore logs for monitoring bores SILVMW05, SILV-MW06, SILV-MW07, SILV-MW11, SILV-MW12, SILV-MW13, SILV-MW14, SILVMW15, SILV-MW17, SILV-MW18, SILV-MW19, SILV-MW20, SILV-MW21, SILV-M22, MB11SILV023, SILV_MW23, SILV_MW24, 20HSTD_M01, 20HSTD_M02, 20HSTD_M03, 20HSTD_M04, MB11SILV005, MB11SILV013 and MB11SILV019; and~~ (e) be signed by a person authorised to represent the licence holder and contains the printed name and position of that person.	Condition 33 (a) The licence holder requests that the condition be amended to allow for certification by a suitably qualified engineer, rather than a hydrogeologist. This change is sought to reflect the nature of the infrastructure being constructed and to ensure alignment with standard engineering practice, noting all reinjection bores and monitoring bores associated with the MAR scheme have already been installed. Condition 33 (b) and (d) The licence holder requests that the requirements to provide bore logs are removed from Conditions 33 (b) and (d). The reinjection bores and monitoring bores associated with the MAR scheme have already been installed. The bore logs are attached as evidence (Attachment 3). Condition 33 (c) The licence holder requests to amend Condition 33 (c) to reflect the available data for the area, and ensure the condition directly relates to the MAR scheme. Referring to information collected prior to the commencement of the scheme better represents the current data context, particularly given the potential influence of historic dewatering activities from the Silvergrass Operations. It is noted that the available vegetation health assessments are based on quadrat sampling and are more appropriately provided in report format; this is reflected in the proposed wording for the condition. The licence holder notes the Department's intent to use background data as a reference for assessing future operational monitoring results. The relevant background data can be provided in the Environmental Compliance Report. However, the licence holder submits that comparison of future operational monitoring results to background data is not an appropriate basis for interpretation because the existing background data represents regional aquifer conditions rather than 'baseline'. Without an established baseline which considers site-specific groundwater trends (aquifer heterogeneity) and natural variability (including climate influences and seasonal fluctuations), against which future monitoring results can be compared, the licence holder risks attributing natural and seasonal variation to MAR activities or misinterpreting operational impacts as within the range of background variability. The licence holder also requests confirmation that surface water quality data, a vegetation health report and stygofauna population health data will not be used as reference data against which future monitoring results can be compared. Groundwater is the pathway via which potential impacts associated with the MAR scheme could influence connected environmental receptors. Groundwater monitoring therefore represents the most direct, sensitive, and scientifically appropriate approach of detecting change. It provides a reliable basis for identifying (via monitoring), investigating and resolving (via a proportionate, risk-based response) potential impacts to ensure groundwater quality is protected. Provided that groundwater quality is protected (and no surface expression of recharge water occurs), the integrity of connected	<u>Condition 33 (a)</u> Amended. <u>Condition 33 (b)</u> Amended . <u>Condition 33 (c)</u> The delegated officer has not specified the way in which the background data must be presented. The licence condition has been updated for clarity, however, the delegated officer emphasises that the onus is on the licence holder to present the data in an appropriate format. The delegated officer confirms that the submitted data will be used as a baseline against which future monitoring results will be compared. It is noted that subsequent monitoring of receptor health is only required when a trigger value is exceeded in three consecutive monitoring events to determine if environmental impact has occurred as a result of that exceedance. This data may then be used to inform enforcement actions undertaken by the department as a result. Trigger values have predominantly been derived using the 95th percentiles of historical data provided by the licence holder and assumes that seasonal variability has been captured within this dataset. Statistically, the probability of exceeding a 95th percentile trigger value in three consecutive events is 0.0125%. The delegated officer therefore considers that such an occurrence represents a strong statistical likelihood that the MAR scheme is influencing water quality. The onus remains on the licence holder to demonstrate that any observed changes in groundwater quality are attributed to natural variability and the MAR scheme has not resulted in unacceptable environmental impact. Based on the information provided, the delegated officer considers the proposed management actions to function as a failsafe mechanism, intended to be activated only in the event that all other preventative controls have failed. Accordingly, these actions are not considered overly onerous and are deemed proportionate to the level of environmental risk.

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		environmental receptors is inherently protected. This includes local surface waters values, groundwater-dependent vegetation health and stygofauna population health, all of which rely on groundwater. Assessment of these receptors would not enhance environmental outcomes and would instead duplicate safeguards already embedded within the existing groundwater monitoring and management framework.	Condition 33 (d) The department sent a request for information to the licence holder on 29 October 2025 to seek clarity on why the Figure's provided as part of the licence holder's comments on the draft package had been reduced from what the licence holder originally proposed as the monitoring bore network. The licence holder provided a response on 12 November 2025 stating that the licence holder undertook a detailed validation of all the monitoring bores associated with the MAR scheme and identified that a number of the proposed bores were dry, non-operational or did not exist. The licence holder provided all construction bore logs for the verified bores. The delegated officer notes that some of the provided bore logs are incomplete and cannot be verified in full by the department. The delegated officer notes that the monitoring bores have not been constructed appropriately for contaminant monitoring. While the bores are still suitable for monitoring most contaminants, the delegated officer notes that the bores are not suitable for monitoring LNAPL and contaminants that tend to exist in the upper sections of an aquifer. These limitations should be noted for the purpose of data interpretation. If groundwater monitoring data begins to indicate contamination or it is found that there are data gaps in monitoring the shallow aquifer, the delegated officer will require a greater network of appropriately constructed bores to be installed.
35 Table 6: Infrastructure and equipment requirements	Header pipeline Must include: • ~~Automatic cut-outs in the event of a pipe failure; OR~~ • ~~Secondary containment sufficient to contain any spill for a period equal to the time between routine inspections; OR~~ • ~~Telemetry systems and pressure sensors along pipelines to allow detection of leaks and failures~~ • Active monitoring of telemetry systems and ~~pressure sensors~~ *flow deviation* to detect leaks or failures; • Routine inspections to verify integrity of containment systems; • Maintenance of automatic shut-off mechanisms to ensure functionality in the event of a pipe failure.	The licence holder notes that the current operational requirements included in Condition 35 relate specifically to the design and construction of the MAR scheme infrastructure, are replicated within Condition 31: design and construction requirements and includes items that would have already been completed and verified through the Environmental Compliance Report. The licence holder requests to amend Condition 35, Table 6 to reflect ongoing operational requirements. This will ensure the conditions remain relevant to the operational phase of the project, ensuring the MAR scheme is functioning as intended, optimising the operational performance and environmental outcomes - confirmed via appropriate monitoring and importantly, avoiding duplication of design and construction requirements that have been completed and reported against.	Amended.
	Water filtration and treatment system • All chemicals must be stored within bunded areas ~~must be~~ capable of containing 110% of the volume of the largest container stored within; • Backflush waste from the *screen filter system* must be *contained within the sedimentation pond*. • *Sedimentation pond must maintain a minimum freeboard of 500 mm at all times*.	The licence holder requests to reflect the design optimisation of the MAR scheme treatment system. See rationale for requested changes to Condition 31: Table 5: Design and construction requirements.	Amended.
	MAR scheme bores and recharge pads • ~~Each recharge pad to accommodate four recharge bores and a monitoring bore with a vibrating wire piezometer (VWP);~~ • Pumps must be able to be switched off remotely if required; • Maintain the telemetry system to support real-time	The licence holder requests that that the requirement specifying the number of reinjection and monitoring bores on each pad be removed. See rationale for requested changes to Condition 31: Table 5: Design and construction requirements.	The department sent a request for information to the licence holder on 29 October 2025 to seek clarity on what has already been constructed. The licence holder provided a response on 12 November 2025 stating that four shallow infiltration bores, one deep injection bore and a VWP has been constructed on each pad. The delegated officer notes that these are authorised discharge points and it is appropriate to list the infrastructure directly relating to the discharge and controls to be listed on the licence. The condition has not been updated as

<table>
<tr><th rowspan="2">Condition</th><th colspan="2">Licence holder's comment</th><th rowspan="2">Department's response</th></tr>
<tr><th>Suggested amendment</th><th>Summary of licence holder comment</th></tr>
<tr><td></td><td>monitoring and fault detection.
• ~~Must have installed a telemetry system.~~</td><td></td><td>requested.</td></tr>
<tr><td></td><td>Deep pressurised reinjection bore backflush system
• Must direct backflush to ~~one of three~~ an infiltration basin.</td><td>The licence holder requests that that the requirement specifying the number of infiltration basins be removed. See rationale for requested changes to Condition 31: Table 5: Design and construction requirements.</td><td>The licence authorises specific discharge points, as such, if the licence holder wishes to construct additional infiltration basins in the future, then a licence amendment will need to be submitted so the new discharge point can be risk assessed. The condition has not been changed.</td></tr>
<tr><td></td><td>Infiltration basins
• Must maintain a minimum freeboard of 500 mm at all times.
[4. Applicant to provide figure with infiltration basin location]</td><td>The locations of the infiltration basins and the sedimentation pond are shown in Attachments 4 and 5, respectively.</td><td>Noted.</td></tr>
<tr><td>36</td><td>The licence holder must ensure that only the emissions specified in Table 7, are discharged only from the corresponding discharge point and only at the corresponding discharge point location as part of the MAR scheme.
Table 7: Authorised discharge points for MAR Scheme
<table>
<tr><th>Emission</th><th>Discharge Point</th><th>Discharge Point Location</th></tr>
<tr><td rowspan="2">Groundwater (sourced from the Silvergrass East dewatering bores)</td><td>~~Valley fill aquifer (shallow)~~</td><td rowspan="2">As shown on Figure 10 in Schedule 1: Maps</td></tr>
<tr><td>~~Fracture rock aquifer (deep)~~
MAR reinjection bores</td></tr>
<tr><td rowspan="2">Backflush water</td><td>Infiltration basin</td><td rowspan="2">[5. Applicant to provide figure with infiltration basin location]</td></tr>
<tr><td>Sedimentation pond</td></tr>
</table></td><td>The licence holder requests the inclusion of the sedimentation pond as an authorised discharge point for the MAR scheme. The locations of the infiltration basins and the sedimentation pond are shown in Attachments 4 and 5, respectively.</td><td>Amended to include sedimentation pond.
The specification of the two distinct aquifers as discharge points has not been removed, as requested. The delegated officer maintains that the aquifers represent separate hydrogeological units, which is further supported by the differing management actions proposed by the licence holder for the shallow and deep injection bores. For clarity, MAR scheme injection bores have been added to the description.</td></tr>
<tr><td>37
Table 8: Emissions and discharge monitoring</td><td>The licence holder must monitor emissions in accordance with the requirements specified in Table 8 and record the results of all such monitoring.
Table 8: Emissions and discharge monitoring
<table>
<tr><th>Discharge Point</th><th>Monitoring Location</th><th>Parameter</th><th>Frequency</th></tr>
<tr><td rowspan="4">MAR Scheme</td><td rowspan="4">Process measurement station</td><td>Reinjection volume</td><td rowspan="4">Continuous</td></tr>
<tr><td>Temperature</td></tr>
<tr><td>pH</td></tr>
<tr><td>EC</td></tr>
</table></td><td>Background water quality has been assessed as part of the H3 Hydrological Assessment (Appendix 4). Based on the water quality assessment, the licence holder requests that that the monitoring requirements be amended, as follows.
<u>Volumes</u>:
Reinjection volumes are a key operational parameter for the MAR scheme, influencing groundwater levels and the risks of potential mounding and surface expression. The licence holder requests that the requirement for continuous monitoring of reinjection volumes be included in Condition 37 to support consistency across licences, transparency and importantly, provide key information (when embedded alongside associated water quality monitoring requirements) for identifying, investigating and resolving (via a proportionate, risk-based response) potential impacts to ensure groundwater quality is protected.
<u>Nitrate</u>:
A system for real-time monitoring of key operational parameters, including flow rates, pressure levels, and water quality indicators has been included in the MAR scheme design. The system is capable of monitoring temperature, pH, turbidity, total suspended solids (TSS), electrical conductivity (EC), and residual chlorine. The system does not include instrumentation capable of providing real-time or continuous monitoring of nitrate (NO_3) concentrations. As such, the License holder requests that the requirement for continuous monitoring of nitrate be removed and instead, annual monitoring of nitrate concentrations be implemented as part of the broader groundwater quality monitoring program.
This is supported by the hydrogeological context of the Greater Brockman region, where nitrate is naturally elevated in groundwater, suggesting that the aquifer is expected to be relatively insensitive to changes in nitrate concentrations. Further, nitrate is not expected to be</td><td><u>Reinjection volume</u>
Reinjection volume has been added as requested.
<u>Nitrate</u>
Nitrate (as N) has been retained and the frequency has been amended to monthly. Annual monitoring is not considered frequent enough to prevent impacts if a spike in nitrate concentrations did occur.
<u>TRH and PFOS:</u>
The delegated officer acknowledges the licence holder's position regarding the low likelihood of PFOS and TRH contamination in the source water for the MAR scheme. However, a potential source of both PFOS and TRH contamination has been identified within the Silvergrass operations, including legacy use of AFFF foam and hydrocarbon refueling infrastructure.
As outlined in the department's request for information dated 5 March 2025, the licence holder was requested to provide evidence demonstrating that the source water is free from these contaminants. To date, this information has not been provided. In the absence of such evidence, and in accordance with the department's regulatory framework, the precautionary principle and the Environmental Protection Authority's (EPA) Inland Waters Environmental Quality Guideline, the delegated officer has determined that quarterly monitoring of PFOS and TRH is necessary to address uncertainty regarding the presence of these contaminants in the source water.</td></tr>
</table>

<table>
<tr><th>Condition</th><th colspan="2">Licence holder's comment</th><th>Department's response</th></tr>
<tr><th></th><th>Suggested amendment</th><th>Summary of licence holder comment</th><th></th></tr>
<tr><td></td><td>
<table>
<tr><td></td><td>Turbidity</td><td></td></tr>
<tr><td></td><td>TSS</td><td></td></tr>
<tr><td></td><td>Residual chlorine</td><td></td></tr>
<tr><td></td><td>~~Nitrate (as N)~~</td><td></td></tr>
<tr><td></td><td>Nitrate (as NO_3_N)</td><td>Annually</td></tr>
<tr><td></td><td>~~TRH~~</td><td>~~Monthly~~ Annually</td></tr>
<tr><td></td><td>~~PFOS~~</td><td>~~Monthly~~ Annually</td></tr>
<tr><td>Reinjection pad monitoring bores</td><td>Surface water level</td><td>Continuous</td></tr>
</table>
</td><td>concentrated through operational processes, as the reinjected water is sourced directly from the same aquifer ensuring that baseline water quality is inherently compatible with the receiving environment and the nature of the MAR system limits the potential for contamination. As such, the risk of nitrate exceedances is considered negligible.

Accordingly, annual monitoring is considered scientifically robust and proportionate to the risk profile of nitrate in this setting. This approach ensures that trends in nitrate concentrations can be effectively monitored, while removing the redundancy of continuous monitoring requirements that do not provide additional environmental protection or operational management benefit.

<u>PFOS and TRH</u>:

The licence holder also requests that the requirement to monitor PFOS and TRH be reconsidered based on the negligible risk of contamination from external sources:

Aqueous Film Forming Foam (AFFF) products containing persistent, bioaccumulative and toxic substances, including PFOS, have been removed from all Rio Tinto Iron Ore sites for several years. Fluorine-free foam is now used exclusively, eliminating the primary source of PFOS contamination.

There is no current use of PFOS and limited historical use (legacy residual contamination associated with firefighting foams historically stored within workshops) at the Silvergrass Operations. Monitoring from potable bores throughout the operations has consistently returned results below detectable limits for PFAS. PFAS testing at nearby Nammuldi operations recorded PFOS concentrations between <0.0002 µg/L and 0.0059 µg/L, with the closest monitoring bore MB22NAM012 (located approximately 7 km east of Silvergrass) recording a PFOS concentration of 0.001 µg/L, below the default guideline value of 0.0091 µg/L for aquatic ecosystem protection (ANZG, 2023). Given this context, the risk of PFOS entering the recharge water via operational activities or asset degradation is low.

Similarly, TRH is considered a low risk parameter. The in-pit refuelling facility at the Silvergrass Operations has been appropriately designed to mitigate any spill risks, and asset integrity monitoring is in place to prevent ingress of hydrocarbons into the dewatering bores. TRH is sampled on an ad hoc basis when new bores are drilled to confirm the drilling process has not introduced hydrocarbon contamination into the aquifer. Monitoring from potable bores throughout the operations has consistently returned results below detectable limits for TRH; monitoring of dewatering discharge to Duck Creek in May 2024 (representative of the source water for the MAR scheme) confirm TRH levels (C10–C40) of <0.1 mg/L, below detectable limits.

Potential PFOS and hydrocarbon contamination sources are located a considerable distance from the production bores that are the source of the reinjected water. This spatial separation provides a natural protective buffer, significantly reducing the likelihood of any contaminant migration into the MAR system.

The nature of the MAR system further mitigates the risk of these, or other contaminants being introduced into recharge water: Firstly, the reinjected water originates in the same aquifer, ensuring that baseline water quality is inherently compatible with the receiving environment. Secondly, the process minimises opportunities for external contamination during water transfer. Controls, including bore integrity monitoring, routine cleaning and flushing, filtration and treatment further reduce the likelihood of contamination, ensuring that baseline water quality is inherently compatible with the receiving environment.

Thirdly, any contamination that did occur would be expected to be identified (via monitoring), investigated and resolved via a proportionate, risk-based response to ensure that aquifer quality is maintained.

As a result, the risks associated with PFOS and hydrocarbons from external contamination sources are considered negligible. It is important that licence conditions adopt a level of monitoring proportionate with the inherently low risk profile of the scheme. Monthly monitoring of PFOS and TRH concentrations is considered disproportionate to the negligible risk of contamination from external sources. This is supported by consistently low or non-detectable concentrations of contaminants in current monitoring.

As such, the licence holder requests that the requirement to monitor PFOS and TRH be removed (or alternatively, that the monitoring frequency be revised to annually).</td><td>The department notes the licence holder's reference to operational controls and historical monitoring data. However, the delegated officer does not consider monitoring results 7 km from the injection water source as an appropriate line of evidence to verify the absence of PFAS in the source water. Similarly, the licence holder's comments are not considered sufficient to constitute direct evidence of the absence of TRH in the source water. The delegated officer considers that TRH and PFAS may cause impact to stygofauna health and PFAS also has the potential to migrate to the Caves Creek system due to its persistent nature.

Until such evidence is provided, the risk profile remains unchanged, and the current monitoring frequency is considered appropriate and proportionate to the level of uncertainty and potential environmental risk particularly given the presence of stygofauna in the receiving aquifer.

Should the licence holder wish to seek a variation to the monitoring frequency in future, a formal application supported by robust evidence demonstrating the absence of PFAS (or, at a minimum PFOS) and TRH in the source water will be required.</td></tr>
</table>

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38 Table 9: Groundwater monitoring of ambient concentration	The licence holder must monitor groundwater ~~for~~ concentrations of the identified parameter(s) in accordance with Table 9.	The MAR scheme uses the abstracted water from production bores at Silvergrass, reinjected into the same aquifer below Caves Creek to recharge the shallow and deep groundwater reserves. Given that the reinjected water originates in the same aquifer, the baseline water quality is inherently compatible with the receiving environment. As such, the likelihood of water quality exceeding background concentrations or representing a material risk to the aquifer or the ecology, is inherently low. The licence holder requests to amend Condition 38, as outlined below and summarised in Attachment 6, to reflect the low risk profile of the MAR scheme. The licence holders notes that the naming conventions and number of monitoring bores have been updated in Table 9 to reflect the as-drilled bore details. Further, the Groundwater Operating Strategy (GWOS) also provides a framework for monitoring and management of potential risks associated with reinjection water quality, ensuring that risks are identified, assessed and addressed via a proportionate, risk based response. Amendments are requested to ensure alignment of monitoring obligations between the Licence and the GWOS. <u>Trigger values:</u> The licence holder requests the removal of groundwater trigger values and instead, requests the inclusion of specified values that reflect the low likelihood of water quality exceeding background concentrations or representing a material risk to the aquifer or the connected environmental receptors. As noted above, the reinjected water is sourced from the same aquifer, ensuring baseline water quality is inherently compatible with the receiving environment. Geochemical modelling has demonstrated that groundwater from the Valley Fill Aquifer, Calcrete Aquifers, and Fractured Rock Aquifers share similar chemical signatures and concentrations. This similarity is expected to limit changes in mineral saturation during abstraction and reinjection. Therefore, the risk of water quality degradation through alteration of aquifer geochemistry is considered low. The licence holder notes that the Department has selected site-specific trigger values using the less conservative 95th percentile for groundwater samples at the injection site. However, the iron trigger value of 0.028 mg/L, based on the 95th percentile for the Wittenoom Formation (WSP 2024), is lower than the corresponding 95th percentile value for the Marra Mamba Aquifer at the same location, which is 0.05 mg/L (WSP 2024). Given the naturally higher background concentrations of iron commonly observed in Pilbara aquifers, the licence holder requests that the higher value of 0.05 mg/L be adopted as the specified value for iron to better reflect regional groundwater conditions. Aquifers in the Pilbara region are characterised by naturally elevated concentrations of certain analytes, these concentrations can differ markedly both within and between aquifer formations. There is also natural variability to consider, concentrations of analytes can fluctuate seasonally, in response to recharge events or subtle changes in groundwater flow pathways. There are some instances where the concentrations of analytes recorded in the source groundwater are naturally higher than the background concentrations in the receiving aquifer. Specified values are nominated to reflect that any exceedances of background or site specific 'trigger' values may be attributable to the presence of naturally elevated concentrations of certain analytes, such as iron, or represent this inherent natural variability rather than a change attributable to reinjection activities and importantly, such exceedances are not expected to represent a material risk to the aquifer or associated ecological values. The nature of the MAR system also mitigates the risk of contaminants being introduced into recharge water (particularly following the removal of flocculant from the water treatment system design). <u>Parameters</u>: The licence holder requests the removal of several analytes listed in Table 9, with the intent to adopt a standardised groundwater monitoring suite. This approach is consistent with the rationale supporting recent updates to the groundwater monitoring program within Rio Tinto Iron Ore's Pilbara Groundwater Operating Strategies. The proposed monitoring suite includes physical parameters, major ions, nutrients, and metals that are relevant to the operations, representative of the receiving environment and consider pathways of environmental risk. Aligning the monitoring suite with the characteristics of the receiving environment and proportionate to the risk profile of the scheme, delivers a monitoring program that is scientifically robust and focused on environmental outcomes: ensuring	<u>Trigger value – iron:</u> The trigger value for iron has been updated to align with the 95th percentile for the Marra Mamba Formation as requested. <u>Trigger values:</u> The department notes the licence holder's statement "*Given that the reinjected water originates in the same aquifer, the baseline water quality is inherently compatible with the receiving environment. As such, the likelihood of water quality exceeding background concentrations or representing a material risk to the aquifer or the ecology, is inherently low*." However, this is contrasted by the acknowledgement that "*there are some instances where the concentrations of analytes recorded in the source groundwater are naturally higher than the background concentrations in the receiving aquifer*." This contradiction highlights the need for a robust and precautionary monitoring program. Trigger values have been derived from the 95th percentiles provided by the licence holder. It is assumed that the licence holder has provided a robust data set that accounts for natural variability, including seasonal fluctuations. The use of the 95th percentiles is consistent with national guidance and ensures that the trigger values reflect the upper range of natural background conditions. Importantly, a management response is only triggered if a value is exceeded in three consecutive monitoring events. Statistically, the likelihood of this occurring by chance is approximately 0.0125%, indicating that such an exceedance would represent a significant deviation from baseline conditions. Where an exceedance is confirmed, the licence holder is expected to investigate the cause. If the investigation concludes that the exceedance is due to natural variability or background conditions, no further action is required and the delegated officer may choose to review the relevancy of the trigger value. If as the licence holder states, the water quality is compatible and the risk of contamination is low, then the trigger values should not be exceeded and there is no additional onus on the licence holder. The department notes that the licence holder wishes to align the obligations of the licence to the GWOS. However, the Part V licence is the primary regulatory instrument. As such, if the licence holder wishes to align the two regulatory documents, the licence holder is required to update and submit an amended GWOS to the department. <u>Parameters:</u> The department acknowledges the licence holder's request to remove several analytes from Table 9 in favour of adopting a standardised groundwater monitoring suite. While the rationale provided is noted, including alignment with recent updates to the GWOS, the delegated officer does not support the proposed amendment. The current monitoring suite has been developed to reflect the specific environmental context of the MAR scheme, including the presence of sensitive ecological receptors such as stygofauna and the potential for localised changes in groundwater quality. The analytes listed in Table 9 have been selected to ensure that any changes in water chemistry, whether due to operational activities, mobilisation of legacy contaminants or geochemical interactions can be detected and appropriately managed. Accordingly, the delegated officer considers the current analyte suite to be appropriate and scientifically robust. <u>Frequency:</u> The current monitoring frequency has been set to ensure that any changes in groundwater quality whether due to operational activities, natural

<table>
<tr><th rowspan="2">Condition</th><th colspan="2">Licence holder's comment</th><th rowspan="2">Department's response</th></tr>
<tr><th>Suggested amendment</th><th>Summary of licence holder comment</th></tr>
<tr><td></td><td></td><td>groundwater quality is protected.

<u>Frequency:</u>

The licence holder requests that the monitoring frequency be amended to annual for all analytes, with the exception of field measurements. Annual monitoring is considered scientifically robust and proportionate to the risk profile of the parameters in this setting. This approach enables effective tracking of concentration trends while avoiding the redundancy of more frequent monitoring, which does not provide additional environmental protection or operational management benefit.

The revised monitoring frequency also aligns with the groundwater monitoring requirements for the MAR scheme proposed in the GWOS. Ensuring alignment of monitoring obligations between the licence and the GWOS is critical to avoid inconsistencies – divergence in monitoring requirements increases monitoring and reporting complexity, and elevates the risk of inadvertent non-compliance, though environmental outcomes and operational performance are not affected. Importantly, alignment of monitoring obligations between the licence and the GWOS also ensures that monitoring obligations are proportionate to the risk – focused on identifying (via monitoring), investigating and resolving (via a proportionate, risk-based response) potential impacts to ensure groundwater quality is protected.

Proposed changes to Table 9 are included in Attachment 6.</td><td>variability, or unforeseen events are detected in a timely manner. Quarterly monitoring provides the necessary resolution to identify emerging trends or exceedances early, enabling a proportionate and risk-based management response. Annual monitoring would significantly reduce the licence holder's and the department's ability to detect and respond to potential impacts, particularly in a system that interacts with sensitive ecological receptors such as stygofauna.

The delegated officer has acknowledged there will be a zone of influence where stygofauna populations may be impacted. Given the department is authorising a discharge where impacts are likely, and the extent of those impacts remains uncertain, quarterly monitoring is required to address these uncertainties. Furthermore, the delegated officer notes that quarterly groundwater monitoring is standard practice where discharges may affect sensitive receptors.

The department also notes the licence holder's desire to align the GWOS with the licence. However, as previously stated, the Part V licence is the primary regulatory instrument. Where inconsistencies exist, the GWOS must be updated to reflect the requirements of the licence, not vice versa.

Accordingly, the delegated officer considers the current monitoring frequency to be appropriate and proportionate to the level of uncertainty and potential environmental risk. No changes will be made to the monitoring frequency at this time.</td></tr>
<tr><td>39

Table 10: Emissions and discharge limits</td><td>The licence holder must ~~ensure that~~ compare emissions from the discharge point listed in Table 10 for the corresponding parameter ~~do not exceed~~ with the corresponding target when monitored in accordance with condition 37.

Table 10: Emissions and discharge targets
<table>
<tr><th>Discharge point</th><th>Sample point</th><th>Parameter</th><th>~~Limit~~ Target</th></tr>
<tr><td rowspan="7">MAR scheme injection bores</td><td rowspan="7">Process measurement station</td><td>Temperature</td><td>~~31C~~
Reinjection temperature must not exceed source groundwater temperature by more than 3°C.</td></tr>
<tr><td>pH</td><td>~~6.5-8.5~~
6.6-9.3</td></tr>
<tr><td>Residual chlorine</td><td>~~1 mg/L~~
0.5 - 1 mg/L</td></tr>
<tr><td>Total recoverable hydrocarbons</td><td>0.15 mg/L</td></tr>
<tr><td>PFOS</td><td>0.31 ug/L</td></tr>
<tr><td>Nitrate (as NO3-H)
~~Nitrate (as N)~~</td><td>~~7 mg/L~~
15 mg/L</td></tr>
</table></td><td>As noted above, the MAR scheme uses the abstracted water from production bores at Silvergrass, reinjected into the same aquifer below Caves Creek to recharge the shallow and deep groundwater reserves. Given that the reinjected water originates in the same aquifer, the baseline water quality is inherently compatible with the receiving environment. As such, the likelihood of water quality exceeding background concentrations or representing a material risk to the aquifer or the ecology, is inherently low. The Licence holder requests to amend Condition 39 to reflect the low risk profile of the MAR scheme.

Specifically, the licence Holder requests the removal of discharge water quality limits and instead, requests the inclusion of targets that accurately reflect background water quality and natural variability.

Background water quality has been assessed as part of the H3 Hydrological Assessment (Appendix 4). Based on the water quality assessment, the licence holder requests that that the targets are amended, as follows:

<u>Temperature</u>:

The current reinjection temperature limit of 31°C does not adequately account for the natural variability of source water temperatures. Groundwater monitoring data from the Silvergrass area consistently shows temperatures ranging from 29°C to 32°C demonstrating that natural variability exceeds the prescribed limit. Aquifer hydrogeology influences temperature dynamics. The high hydraulic connectivity within the receiving aquifers facilitates rapid dissipation of heat through groundwater flow, limiting the potential for localised elevated temperatures at the point of reinjection. Recharge depth also influences the response, with deeper recharge providing greater thermal buffering. In addition, the thermal inertia of the surrounding geological substrate acts as a thermal buffer during reinjection, slowing temperature changes, ensuring that injected water equilibrates quickly with ambient aquifer conditions (WSP, 2024). Given these natural moderating processes and the background variability of aquifer temperatures, the licence holder requests that the target temperature be amended to not exceed source groundwater temperature by more than 3°C. This approach provides a scientifically robust, risk-based limit that reflects actual aquifer conditions while ensuring protection of environmental values and operational performance.

<u>pH</u>:

The Licence Holder also requests that the target range for pH is amended to 6.6-9.3 to reflect the natural pH range observed in the aquifer, based on the groundwater quality dataset used in the H3 Hydrological Assessment (WSP, 2024), ensuring consistency with site-specific baseline conditions.</td><td>The department acknowledges the licence holder's request to replace discharge water quality limits with targets that reflect background water quality and natural variability. However, the delegated officer does not support this amendment.

Limits have been applied to parameters that are not expected to naturally attenuate or where concentrations may pose a risk to ecological receptors, namely stygofauna. These limits are necessary to ensure that reinjection activities do not result in adverse changes to groundwater quality that could result in unacceptable levels of stygofauna mortality.

The department's regulatory framework does not support the use of targets in place of enforceable limits. Targets are not considered sufficient for compliance or enforcement purposes. Limits are essential to ensure that environmental protection objectives are met and that any exceedances are appropriately investigated and managed.

If, as stated by the licence holder, the reinjection water is compatible with the receiving aquifer, then compliance with the prescribed limits should be readily achievable.

Accordingly, the delegated officer considers the current discharge limits to be appropriate and proportionate to the level of environmental risk. No changes will be made to Condition 39 at this time.

<u>Temperature:</u>

The department sent a request for information to the licence holder on 29 October 2025 to seek clarity on how the licence holder intended to monitor temperature in the target aquifer to ensure compliance with the limit proposed by the licence holder. The licence holder provided a response on 12 November 2025 stating that they have revisited their request and instead wish to amend the condition to state "the reinjection temperature shall not exceed 31°C by more than 3°C."

The delegated officer acknowledges that meeting this limit may be challenging due to water being conveyed via a 14 km overland pipeline.The delegated officer notes that the aquifer has some buffering capacity for temperature. Accordingly, the limit has been updated to 34°C as requested, with the understanding that at this temperature, changes in regional aquifer temperature should not occur beyond the zone of influence.</td></tr>
</table>

Condition	Licence holder's comment		Department's response
	Suggested amendment	Summary of licence holder comment	
		Nitrate: Water quality monitoring data also confirms that the only parameters exceeding guideline values are nitrate and zinc, both naturally elevated across the Greater Brockman region and not indicative of mining-related contamination. The Licence Holder requests that the target concentration for nitrate (NO3) is amended to 15 mg/L to reflect the naturally elevated concentrations already occurring in the aquifer and aligned with the site-specific guideline values (SSGV) for nitrate toxicity in Pilbara receiving waters (van Dam et al, 2022). Chlorine: The MAR scheme includes sodium hypochlorite dosing. Chlorine is the only chemical intentionally introduced into the MAR system for biofouling control and is maintained within a standard operational range of 0.5–1 mg/L. Chlorine is highly unstable in groundwater, reacting with dissolved natural organic matter and minerals, resulting in the degradation of the chlorine residuals to non-detectable levels. Typical hydrogeological conditions of the Pilbara region, characterised by elevated groundwater temperatures and the presence of naturally occurring organic matter, accelerate the degradation process. As a result, the potential for persistence of chlorine within the receiving aquifer is negligible, ensuring that the MAR will not alter the groundwater quality or pose a risk to connected environmental receptors. PFOS and TRH: As already discussed, potential PFOS and hydrocarbon contamination sources are located a considerable distance from the production bores that are the source of the reinjected water. This spatial separation provides a natural protective buffer, reducing the likelihood of any contaminant migration into the MAR system. The nature of the MAR system further mitigates the risk of contaminants being introduced into recharge water: Firstly, the reinjected water originates in the same aquifer. Secondly, the process minimises opportunities for external contamination during water transfer. Controls, including bore integrity monitoring, routine cleaning and flushing, filtration and treatment reduce the likelihood of contamination, ensuring that baseline water quality is inherently compatible with the receiving environment. Thirdly, any contamination that did occur would be expected to be identified (via monitoring), investigated and resolved via a proportionate, risk-based response to ensure that aquifer quality is maintained. As a result, the risks associated with PFAS and hydrocarbons from external contamination sources are considered negligible. It is important that licence conditions adopt a level of monitoring proportionate with the inherently low risk profile of the scheme. The licence holder requests that the monitoring of PFOS and TRH, and the associated target concentrations, be removed.	pH: The adopted limits for pH are based on the simplified assessment levels specified in *Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 2) Managed Aquifer Recharge* (NRMMC 2009). These limits are designed to protect aquifer integrity and ecological values, including stygofauna, and are consistent with national guidance. Furthermore, the minimum and maximum pH values recorded at the MAR site all fall within this range, confirming that the adopted limits are representative of site-specific conditions. The delegated officer notes that the guideline specifies that to derive acceptance criteria that is outside of the simplified assessment level range, the licence holder must demonstrate geochemical modelling showing that dissolution will not occur, or is so slow, or that aquitard or well instability will not occur within the working life of the well (50 years minimum) and clay cation exchange calculations show that dispersion and slumping of clays in the aquifer and aquitard will not occur within the working life of the well (50 years minimum). Should the licence holder wish to seek a variation to the pH limit, a licence amendment application must be submitted accompanied with the appropriate data. Nitrate: The adopted limit for nitrate (as N) of 7 mg/L is based on recent research conducted in New Zealand. This limit is more conservative than the concentration proposed by the licence holder and is over three times higher than the maximum recorded concentration for nitrate (as N) in the receiving aquifers. The delegated officer considers this limit to be appropriate and proportionate to the environmental risk. The limit provides a protective threshold while allowing for natural variability and operational flexibility. Accordingly, the nitrate (as N) limit has not been amended at this time. Chlorine: The licence holder has proposed the same limit that was set by the department. The delegated officer does not consider there to be a valid reason to include a lower limit in this instance. Accordingly, the residual chlorine limit remains the same. PFOS and TRH: The department acknowledges the licence holder's request to remove PFOS and TRH from the monitoring suite and associated limits. However, the delegated officer does not support this amendment. As previously stated, potential sources of PFOS and hydrocarbon contamination have been identified within the Silvergrass operations, including legacy use of firefighting foams and refuelling infrastructure. While operational controls and spatial separation may reduce the likelihood of contamination, they do not eliminate the risk. Limits for TRH and PFOS have been applied based on scientifically derived criteria. Both contaminants have the potential to adversely affect stygofauna health, with PFOS being highly mobile and capable of bioaccumulation. These characteristics warrant precautionary monitoring, particularly in aquifers supporting sensitive ecological receptors. To date, the licence holder has not provided sufficient evidence demonstrating that the source water is free from harmful concentrations of PFOS and TRH. If, as stated, the source water is compatible with the receiving aquifer and does not contain these contaminants, then compliance

Condition	Licence holder's comment		Department's response
	Suggested amendment	**Summary of licence holder comment**	
			with the limits should be readily achievable. The current monitoring requirements are considered proportionate to the level of uncertainty and potential environmental risk. As such, the limits for PFOS and TRH will remain on the licence.
40 Table 11: Management Actions	Event: A discharge ~~limit~~ *target* specified within Table 10 is exceeded over five consecutive events (for daily averages) or exceeded for one event (for annual samples). Management action: (a) The licence holder must investigate the cause of the exceedance within ~~24 hrs~~ *7 days* of becoming aware of the exceedance; (b) Where the investigation identifies injection water quality has been contaminated by the MAR process, ~~immediately cease discharging via injection or infiltration; and~~ *implement mitigation actions to prevent further exceedances. This may include, but is not limited to:* • *Investigating the source of the contamination* • *Modifying the treatment process* • *Adjusting the discharge volume* (c) The licence holder must report the investigation to the CEO including proposed resolutions within 21 days.	Given the remote nature of the MAR scheme in the Pilbara region, the requirement to *(a) investigate the cause of a discharge exceedance within 24 hours of becoming aware of the exceedance* is not practical; accessing the MAR location, collecting and analysing water quality samples (and in many cases, laboratory analysis which is necessary to confirm exceedances) cannot be completed within 24 hours. The licence holder requests to amend Condition 40 to require the investigation of the cause of exceedances within 7 days to reflect the remote nature the MAR scheme. The requirement to *(a) investigate the cause of a discharge exceedance within 24 hours of becoming aware of the exceedance and (b) where the investigation identifies injection water quality has been contaminated by the MAR process, immediately cease discharging via injection or infiltration* also ignores the low risk profile of the MAR scheme. These responses are considered appropriate in high risk scenarios, such as where the reinjected water originates from a different aquifer or where there is potential for contamination during the process. However, the reinjected water in this scheme originates from the same aquifer, ensuring that baseline water quality is inherently compatible with the receiving environment and as such, the likelihood of water quality exceeding background concentrations or representing a material risk to the aquifer or the ecology, is inherently low. Further, the nature of the MAR system limits the potential for contamination. Any exceedance that did occur would be expected to be identified (via monitoring), investigated and resolved via a more proportionate, risk-based response. The licence holder requests to amend Condition 40 to reflect the inherently low risk profile of the MAR scheme. The proposed amendments introduce a risk-based, adaptive management approach, allowing for appropriate mitigation actions (which may include investigating contamination sources, adjusting treatment processes, or modifying discharge volumes) to be determined and then implemented as required while maintaining operational continuity, providing a more efficient, effective and environmentally responsible solution.	(a) The department notes that the intent of the condition was not that an investigation be complete in 24 hours, but rather an investigation commences within 24 hours of the exceedance being identified. This requirement ensures that investigations are initiated promptly, allowing for timely identification of potential contamination sources and the implementation of appropriate mitigation measures. The condition has been updated to reduce ambiguity and clarify this intent. (b) The department also notes that the requirement to cease discharge via injection or infiltration only applies where the investigation confirms that the water quality has been compromised by the MAR process (e.g. contamination resulting from a hydrocarbon spill). This safeguard is necessary to protect the aquifer and associated stygofauna from harm. Where no contamination has occurred, the licence holder is expected only to submit a report to the department outlining the cause of the exceedance and the proposed mitigation strategies, such as adjustments to treatment processes or discharge volumes. The delegated officer considers that the licence holder's proposed adaptive management approach is already consistent with the intent of the condition. Accordingly, the condition has not been amended.
	Event: A ~~specific trigger~~ *specified value* as specified detailed within Table 9 is exceeded for ~~three~~ *two* consecutive monitoring events Management action: (a) The licence holder must investigate the cause of the exceedance; (b) ~~The licence holder must determine environmental impact by conducting a stygofauna assessment, vegetation health assessment, surface water assessment and fish assemblage assessment (where applicable)~~; *If the exceedance is linked to the MAR scheme, determine the impact of the exceedance and implement mitigation actions if required.* (c*) If the exceedance is not linked to the MAR scheme, undertake appropriate review of specified values.* ~~(d) The licence holder must report the findings of the investigation and any environmental impact to the CEO within 30 days of becoming aware of the exceedance.~~ ~~(c)~~ *(d) The licence holder must include a summary of the investigation and any reviews of the specified values in the subsequent Environmental Report.*	An extensive network of groundwater monitoring bores has been installed to monitor changes to groundwater levels and quality following the commencement of reinjection activities under the MAR scheme. Table 11 outlines mandatory management actions triggered by exceedances of environmental trigger values. As described above, the trigger values specified within Table 9 are not necessarily relevant to the operations, representative of the receiving environment (reflective of existing background conditions, naturally elevated concentrations of certain analytes, or natural variability) or consider pathways of environmental risk. Under the current framework, if a trigger value is exceeded for three consecutive monitoring events, the licence requires an investigation into the exceedance and completion of an environmental impact assessment. The licence holder considers the application of such management actions may result in disproportionate operational consequences such as the suspension of MAR operations, interruption of dewatering operations and broader production delays where no material environmental risk exists. Importantly, the fundamental intent of the MAR scheme to mitigate environmental harm by maintaining groundwater levels. A highly conservative trigger structure, if applied without consideration of background conditions, natural variability or risk profile, has the potential to unnecessarily constrain MAR operations which may compromise the ability of the scheme to maintain groundwater levels and support sensitive groundwater dependent vegetation – inadvertently resulting in environmental outcomes that conflict with its intended purpose. The licence holder requests that this condition be amended to ensure that management actions remain proportionate to risk profile and aligned with the environmental objectives of the MAR scheme.	The delegated officer acknowledges the licence holder's concerns regarding the application of management actions following trigger value exceedances. However, the current condition is considered appropriate and proportionate to the level of environmental risk. Trigger values have been derived using the 95th percentile of native groundwater quality, based on data provided by the licence holder. Parameters with trigger values have been selected because they either represent indicators of general groundwater quality or are known contaminants with the potential to impact sensitive environmental receptors. As previously noted, the probability of exceeding a trigger value based on a 95th percentile in three consecutive monitoring events is approximately 0.0125%. The delegated officer considers this statistically sufficient to indicate a significant deviation from baseline conditions, warranting investigation. Where this occurs, it is reasonable to assume that the MAR scheme may be contributing to the observed change. The delegated officer has identified a number of sensitive ecological receptors hydrologically linked to the MAR scheme, including stygofauna, threatened and priority flora, aquatic fauna and culturally and ecologically significant pools. Pathways exist whereby these receptors may be impacted. While some impact to stygofauna population health within the zone of influence is expected, it remains necessary that any exceedance be assessed to determine whether further mitigation, regulatory action or enforcement is required. To clarify the intent of the condition, the delegated officer has amended the wording to specify that an environmental impact assessment is only required where the investigation confirms that the MAR scheme is the cause of the exceedance. No other aspect of the condition has been amended at this

<table>
<tr><th rowspan="2">Condition</th><th colspan="2">Licence holder's comment</th><th rowspan="2">Department's response</th></tr>
<tr><th>Suggested amendment</th><th>Summary of licence holder comment</th></tr>
<tr><td></td><td></td><td></td><td>time.</td></tr>
<tr><td></td><td>Event: A surface expression of groundwater is found or artesian conditions from within any monitoring or injection bore specified in Table 8 and as depicted in Schedule 1, Figure 10.

Management action:

(a) The licence holder must <s>immediately</s> cease discharge <s>and notify the CEO</s> within 24 hours;

(b) The licence holder must <s>investigate the cause of the event within 24 hours</s>; notify the CEO within 7 days;

(c) The licence holder must <s>report the investigation to the CEO including proposed resolutions within 7 days</s> investigate the cause of the event within 21 days and implement mitigation measures which may include a review of hydrogeological and geochemical models; and

(d) The licence holder must report the findings of the investigation to the CEO including proposed resolutions within 21 days.</td><td>The potential risk of groundwater mounding and subsequent surface expression is highest at the MAR reinjection locations. Targeted monitoring will be undertaken at reinjection locations to ensure that groundwater levels remain below the ground surface.

The risk decreases as spatial separation from the reinjection locations increases due to the natural attenuation and dissipation of both lateral and upward pressure with distance, limiting the potential for groundwater mounding or surface expression to occur at monitoring locations distal to reinjection locations.

Groundwater levels at monitoring locations distal to the MAR scheme will continue to be monitored (via nominated bores). However, applying the same management responses across all monitoring locations, irrespective of their distance from reinjection locations, is not considered proportionate to the risk of groundwater mounding and subsequent surface expression at the more distant monitoring locations. The License holder requests that management responses be triggered only where groundwater expression is observed at reinjection locations, where the risk is most relevant.

The licence holder further requests that this condition be amended to reflect the low risk profile of the MAR scheme (refer to the rationale for requested changes to Condition 40 above) and align with standard notification and reporting timeframes applied within other licences for Rio Tinto Iron Ores Pilbara operations. This will ensure that regulatory requirements remain risk-based, proportionate, and aligned with established practices across comparable operations.</td><td>The delegated officer notes that pressurised reinjection is occurring into a fractured rock aquifer. It is therefore reasonable to assume that due to the complex nature of fractured rock aquifers, preferential pathways may be created that results in impacts occurring at locations distant from the reinjection site even where no impacts are observed at the reinjection point.

While the reinjection scheme is aimed at restoring natural groundwater levels and offset drawdown impacts, it is unacceptable to alter hydrogeological regimes in a manner that results in artesian conditions. The GWOS specifies upper triggers for each aquifer, however, as previously noted, the Part V licence is the primary regulatory instrument. The environmental objective for mounding is that no upward leakage of groundwater or artesian conditions can occur.

As such, the trigger event remains unchanged to ensure this objective is met. However, the timing of management actions has been amended to reflect the relative risk and reduce operational burden, while maintaining compliance with the licence conditions.</td></tr>
<tr><td>44</td><td>The licence holder must:

a) prepare an Environmental Report that provides information in accordance with Table 12 for the preceding annual period, and

b) submit that Environmental Report to the CEO by 30 April each year.

Table 12: Environmental reporting requirements
<table>
<tr><th>Condition</th><th>Requirement</th></tr>
<tr><td>-</td><td>A tabulated data summary of monitoring results and data collected as a requirement of any condition of this licence.</td></tr>
<tr><td>35</td><td>A summary of inspections, maintenance and audits performed to address the requirements of Table 6.</td></tr>
<tr><td>37</td><td>a) A tabulated data summary of monitoring results and the cumulative reinjection volume at the MAR Scheme; and
(b) An interpretation of monitoring data results including comparison to historical trends<s>; and</s>
<s>(c) An updated set of model of hydrogeological and geochemical models.</s></td></tr>
<tr><td>38</td><td>a) A tabulated data summary of monitoring results; and
(b) An interpretation of monitoring data results including comparison to historical trends.</td></tr>
<tr><td>39 and 40</td><td>A summary of any exceedance of discharge <s>limits</s> targets <s>or trigger values</s> and a summary of any actions taken as a result.</td></tr>
</table></td><td>The licence holder requests amendments to the reporting requirements to align with the requested changes to the associated conditions. Specifically, it is requested that the requirement to update the hydrogeological and geochemical models annually be removed from the licence. Validation of both conceptual and numerical models is undertaken as required by the existing Brockman Syncline 2, Nammuldi and Silvergrass East Operations Groundwater Operating Strategy.

Groundwater response is monitored and reported annually through the Annual Aquifer Review, with a more detailed assessment of groundwater quality and water levels provided in the Triennial Review. Should aquifer behaviour deviate from expected parameters, a review of the conceptualisation and associated modelling would be initiated.

This approach ensures that model updates are driven by observed changes in aquifer performance, rather than a fixed annual schedule, aligning with best practice in adaptive groundwater management.</td><td>Cumulative reinjection volumes have been added to the reporting requirements as requested.

The Part V licence is the primary instrument for the regulation of the MAR scheme. The delegated officer expects that hydrogeological and geochemically models are iterative tools that are continuously validated and updated to ensure their currency, relevancy and accuracy.

To reflect this, the condition has been amended to require reporting on the performance of the MAR scheme and validation of the conceptual and numerical models. Where validation identifies that the models are no longer representative of current conditions, the delegated officer expects that the models will be updated accordingly.

This approach maintains alignment with adaptive groundwater management principles while ensuring that the department retains oversight of model performance and environmental risk.</td></tr>
</table>

Appendix 2: Summary of licence holder's comments on 2nd draft amendment report and draft conditions

<table>
<tr><th rowspan="2">Condition</th><th colspan="2">Licence holder's comment</th><th rowspan="2">Department's response</th></tr>
<tr><th>Suggested amendment</th><th>Summary of licence holder comment</th></tr>
<tr><td>31</td><td>The licence holder must:
(a) construct and/or install the infrastructure and/or equipment;
(b) in accordance with the corresponding design and construction / installation requirements;</td><td>The licence holder suggests conditions 31(a) and 31(b) are combined to improve clarity.</td><td>The department has updated the wording in line with the standardised condition set.
The licence holder must construct and/or install the infrastructure and/or equipment listed in Table 5, in accordance with;
(a) the corresponding design and construction / installation requirements; and
(b) at the corresponding infrastructure location,
as set out in Table 5.</td></tr>
<tr><td>37
Table 8: Emissions and discharge monitoring</td><td>
<table>
<tr><th>Discharge Point</th><th>Monitoring Location</th><th>Parameter</th><th>Frequency</th></tr>
<tr><td rowspan="8">MAR Scheme</td><td rowspan="6">Process measurement station</td><td>Reinjection volume</td><td rowspan="6">Continuous[2]</td></tr>
<tr><td>Temperature</td></tr>
<tr><td>pH[1]</td></tr>
<tr><td>EC[1]</td></tr>
<tr><td>Turbidity[1]</td></tr>
<tr><td>TSS[1]</td></tr>
<tr><td>Residual chlorine[1]</td><td rowspan="2">~~Continuous~~ Monthly</td></tr>
<tr><td>Nitrate (N)</td></tr>
<tr><td rowspan="2"></td><td rowspan="2"></td><td>TRH</td><td>Quarterly</td></tr>
<tr><td>PFOS</td><td>Quarterly</td></tr>
<tr><td></td><td>Reinjection pad monitoring bores</td><td>Surface water level</td><td>Continuous</td></tr>
</table>
Notes:
[1] In-field non-NATA accredited analysis is permitted.
[2] Where equipment or communication failures occur for a period of less than two weeks, continuous monitoring data to be calculated by averaging the preceding monitoring period.</td><td>Table 8 has been amended to reflect the updated requirement to monitor nitrate monthly, the system does not include instrumentation capable of providing real-time or continuous monitoring for this parameter.
Real-time monitoring equipment can be affected by intermittent communication failures due to the remote and harsh conditions of the Pilbara. As such, the licence holder requests the inclusion of the below footnote to account for possible outages.
Note 2: Where equipment or communication failures occur for a period of less than two weeks, continuous monitoring data to be calculated by averaging the preceding monitoring period.
Short-term disruptions of this nature are not uncommon and do not necessarily reflect a loss of environmental control or failure to meet the intent of the monitoring requirement. The proposed footnote recognises these practical constraints and provides a solution for managing short data gaps.</td><td>The department has included footnote 1 and reference against the relevant parameters.
Footnote 2 as requested by the licence holder has also been included.
The requirement to monitor Nitrate continuously has been updated to monthly based on the licence holder's comment.</td></tr>
<tr><td>38
Table 9: Groundwater monitoring of ambient concentration</td><td>Please refer to Attachment 2.
(Only those the licence holder has requested changes to are shown)
<table>
<tr><th>Monitoring well location[2]</th><th>Parameter</th><th>Unit</th><th>Trigger value</th><th>Frequency</th></tr>
<tr><td rowspan="2">MB11SILV016
MB11SILV017
MB11SILV021
MB11SILV023
MB11SILV024
MB11SILV025</td><td>Electrical conductivity</td><td>µS/cm</td><td>~~2165~~ 2238</td><td rowspan="2">Quarterly</td></tr>
<tr><td>Total alkalinity (as $CaCO_3$)</td><td>mg/L</td><td>~~425~~ 449</td></tr>
</table></td><td>Summarised table provides proposed updates to the trigger values specified in Table 9. The revised trigger values have been developed from an expanded and updated groundwater quality dataset for the receiving aquifer, which builds on and supersedes the dataset used in the earlier H3 Assessment.
The updated dataset incorporates results from additional monitoring bores, and the MAR reinjection bores, providing a wider representative characterisation of native groundwater conditions, accounting for natural background variability, aquifer-specific conditions, and analytical reporting constraints. -specific conditions, and analytical reporting constraints.
Where limited sample sizes for a particular parameter have reduced the ability to calculate a revised trigger value based on the 95th percentile, the ANZG (2018) 95th percentile trigger value for a slightly to moderately disturbed system has been proposed.
The updated values provide a robust framework for assessing MAR performance, while reducing the likelihood of false positives unrelated to risks associated with reinjection. The</td><td>The department has made the requested changes with the exception of the following:
<u>Total Nitrogen</u>
The reference to 2.4 mg/L as the trigger value for Total Nitrogen is incorrect. There is currently no trigger value for Total Nitrogen. The department has not included a trigger value for Total Nitrogen.
<u>Nitrate (NO_3) as N</u>
If the licence holder has referenced Total Nitrogen in error and is instead proposing a change to the trigger value for Nitrate (NO_3) as N from 2.4 to 7.6 mg/L – the department does not support this change. No justification has been provided for the requested change.
As per condition 39, Table 10 and the comment below – the department</td></tr>
</table>

<table>
<tr><th rowspan="2">Condition</th><th colspan="3">Licence holder's comment</th><th rowspan="2">Department's response</th></tr>
<tr><th colspan="2">Suggested amendment</th><th>Summary of licence holder comment</th></tr>
<tr>
<td></td>
<td colspan="2">
<table>
<tr><td>MB11SILV027
MB11SILV028
MB10SILV008
MB10SILV007
WB17SILV0003
WB24HSTD0001
Reference bores[3]
MB11SILV018
MB11SILV019</td><td>Total Nitrogen (TN) as N</td><td></td><td><s>2.4</s> 7.6</td><td></td></tr>
<tr><td></td><td>Cobalt</td><td></td><td><s>0.01</s>
0.23</td><td></td></tr>
<tr><td></td><td>Iron</td><td></td><td><s>0.05</s>
0.84</td><td></td></tr>
<tr><td></td><td>Manganese</td><td></td><td><s>0.518</s>
1.9</td><td></td></tr>
<tr><td></td><td>Molybdenum</td><td></td><td><s>0.0085</s>
0.034</td><td></td></tr>
<tr><td></td><td>Nickel</td><td></td><td><s>0.01</s>
0.018</td><td></td></tr>
<tr><td></td><td>Uranium</td><td></td><td><s>0.0005</s>
0.004</td><td></td></tr>
<tr><td></td><td><s>Acrylamide</s></td><td></td><td>-</td><td></td></tr>
</table>
Note:
[1]In-field non-NATA accredited analysis permitted.
[2]Where a monitoring bore is damaged, destroyed or rendered inaccessible for monitoring purposes, a representative monitoring bore can be used. [3]Trigger values do not apply to reference bores.
</td>
<td>rationale for the revised trigger values is provided in Attachment 3 (WSP, 2026).

The licence holder also requests the removal of acrylamide as a monitoring parameter. Following revision to the secondary treatment process, flocculant will no longer be introduced into the system. As a result, there are no pathways by which acrylamide could be introduced into the MAR source water.

The licence holder has recently identified that monitoring bores MB11SILV017 and MB11SILV021 were damaged in a fire and are no longer operational. Replacement monitoring bores will be installed in representative locations prior to the commencement of reinjection. To reflect the remote nature of the proposed monitoring bores and possible access constraints. The licence holder proposes to include the following footnote;

Note: Where a monitoring bore is damaged, destroyed or rendered inaccessible for monitoring purposes, a representative monitoring bore can be used.

As part of the review completed by WSP, it was identified that two proposed monitoring bores, MB11SILV019 and MB11SILV018, are located outside the predicted extent of the MAR zone of influence and are screened within an older groundwater system. Background concentrations of several analytes within this aquifer naturally exceed the trigger values developed for the receiving aquifer, resulting in false positives when applied to these locations. Accordingly, MB11SILV019 and MB11SILV018 have been identified as reference sites in Table 9, and it is requested that the associated trigger values do not apply to monitoring data collected from these bores.</td>
<td>has updated the limit for Nitrate (as N) from 7 to 7.6 mg/L as requested.

Table 11 of this amendment report has also been updated to reflect the changes made to the discharge limits and trigger values for the MAR scheme.

<u>Footnote 2</u>

The department has included a footnote 2 which reads – "Where a monitoring bore is damaged, destroyed or rendered inaccessible for monitoring purposes, a representative monitoring bore can be used in the interim while a replacement monitoring is installed".</td>
</tr>
<tr>
<td>39

Table 10: Emissions and discharge limits</td>
<td colspan="2">
<table>
<tr><th>Discharge Point</th><th>Monitoring Location</th><th>Parameter</th><th>Limit</th></tr>
<tr><td>MAR scheme injection bores</td><td>Process measurement station</td><td>Temperature</td><td>34-35.7°C</td></tr>
<tr><td></td><td></td><td>pH</td><td>6.5-<s>8.5</s> 8.7</td></tr>
<tr><td></td><td></td><td>Residual chlorine</td><td>1 mg/L</td></tr>
<tr><td></td><td></td><td>Nitrate (as N)</td><td><s>7</s> 7.6 mg/L</td></tr>
<tr><td></td><td></td><td>Total recoverable hydrocarbons</td><td>0.15 mg/L</td></tr>
<tr><td></td><td></td><td>PFOS</td><td>0.31 µg/L</td></tr>
</table>
Note: the discharge limit is calculated as a 24-hr average period for parameters monitored continuously.
</td>
<td>The licence holder proposes to update Table 10 to reference the specific monitoring location associated with the scheme and update the discharge limit for pH and nitrate, specifically;

• Data collected at the process measurement station will be used to verify the quality of discharge water prior to reinjection.

• The revised discharge limit for pH reflects the native alkaline conditions, the increase in pH range avoids natural false positives.

• The revised discharge limit for nitrate reflects the hardness-adapted value of 7.6 mg/L specific to the Pilbara (van Dam, 2022).

The rationale for the updated discharge limits is provided in Attachment 3 (WSP, 2026).

The licence holder acknowledges the Department's acceptance of the original request to amend the temperature limit for MAR reinjection discharge water to 34 °C. While recognising that surface water temperatures are not directly comparable to groundwater thermal regimes, further review of discharge monitoring data from Duck Creek has identified temperatures of up to 35.7 °C during summer, reflecting the elevated ambient thermal conditions typical of the region.

Reinjection water will be conveyed approximately 14 km via above-ground pipeline, during which it is exposed to ambient climatic conditions and subject to diurnal heating. As a result, short-term temperature elevations above 34 °C may occur due to environmental factors. Accordingly, the Licence holder requests that the temperature limit be amended to the range 34–35.7 °C, to better reflect recorded ambient conditions and operational conditions.</td>
<td>The department has updated Table 10 to include the Monitoring Location (being the Process measurement station).

The limit for Temperature has been set at 35.7°C.

The limit for pH has been updated to state 'pH must be between 6.5-8.7'. Exceedances outside of those values must be investigated.

Nitrate (as N) has been updated from 7 mg/L to 7.6 mg/L as requested.

Note 1 has also been included next to Temperature, pH and Residual chlorine as those are the parameters that have continuous monitoring (condition 37, Table 8); and a footnote (1) added as requested.</td>
</tr>
<tr>
<td>40

Table 11: Management Actions</td>
<td colspan="2">Event: A discharge limit specified within Table 10 is exceeded for three consecutive monitoring events (represented by a daily averaging period)

Management action:</td>
<td>The licence holder requests the Department's consideration of the following amendments;

Event:

To better reflect the operational characteristics of the monitoring system and discharge process, the licence holder suggests amending the condition such that an event occurs only</td>
<td>Event:

The department has not included "for three consecutive monitoring events (represented by a daily averaging period)" as requested by the licence holder.</td>
</tr>
</table>

Condition	Licence holder's comment		Department's response
	Suggested amendment	**Summary of licence holder comment**	
	(a) The licence holder must begin to investigate the cause of the exceedance within 24 hours *of becoming aware of the exceedance*; (b) Where the investigation identifies injection water quality has been contaminated; i. immediately cease discharging via injection or infiltration *if the contamination has not been resolved*; and ii. the licence holder must report the investigation to the CEO including proposed resolutions within ~~7~~ *30* days.	after three consecutive exceedances of a discharge limit. Single-day exceedances identified through daily averaging may occur due to short-term operational variability, transient environmental influences, or instrumentation uncertainty, and do not necessarily indicate a material or ongoing contamination risk. Management action: (a) The updated wording recognises the remote nature of the scheme and potential operational constraints in identifying an exceedance within 24 hours. While the monitoring and control system operate in real time and can trigger automated responses, there are still practical circumstances where awareness may be delayed. These include: • communications outages or telemetry drop-outs at the remote site; • equipment failures or sensor faults; • periods where the system is operating in a reduced-visibility mode (e.g., maintenance or commissioning states) and/or; • alarms being triggered but requiring human verification before they are classified as "exceedances" under the licence. The proposed amendment recognises the constraints in operating a remote MAR system. (b) For the purposes of the SGE MAR Scheme, and to support the interpretation of these management actions, contamination is defined as a single unplanned event or continuous/repetitive series of events, arising from emissions, that results in, or is reasonably likely to result in, a material adverse impact on the environment or operational integrity. i. The licence holder seeks to amend the condition to allow reinjection to continue if the contamination has been identified and corrective actions have been implemented. ii. The licence holder proposes to standardise reporting timeframes in Table 11 to reduce administrative complexity and the risk of inadvertent non-compliance. The amended wording also clarifies that reporting is only required when contamination has occurred.	This requirement does not suit the intent of stipulating a discharge limit. A limit is applied to parameters where the assessment of risk has determined that a limit needs to be imposed to ensure that acceptable outcomes are achieved. Investigations required by a limit exceedance can involve an increased sampling frequencies for those parameters that aren't monitored continuously to assist with the investigation process and determine if impacts warrant the cessation of reinjection activities. The allowance of three consecutive monitoring events has been applied for the trigger values. Management action: (a) Updated as requested. Wording updated also to reflect potential nature of contamination in reinjection water. (b) i. The department has not updated the condition with the wording requested by the licence holder. Instead, the department has updated the condition to read – *Where the investigation identifies injection water quality has been potentially contaminated, immediately cease discharging via injection or infiltration unless evidence can demonstrate that the contamination has been resolved; and* ii The department has updated the timeframe for the submission of the investigation from 7 days to 30 days as requested by the licence holder. The department has not included the definition of 'contaminated' as requested by the licence holder. The *Contaminated Sites Act 2003* has a definition of 'contaminated'. This definition has been adapted for use in part for the purpose of this table.
	Event: A trigger value as specified within Table 9 is exceeded for three consecutive monitoring events Management action: (a) The licence holder must investigate the cause of the exceedance; (b) If the cause of the exceedance is determined to be ~~the MAR scheme~~ *from contamination*, the licence holder must; *i.* determine environmental impact by conducting *appropriate assessments* ~~a stygofauna assessment, vegetation health assessment, surface water assessment and fish assemblage assessment~~ (where applicable); and ~~(c)~~ *ii.* ~~The licence holder must~~ report the findings of the investigation and any *proposed assessments* ~~environmental impact~~ to the CEO within 30 days of becoming aware of the exceedance.	Management action: (b) The licence holder requests that the prescriptive requirement to undertake specific assessments (stygofauna, vegetation health, surface water, and fish assemblage) be replaced with wording that requires appropriate environmental assessments to be undertaken, as required, based on the nature and confirmed cause of the trigger value exceedance. Exceedances may arise from a range of causes, including monitoring system anomalies, data handling issues, hydrochemical variability, or operational factors that do not result in a credible pathway for environmental impact. In such cases, preliminary data review and targeted investigations may demonstrate that the exceedance does not pose a plausible risk to the specified receptors and a stygofauna assessment, vegetation health assessment, surface water assessment and fish assemblage assessment may not be warranted. (c) The licence holder requests the wording be amended to remove the requirement to report both the findings of the investigation and the determination around environmental impact within 30 days of becoming aware of the exceedance. While the licence holder can investigate and report the likely cause of an exceedance within this timeframe, the assessment and determination of environmental impact, particularly where specialised stygofauna, vegetation health, surface water, or fish assemblage assessments are required, cannot practicably be completed within this time frame. These assessments are typically undertaken by third-party specialists and can take in excess of 12 months to complete.	Management action : (b) The department has retained reference to the MAR scheme rather than 'from contamination'. The intent of this condition is to investigate exceedances of water quality trigger values, with the water samples taken from bores associated with the MAR scheme. The department has changed the wording to include 'appropriate assessments' as requested by the licence holder. The department has included a footnote so the original intent of the condition is retained, which stipulates – *The licence holder's assessment must be based on the nature and confirmed cause of the trigger value exceedance. Appropriate assessments (if applicable) may include but not be limited to a stygofauna assessment, vegetation health assessment, surface water assessment and fish assemblage assessment.* (c) Updated as requested.

<table>
<tr><th rowspan="2">Condition</th><th colspan="2">Licence holder's comment</th><th rowspan="2">Department's response</th></tr>
<tr><th>Suggested amendment</th><th>Summary of licence holder comment</th></tr>
<tr><td></td><td>Event: A surface water expression of groundwater is found or artesian conditions form within any monitoring or injection bore listed in Table 9 or shwon in Schedule 1, Figure 10

Management action:

(a) The licence holder must cease discharge within 24 hours of being identified;

(b) The licence holder must investigate the cause of the event; and

(c) The licence holder must report the findings of the investigation to the CEO including proposed mitigation measures within ~~21~~ 30 days.</td><td>Management action:

c)

The Licence holder seeks to standardise reporting timeframes in Table 11 to reduce administrative complexity and the risk of inadvertent non-compliance associated with managing multiple reporting periods for the different management actions.</td><td>Management action:

(a)

Amended as requested

(c)

Updated from 21 days to 30 days as requested by the licence holder.</td></tr>
<tr><td>44</td><td><table><tr><th>Condition</th><th>Requirement</th></tr><tr><td>37</td><td>c) An update on the performance of the MAR scheme and validation of the hydrogeological and geochemical models if an event in Table 11 has been triggered for the corresponding annual period.</td></tr></table></td><td>The licence holder requests the validation of the hydrogeological and geochemical models under the Licence is prompted only if an event specified in Table 11 occurs. Groundwater response is monitored and reported annually through the Annual Aquifer Review, with a more detailed assessment of groundwater quality and water levels provided in the Triennial Review. Should aquifer behaviour deviate from expected parameters, or an event in Table 11 triggered, a review of the conceptualisation and associated modelling would be initiated.

This approach ensures that model updates are driven by observed changes in aquifer performance and observed exceedance/s rather than a fixed annual schedule, aligning with best practice in adaptive groundwater management.</td><td>The department has not made the requested change.

As previously outlined in Appendix 1 (for this condition), hydrogeological and geochemically models are iterative tools that are continuously validated and updated to ensure their currency, relevancy and accuracy.

The condition requires reporting on the performance of the MAR scheme and validation of the conceptual and numerical models. Where validation identifies that the models are no longer representative of current conditions, the delegated officer expects that the models will be updated accordingly.

This approach maintains alignment with adaptive groundwater management principles while ensuring that the department retains oversight of model performance and environmental risk.</td></tr>
</table>