Stygofauna Values Assessment Report

Daunia West Infrastructure Project

Whitehaven Daunia Pty Ltd

Prepared by:

SLR Consulting Australia

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1.0	6 August 2025	Vanessa Clark and Andrew Mather	Ben Cook	
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Basis of Report

This report has been prepared by the Aquatic Environmental Services group at SLR Consulting Australia (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Whitehaven Daunia Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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Acronyms and Abbreviations

AES	Aquatic Environmental Services
DES	Department of Environment and Sciences
DNM	Daunia Mine
DWIP	Daunia West Infrastructure Project
EA	Environmental Authority
EC	Electrical Conductivity
EP Act	*Environmental Protection Act 1994*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPP	*Environmental Protection (Water and Wetland Biodiversity) Policy 2019*
ERA	Environmentally Relevant Activities
EV	Environmental Values
GDE	Groundwater Dependent Ecosystem
km	kilometres
MIA	Mine Infrastructure Area
ML	Approved Mining Lease under the *Mineral Resources Act 1989*
MNES	Matters of National Environmental Significance
Project	The Project is the construction and operation of an out-of-pit dump to the west of, and adjacent to, ML1781, off-lease from DNM
Project Area	The proposed out-of-pit dump to the west of, and adjacent to, ML1781, off-lease from DNM
SLR	SLR Consulting Pty Ltd
TDS	Total Dissolved Solids
WHC	Whitehaven Daunia Pty Ltd
OOPD	Out of Pit Dump

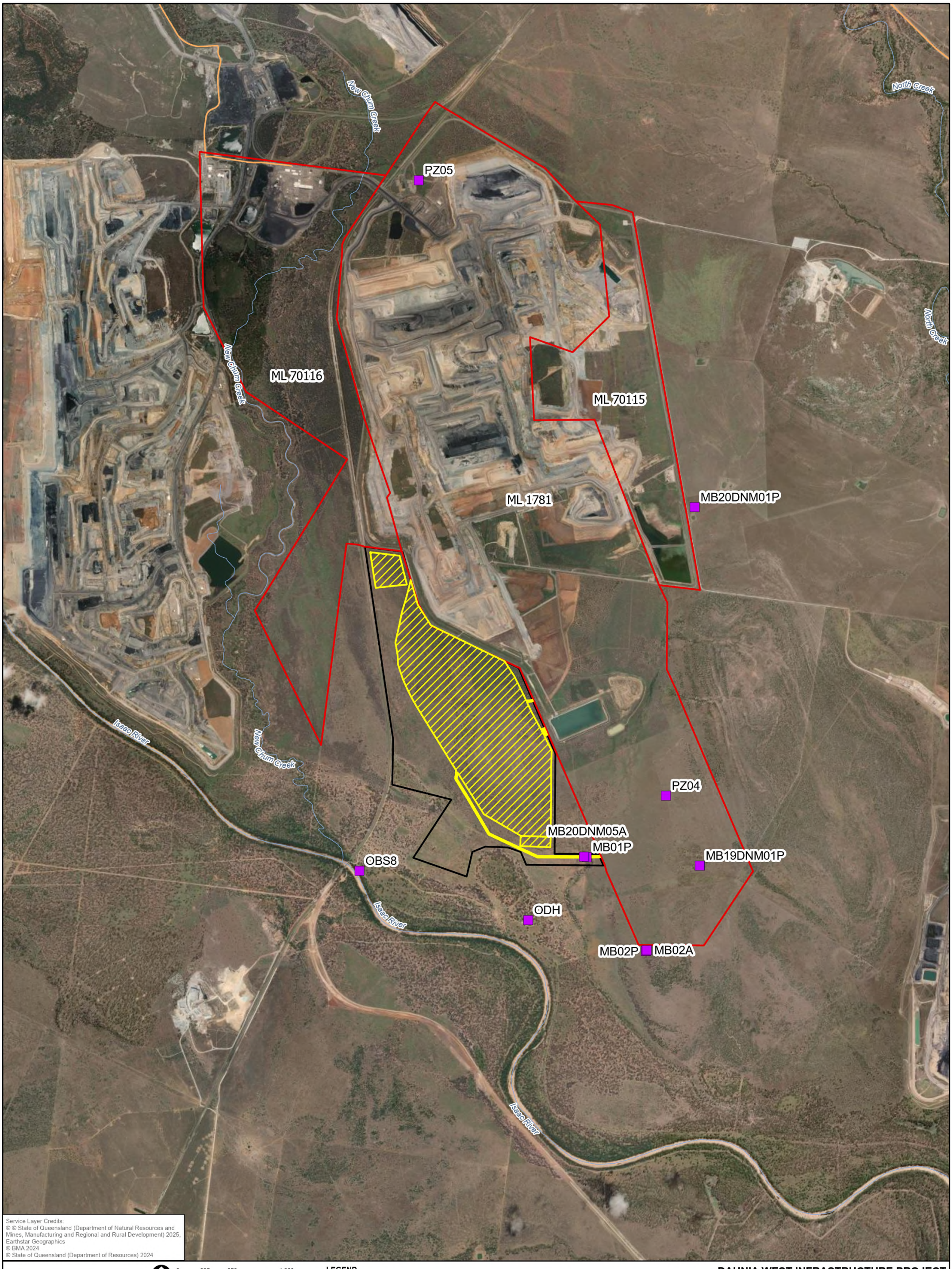
1.0 Introduction

The Daunia Mine (DNM) is located approximately 25 kilometres (km) southeast of Moranbah in Central Queensland, on mining leases (ML) 1781, ML70115, and ML 70116. Whitehaven (WHC) owns and operates DNM, which was approved in 2009 and operates under the Environmental Authority (EA) EPML00561913 and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Approval 2008/4418. Environmentally Relevant Activities (ERA) at DNM include chemical storage, sewage treatment, resource recovery and transfer, mineral processing, and mining of black coal. WHC proposes the construction and operation of an out of pit dump (OOPD) to the west of, and adjacent to, ML1781, off-lease from DNM (the Daunia West Infrastructure Project (DWIP); the Project). A new MLA will be submitted for the area subject to the OOPD.

SLR Consulting's Aquatic Environmental Services (AES) team was commissioned by Whitehaven Coal to implement an assessment of stygofauna values of groundwaters underlying the Project Area (Figure 1-1). The objective of the study was to assess the potential impact the Project may have on the ecological values of stygofauna of the Project Area.

The scope of this report is to present a stygofauna pilot study, as defined the *Guideline for the Environmental Assessment of Subterranean Aquatic Fauna* (DoSITI 2015), including:

- A desktop assessment of stygofauna of the region, including synthesis of relevant historical survey data.
- The methods and results of the 2024 and 2025 targeted stygofauna survey in and adjacent to the Project Area.
- An assessment of the stygofauna values of groundwaters of the Project Area.
- An assessment of environmental impact on stygofauna communities of the Project, comprising application of Risk-based impact assessment.



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0 325 650 1,300 Meters

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:40,000 at A3
Project Number:	620.042120.00005
Date Drawn:	19/05/2026
Drawn by:	AB
Reviewed by:	AM

LEGEND

- Surveyed bores
- Mining Lease Application Area (Project Area)
- Mining Lease
- Disturbance Footprint
- Watercourse

Roads and tracks

Road classification

- Local

DAUNIA WEST INFRASTRUCTURE PROJECT STYGOFAUNA VALUES AND IMPACT ASSESSMENT

DAUNIA WEST INFRASTRUCTURE PROJECT AREA AND BORE LOCATIONS.

FIGURE 1-1

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2.0 Stygofauna Pilot Study and Assessment of Environmental Values

2.1 Methods

Stygofauna were assessed using a desktop review and field survey, as described for a stygofauna pilot study in the *Guideline for the Environmental Assessment of Subterranean Aquatic Fauna* (DoSITI 2015), see also the Department of Environment and Science's (DES) Water Monitoring and Sampling Manual (DES 2018).

2.1.1 Desktop Assessment

A desktop review was used to describe stygofauna of the region and determine the suitability of groundwater ecosystems of the Project Area to provide habitat for stygofauna on the basis of geological, hydrological and water quality characteristics of local groundwater ecosystems. The desktop review included:

- Review of stygofauna of the region using published and otherwise available information (e.g. Glanville et al. 2016; Hancock & Boulton 2008; Hose et al. 2015; Saccò et al. 2022) to determine the recorded presence and distribution of stygofauna in the region.
- Review of hydrogeological data for the Project Area.
- Review of groundwater pH, electrical conductivity (EC) and total dissolved solids (TDS) data within and surrounding the Project Area.

2.1.2 Field Survey

Stygofauna survey at ten bores was completed in July 2024 and May 2025 (Table 2-1; Figure 1-1). While three of the surveyed bores were dry during both surveys, a total of fourteen samples were collected across the two surveys meeting the requirement of a minimum of ten samples as described for a stygofauna pilot study in the *Guideline for the Environmental Assessment of Subterranean Aquatic Fauna* (DoSITI 2015). The full water column in each bore was sampled using six hauls of a weighted phreatobiological net (similar to a plankton net). Three of the hauls with a very fine net (mesh size 50 µm), and three hauls with a fine net (mesh size 150 µm) were used. Samples were preserved in 100 per cent ethanol and transported to SLR Consulting's laboratory where stygofaunal specimens were identified to Order or Family using available taxonomic keys. Each specimen was then identified to morpho-species by trained ecologists as taxonomic keys are not available for species-level identification of stygofauna.

Table 2-1 Bores sampled for stygofauna in the DWIP Project Area in July 2024 and May 2025.

Bore	Easting	Northing	Drilled depth (m)	Lithology	Electrical conductivity (µS/cm)	TDS (mg/L)	pH
ODH (Olive Downs House)	633884	7553065	NDA	Alluvium	NDA	NDA	NDA
MB01P	634583	7553819	24.4	Mudstone/sandstone	NDA	NDA	NDA
PZ04	635531	7554554	90.0	Sandstone/Siltstone	18208.9	12328.9	7.7
MB19DNM01P	635935	7553717	67.5	Coal seam	NDA	NDA	NDA
MB02P	635301	7552706	36.4	Coal seam	12600.0	8465.0	7.3
PZ05	632576	7561914	49.0	Sandstone	6552.5	3759	7.5
MB20DNM01P	635874	7558005	NDA	Coal seam	NDA	NDA	NDA
OBS8*	631867	7553656	20.5	Alluvium	NDA	NDA	NDA
MB20DNM05A*	634551	7553825	8.5	Alluvium	NDA	NDA	NDA
MB02A*	635292	7552696	8.5	Coal seam	NDA	NDA	NDA

NDA = no data available
* dry

2.2 Assessment of Environmental Values

Stygofauna taxa are grouped into one of several classes based on the degree of their requirement for subterranean life (Tomlinson & Boulton 2008). For the purpose of this assessment, two classes of stygofauna are considered:

- **Stygobites**: obligate groundwater aquatic fauna that have specialised adaptations (e.g. lack of eyes and pigmentation, elongated appendages for tactile sensing of surrounds, etc) to underground life and that live within groundwater systems for their entire life.
- **Stygoxenes**: aquatic fauna that facultatively use groundwater ecosystems, but are not dependent on groundwater to complete their life cycle.

Stygobites generally comprise taxa with narrower distributional ranges than stygoxenes (many stygobites are narrow range endemics) (Cook et al. 2012; Eberhard et al. 2009; Finston et al. 2007; Hancock & Boulton 2008; Hose et al. 2015; Little et al. 2016), and this coupled with their higher degree of specialisation for subterranean life, suggests that subterranean aquatic ecosystems inhabited by stygobites have higher Environmental Value than those inhabited by stygoxenes only.

Therefore, the environmental values of stygofauna of the Project Area and surrounds were determined using the following criteria:

- **High value**: threatened species listed under State or National legislation;
- **Moderate value**: non-listed stygobites and / or suitable habitat for stygofauna present; and
- **Low value**: only non-listed stygoxenes and / or potentially suitable habitat for stygofauna present.

2.3 Stygofauna Risk Assessment Method

Sources of potential impact were identified from the review of the Project Description and assessed aquatic ecological values of stygofauna in the Project Area.

The assessment of potential Project impacts of the OOPD on the EVs of stygofauna comprised a risk-based assessment, with the level of risk being an outcome of the consequence and likelihood of the potential impact (Table 2-2, Table 2-3 and Table 2-4).

Table 2-2 Ratings Used to Assess the Likelihood of Potential Impacts.

Rating	Likelihood of occurrence
Very high	Almost certain to occur frequently
High	Probably would happen sometimes to frequently
Moderate	Could happen sometimes
Low	Remote possibility of occurring
Very low	Unlikely or not expected to occur

Table 2-3 Ratings Used to Assess the Consequence of Potential Impacts.

Rating	Consequence of Potential Impacts
Very high	Long-term harm to protected components of the environment.
High	Short-term but reversible harm to protected components of the environment; long-term harm to sensitive (i.e. rare, threatened, narrow range endemic) components of the environment.
Moderate	Long-term harm to non-protected components of the environment; no environmental harm to protected or sensitive (i.e. rare, threatened, narrow range endemic) components of the environment.
Low	Short-term but reversible harm to non-protected components of the environment; no environmental harm to protected or sensitive (i.e. rare, threatened, narrow range endemic) components of the environment.
Very low	Negligible or minimal impact with no material harm to any component of the environment.

Table 2-4 Aquatic Ecological Risk Matrix

		Likelihood				
		Very Low	**Low**	**Moderate**	**High**	**Very High**
Consequence	**Very Low**	low	low	low	low	moderate
	Low	low	low	low	moderate	moderate
	Moderate	low	low	moderate	moderate	high
	High	low	moderate	moderate	high	high
	Very High	low	moderate	high	high	extreme

2.4 Legislative Context

2.4.1 Commonwealth Environment Protection and Biodiversity Act 1999

The Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) provides the legal framework for the protection and management of matters of national environmental significance (MNES). The nine MNES to which the EPBC Act applies are:

- World heritage properties;
- National heritage places;
- Wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed);
- Nationally threatened species and ecological communities;
- Migratory species;
- Commonwealth marine areas;
- The Great Barrier Reef Marine Park;
- Nuclear actions (including uranium mining); and
- A water resource, in relation to coal seam gas development and large coal mining development.

The EPBC Act provides protection for threatened flora, fauna and ecological communities by:

- Identifying and listing species and ecological communities as threatened;
- Developing conservation advice and recovery plans for listed species and ecological communities;
- Developing a register of critical habitat;
- Recognising key threatening processes;
- Where appropriate, reducing the impacts of these processes through threat abatement plans and non-statutory threat abatement advices; and
- Requiring approval for certain actions or activities that will, or are likely to, have a significant impact on an MNES or other protected matter.

The Cape Range remipede (*Kumonga exleyi*), Cape Range blind gudgeon (*Milyeringa veritas*), the blind cave eel (*Ophisternon candidum*) are a stygofauna species that are listed as vulnerable under the EPBC Act; however, these Western Australian species from the Cape Range peninsula are not relevant for the current assessment.

Water resources in relation to coal seam gas and large mining developments under the EPBC Act includes surface waters and groundwaters that provide utility to third party users of the water resource, including environmental users. The presence of stygofauna, and especially stygobitic taxa, indicate groundwater ecosystems that provide supporting services to environmental third-party users of the groundwater resources, as defined under the EPBC Act Significant Impact Guidelines 1.3 for water resources in relation to coal seam gas and large mining development (Department of the Environment (DoE) 2013) (i.e. stygofauna, and especially stygobitic stygofauna, are third party users of groundwater). Where an action is likely to have a significant impact on a water resource that will directly or indirectly reduce

the current or future utility of a water resource for a third-party user of the water resource, then the action is likely to have a significant impact on a MNES under the EPBC Act.

2.4.2 Queensland Environmental Protection Act 1994

The Queensland *Environmental Protection Act 1994* (EP Act) provides for the protection of EVs of Queensland's natural environment, with the *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* (EPP (Water and Wetland Biodiversity); pursuant to the EP Act) providing for the protection of EVs of Queensland's surface, marine and groundwaters. EVs of water to be protected under the EPP (Water and Wetland Biodiversity) include protection of water for drinking, stock watering, irrigation, human consumers of aquatic food resources, aquaculture, farm water supply and aquatic ecosystems. Of relevance to this assessment is the aquatic ecosystems Environmental Value, which in the context of groundwater relates to stygofauna, as indicated in the *Guideline for the Environmental Assessment of Subterranean Aquatic Fauna* (DoSITI 2015); see also DES (2018). Therefore, the presence of stygofauna, and especially stygobitic taxa, indicate groundwater ecosystems where protection of the aquatic ecosystem's EV, as defined in the EPP (Water and Wetland Biodiversity), is required by the legislative framework set out under the EP Act.

2.4.3 Queensland Nature Conservation Act 1992

There are no stygofauna species listed as threatened under the Queensland *Nature Conservation (Animals) Regulation 2020* pursuant to the *Nature Conservation Act 1992*.

2.5 Desktop Assessment Results

2.5.1 Stygofauna of the Region

The diversity and biogeography of stygofauna in Queensland is reported by Glanville et al. (2016), with their key preliminary findings being:

- A total of 24 described families and 23 described genera have been recorded from Queensland across numerous bioregional areas. The Project Area is located at the northern end of the Northern Bowen Basin sub-bioregion, with five families from six samples reported from this region. Saccò et al. (2022) reported 12 higher taxa of stygofauna (stygoxenes and stygobites collectively) from coastal river basins in eastern Australia from alluvial and karst geological units.
- Syncarid shrimps (families Parabathynellidae and Bathynellidae) are the two most widespread families in Queensland, followed by Cyclopidae (copepods) and Naididae (clitellate oligochaete worms). All of these taxa are reported from a wide range of lithology types, including alluvium, gravel, sand, sandstone and fractured basalt.
- Of all described stygofauna families recorded from Queensland to date, 36 per cent are crustaceans, with the taxonomic richness of syncarid crustaceans higher in Queensland than the global average, but the richness of amphipods in Queensland lower than the global average.

Similarly, the diversity of stygofauna reported across Australia's coal regions were synthesised by Hose et al. (2015), with key findings synthesised from 12 studies for the Bowen Basin being:

- Stygofauna, including syncarids, amphipods, and harpacticoid and cycloid copepods, were most frequently recorded from alluvial aquifers, but also from basalt aquifers and coal seams;
- Stygofauna were recorded where standing water level was between 1.4 and 45 m below ground level; and
- Stygofauna were recorded from groundwaters with the following water quality characteristics:
  - EC: 342–9,975 µS/cm;
  - pH: 6.39–10.27; and
  - dissolved oxygen: 0.93–6.54 mg/L.

Field-based assessment of stygofauna (i.e. subterranean aquatic fauna that live in groundwater ecosystems) from across the broader region identified in historical surveys by frc environmental showed (Table 2-5):

- Mostly sytgoxenes (non-obligate inhabitants of groundwater ecosystems) were previously identified from bores in the region.
- Two stygobite (obligate groundwater fauna) taxa were previously identified from bores in the region.

The characteristics of groundwater where the stygobite taxa were recorded were:

- Predominantly alluvium geology but also regolith geology;
- Low to high EC and TDS; and
- Shallow to deep depth to water table, often below the likely root zone of terrestrial vegetation.

The GDE Atlas indicated that there are no subterranean GDEs within or near the broader Project Area.

None of the stygofauna taxa likely to occur in the Project Area are listed species under the EPBC Act.

Table 2-5 Stygofauna species identified in previous surveys of the region.

Stygofaunal taxon	Common name	Class
Cyclopoida sp. 1	Cyclopoid copepod	Stygoxene
Acarina sp. 1	Aquatic mite	Stygoxene
Parabathynellidae sp. 1	Syncarid shrimp	Stygobite
Oligochaeta sp. 1	Segmented worm	Stygoxene
Oligochaeta sp. 2	Segmented worm	Stygoxene
Ostracoda Podocopida	Seed shrimp	Stygoxene
Bathynellidae	Crustacean	Stygobite
Nematode	Parasitic worm	Stygoxene

2.5.2 Characterisation of the Groundwater Ecosystem Underlying the Project Area and Habitat Suitability

The geology of the Project Area, from shallowest to deepest, comprises partly saturated shallow alluvial aquifer (which is considered to follow the Isaac River), which overlays the Blackwater Group. The Blackwater Group comprises the Rangal Coal Measures, Fort Cooper Coal Measures and the Moranbah Coal Measures, which collectively comprise coal deposits with seams of sandstone and siltstone. The deepest hydrogeologicial unit is comprised of low permeability bedrock. Groundwater levels are reported to be brackish with naturally elevated concentrations of some metals such as copper and high concentrations of ammonia (as nitrogen).

2.5.2.1 Lithology

Stygofauna have the potential to occur in aquifers composed of any geological unit with sufficient pore space to complete their life cycle (Tomlinson & Boulton 2008). Consequently, stygofauna are less likely in geological units with relatively small pore spaces, such as those dominated by mudstone, siltstone and clays. Preliminary discovery rates of stygofauna in Queensland indicate that (Glanville et al. 2016):

- No stygofauna have been recorded in mudstone or siltstone to date;
- Stygofauna are less common in clay, coal and basalt dominated geologies; and
- Stygofauna are most common in alluvium, granite, gravel, sand, sandstone, silt, and volcanic geological units.

The diversity of stygofauna in Queensland is highest in alluvium, with 14 described families in alluvial geological units, five in both basalt and coal, four in both gravel and sand, two in sandstone, and one in silt (Glanville et al. 2016). Limestone reportedly has diverse stygofauna communities (Tomlinson & Boulton 2008), with preliminary data indicating the presence of diverse stygofauna in limestone geological units in Queensland (frc environmental, unpublished data). Indeed, a recent study reported 12 higher taxa of stygofauna (stygoxenes and stygobites collectively) from coastal river basins in eastern Australia from alluvial and karst geological units (Saccò et al. 2022), indicating these two units likely contain the highest stygofaunal diversity in Queensland.

The geology of the Project Area comprises alluvium with underlying coal seam, and bores surveyed in this study were in alluvial, sandstone, siltstone and coal seam geological types and therefore comprises geological units that are suitable for supporting stygofauna.

2.5.2.2 Depth to Water Table

In eastern Australia the average number of stygofauna taxa was higher when the samples were collected where the water table was less than approximately 15 mbgl below ground (Hancock & Boulton 2008) , although a more recent study indicated higher diversity of stygofauna where depth to water table is less than approximately 45 mbgl (Hose et al. 2015).

The depth to water table recorded at the Daunia site in alluvium, determined by a trench dug near the Isaac River, was approximately 2 meters below the ground level. However, however monitoring bores in the vicinity of the Isaac River were dry at the time of survey. Depth to water in the bores that were assessed in this study that were not dry ranged from approximately 5 to 40 m below ground level. Therefore, depth to water table of alluvial deposits is generally suitable for supporting stygofauna; however, the area of potential groundwater table suitability is likely concentrated in areas closer to the river.

2.5.2.3 Water Quality

The mean electrical conductivity of water from which stygofauna have been sampled is less than 4,000 µS/cm; however, the range of electrical conductivity concentrations of groundwater that stygofauna have been sampled from is large (i.e. 11.5–54,800 µS/cm) (Glanville et al. 2016). Electrical conductivity of the groundwater in the sampled bores (of which water quality data was available) was within the range known to support diverse stygofauna (Table 2-6).

Stygofauna have been recorded from groundwater with pH ranging from 3.5 to 10.3, but diversity is highest between 6.5 and 7.5 (mean of 7.0) (Hancock & Boulton 2008). The pH of groundwater underlying the sampled bores in the Project Area ranged from 7.0 to 8.8, with a median of 7.7 and therefore generally aligned with the pH range known to support stygofauna (Table 2-6).

In Western Australia, stygofauna were almost always absent where total dissolved solids (TDS) was higher than 15 mg/L (Halse et al. 2014); however, a recent study in Queensland found stygofauna where TDS was 8,520 mg/L (frc environmental, unpublished data). The TDS of groundwater in the sampled bores was within the range of TDS known to support stygofauna at one bore (PZ05) but higher than the TDS of groundwater known to support stygofauna at all other bores where data was available (i.e. PZ05, MB01P and MB02P). Therefore, the TDS for groundwater in the Project Area is partially suitable for supporting stygofauna (Table 2-6).

Table 2-6 DWIP Groundwater Quality Summary Statistics.

Statistic	Electrical Conductivity	Total Dissolved Solids	pH
Unit	µS/cm	mg/L	unit
Minimum	6,030	2,870	7.0
Median	10,450	6,245	7.7
Average	10,931	6,812	7.7
Maximum	20,000	15,200	8.8

2.6 Field survey

2.6.1 Results

The July 2024 and May 2025 surveys indicated one stygofauna taxa (a stygoxene Nematode worm) was recorded from bore ODH (Table 2-7 and Table 2-8).

Table 2-7 Results of July 2024 Stygofauna survey.

Bore	Stygofauna Taxon	Count	Class
ODH	Nematoda	1	Stygoxene
MB01P	–	–	–
PZ04	–	–	–
MB19DNM01P	–	–	–
MB02P	–	–	–
PZ05	–	–	–
MB20DNM01P	–	–	–
OBS8 [a]	–	–	–
MB20DNM05A [a]	–	–	–
MB02A [a]	–	–	–

– no stygofauna recorded

[a] dry bore

Table 2-8 Results of May 2025 Stygofauna survey.

Bore	Stygofauna Taxon	Count	Class
ODH	Nematoda	1	Stygoxene
MB01P	–	–	–
PZ04	–	–	–
MB19DNM01P	–	–	–
MB02P	–	–	–
PZ05	–	–	–
MB20DNM01P	–	–	–
OBS8 [a]	–	–	–
MB20DNM05A [a]	–	–	–
MB02A [a]	–	–	–

– no stygofauna recorded

[a] dry bore

3.0 Stygofauna Values Assessment

Overall, the stygofauna community of the Project Area was assessed as having low environmental value due to:

- Stygofauna being recorded in only one of the bores sampled;
- The occurrence of one stygoxene taxa (and only one individual), and no stygobite taxa; and
- The suitability of groundwater for stygofauna being variable across the Project Area, notably with high total dissolved solids.

The results of this assessment indicate that groundwater of the Project Area is unlikely to provide supporting services to environmental third-party users of the water resource (i.e. groundwater dependent stygobitic fauna), as defined under the EPBC Act.

4.0 Impact Assessment

4.1 Sources of Potential Impact to Aquatic Ecological Values

The Project plans to clear vegetation for the Project, and requires permanent removal of an unnamed waterway to the west of the Project Area and construction/formalisation of access tracks and haul roads. It is anticipated that these tracks and/or haul roads may cross waterways.

The Project may cause adverse impact to aquatic ecological receptors relevant to stygofauna via:

- Vegetation clearing, which may cause direct impact to stygofauna habitat.
- Localised leachate/contamination of groundwater, which may cause lethal (i.e. mortality of stygofauna) or sub-lethal (i.e. reduced rate of reproduction, impacted physiology) impacts. This may come from fuel and chemical spills, which is discussed further in **Section** Error! Reference source not found..

4.2 Risk-based Impact Assessment

4.2.1.1 Vegetation Clearing

Terrestrial vegetation overlying shallow groundwater ecosystems of suitable lithology and water quality, where the water table intersects the root zone of the vegetation (i.e. <20 mbgl for deep-rooted vegetation), is thought to provide favourable habitat conditions for stygofauna (Eamus et al. 2006; Hancock & Boulton 2008). Clearing of vegetation during the construction phase of the Project may therefore reduce the habitat quality of these types of shallow groundwater ecosystems for stygofauna. Potential impacts would be localised to the immediate area of clearing.

Shallow groundwaters within the root zone of deep-rooted vegetation have the potential to provide suitable habitat for stygofauna within the proposed development area on the basis of lithology and water quality. However, no stygobitic stygofauna were recorded from within the proposed development area or surrounding area, and only one stygoxene was recorded from the surrounding area.

The consequence of impact of terrestrial vegetation clearing on stygofauna is low because this impact pathway may cause long-term change to stygofauna habitat (non-protected

component of the environment), although stygofauna have been recorded in areas that are heavily cleared as well as areas that are cultivated.

The likelihood of impact of terrestrial vegetation clearing on stygofauna is low because vegetation across the proposed development area is already heavily cleared, the proportion of additional vegetation clearing required for the Project is limited and baseline assessments did not record stygofauna from the Project Area.

The risk of impact of terrestrial vegetation clearing on stygofauna is low.

4.2.1.2 Contamination of Groundwater

Contamination of groundwater includes seepage and spillage of fuels, oils and other chemicals required for the operation of vehicles and machinery, used in both construction and operation phases of the Project. Toxicants such as fuel and oil are potentially toxic to aquatic fauna (including stygofauna) at relatively low concentrations. Spilt chemicals, fuel and oils have potential to seep into shallow groundwater ecosystems, where they can impact the condition of the groundwater ecosystem and cause lethal or sub-lethal impacts to stygofauna. Potential impacts would depend on the magnitude and type of any chemical, fuel or oil spill, but a small chemical, fuel or oil spill would likely cause impact on a relatively local scale.

The risk of contamination of groundwater by fuel and chemical spills is low because:

- Storing and handling of all applicable materials will be in accordance with the relevant legislative requirements and Australian Standards.
- A Spill Prevention and Response Procedure will be implemented.
- Refuelling facilities are bunded within the mine infrastructure area (MIA), and are not adjacent to the Project Area.

The consequence of impact to stygofauna by groundwater contamination is moderate because this impact pathway may cause long-term harm to stygofauna habitat (a non-protected component of the environment).

The likelihood that groundwater contamination will adversely impact stygofauna is low, because the above-described mitigations effectively control likelihood of impact.

The risk of impact to stygofauna from groundwater contamination is low.

5.0 Summary

While stygobitic stygofauna is considered a sensitive groundwater ecological receptor, no stygobitic stygofauna were recorded from the Project Area or surrounding area. Low diversity and abundance of sygoxenes (i.e. a single nematode taxon) was recorded from one bore; however, most of the Project Area was assessed as having low values for stygofauna.

The identified sources of potential impact on stygofauna were:

- Vegetation clearing, which may cause direct impact to stygofauna habitat.
- Localised contamination of groundwater from fuel or chemical spills, which may cause lethal (i.e. mortality of stygofauna) or sub-lethal (i.e. reduced rate of reproduction, impacted physiology) impacts.

Risk-based assessment of these sources of potential impact indicated low risk to stygofauna.

6.0 References

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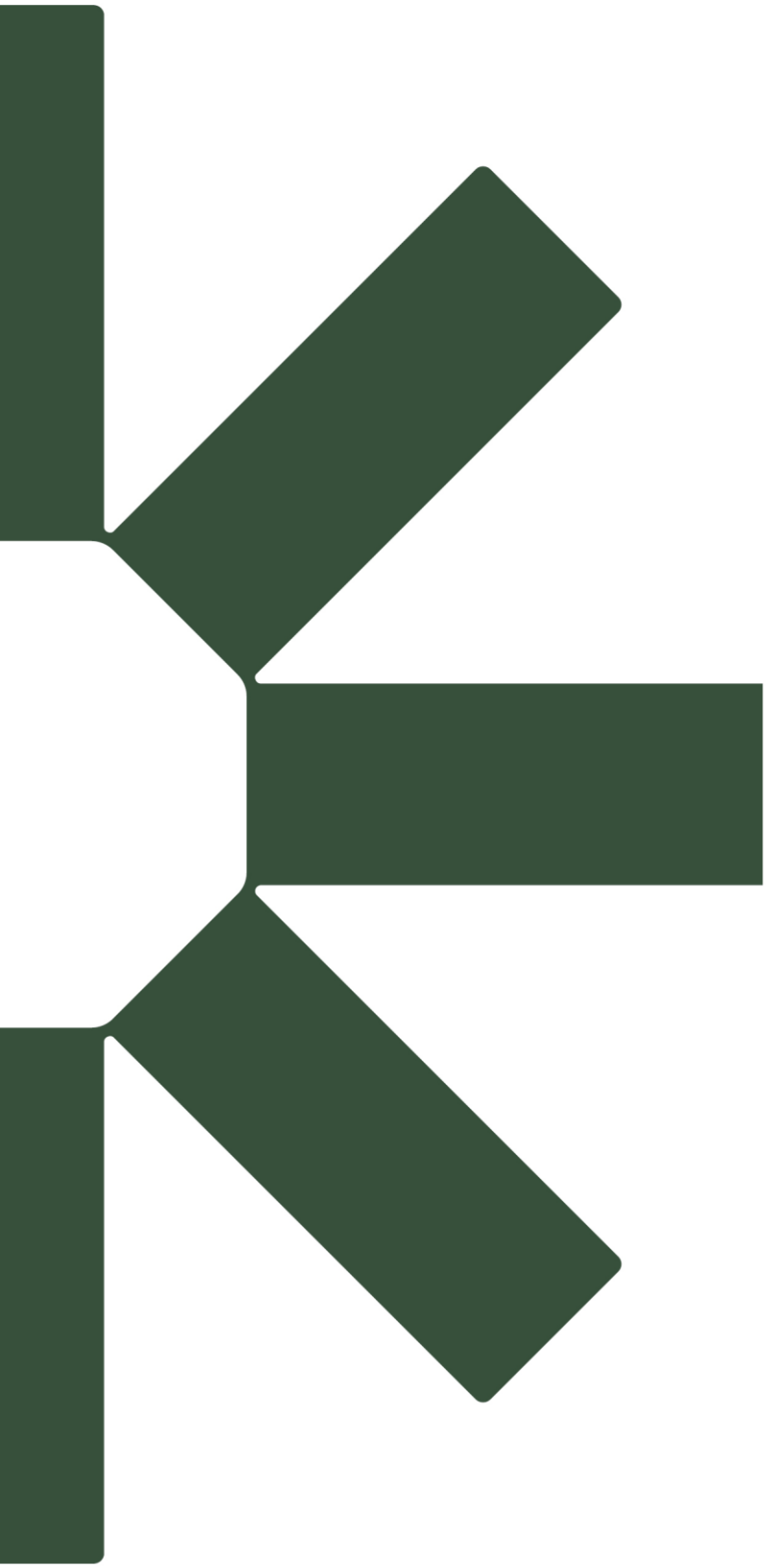

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